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The second part of the S.U.S.S. review.

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Editor David Drummond.

The Editor would like to thank
all those who have contributed
to the production of this journal.

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PLATES.

EDITORIAL

If one looks back into one's experiences in caving, or in particular in S.U.S.S., one is appalled at the discomfort one has endured, at the incredible number of hours spent in journeying the length of the state, at the unpalatability of one's diet, and at certain memorable risks taken of which one is not perhaps particularly proud. One asks oneself, "Why did I do it?", and it is difficult to find an answer.

If a caver wishes to continue his sport past his young years he must learn to love that type of freedom which lifts him beyond the reach of the impingement continuum of herd life. He must go new places and find new endeavours in which to exercise his skill and judgment, and must make responsible decisions involving degree of risk. The attitude that other cavers are competitors to be beaten by great feats is no more than an abdication of individual responsibility and is foreign to the sport. Co-operation on the other hand teaches one to evaluate the degree of trust that can be placed in a companion, and cultivates human understanding and a better friendship. Clearly those who care for the future of the speleological art will support measures ensuring that newcomers are given a chance to attain competence sufficient for them to approach risks with their eyes open, rather than being blindly let into avoidable danger so that they become disgusted with the sport as a whole, as has happened too frequently in the recent past.

Perhaps there is no activity in which independence, dependence, satisfaction, and dissatisfaction are so insolubly welded together as in scientific endeavour. The independence of scientific

enquiry, dependent as it is on what has gone before, gives a facet of satisfaction additional to the normal pleasures of speleology when applied in cave science. In this way the dissatisfactions of not knowing why certain troglobites are limited in their distribution, or how certain caves are formed, and so on, are overcome, thus resulting in further problems and enquiry so giving a broader meaning to the old axiom, "Speleology is a way of life".

Competence in the caving art, and scientific endeavour, are not the only aspects of speleology. Many people go caving for the challenge of caves, for their beauty, or simply for enjoyment. There is an undeniable pleasure in the variety of caving activity. Getting away from it all, and the intoxicating shock of realization that so much of ordinary life is a dreary compromise, (an inhibition that should be broken once in a while for the sake of the soul), is enough to ensure that once one has become a cave-man, one will always remain so.

Caving holds a wealth of enjoyment for its participants, physical and mental endeavour, excitement, getting away from it all, and it is pleasurable to let off steam in camp life. In the process of this one develops a high standard of achievement, which is valuable in all phases of life. There is more to caving than crawling down caves. Speleology is a way of life.

In the first part of the S.U.S.S. Caving Review, the accent was on equipment and methods, in this second part we move on to a brief discussion of caving areas followed by a review of cave biology and palaeontology as it has affected society members. We justify a biological journal on the grounds that if anything is worth doing it is worth doing properly. However, it

is hoped that readers will overlook inadequacies that they may find in the articles, as the state of present knowledge is a severe limitation.

Ed.

A CONSPECTUS OF THE CAVE SYSTEMS WITHIN FIVE HUNDRED MILES OF SYDNEY. by C.H.C. Shannon.

The table set out below is a list of cave systems within five hundred miles of Sydney. Supplementary information intended to help a trog to decide where to go when planning trips is also included. The previous list in Journal 2:2 has been expanded to include the many systems not mentioned in Mines Department sources, whilst the "red herrings" from these sources have been separated from the areas that can be located.

Parameters for comparing the systems have been taken as:-

Total passage length in feet.

Number of caves.

Future prospects for extensions and new caves.

Distance from Sydney in miles.

Locations of the caves are not given but bona fide persons should be able to find the people to ask anyway.

The estimates of cave length are based on a combination of my own experience, first hand accounts, trip reports, cave maps, interviews with other speleologists who are reliable observers, quizzing of possible unreliable observations, traditional S.U.S.S. views, or interpretation of newsletters. I do not claim 100% accuracy from a method that is indirect as well as subjective, but I think it is the best that can be done with the information available.

Cave number in asystem is a variable quantity because of the hazy border between a cave and a "Wombat hole". Distances are from road maps and Society publications. "X" denotes an area visited and checked by the author.

WEST BLUE MOUNTAINS PROVINCE.

Silurian limestone.

Cave system or locality.	Total Length of passages feet.	Approx. No. of Caves.	Prospects.	Distance from Sydney Car.	Foot.
Jenolan[X]	30,000	40	excellent	120	
Tuglow	2,000	1	some	130	2
Tuglow River[X]	500	5	slight	130	5
Church Creek	1,000	1	fair	170	8
Billy's Creek[X]	200	1	0	170	4
Colong[X]	8,000	1	some	170	2
Wombeyan[X]	12,000	12	some	120	
Jerrara	? 200	1	?destroyed	110	
Bungonia	8,000	8	fair	130	

SOUTH EASTERN PROVINCE.

Silurian limestone.

System	Length.	Number.	Prospects.	Distance.
Mt. Fairy = Fairy Meadow[X]	700	4	some	170
Michelago	500	10	0	210
London Bridge etc.				200
Bettowynd				230 5
Cheitmore = Back Ck.	300	1	good	230 2
The Marble Arch = Moodong Ck.	300	1	fair	230 1
Wyanbene	1,000	3	some	225
Pondithera[X]	2,000	8	good	250 4
Rose Valley = Rosebrook	1,000	3	slight	260
Kybean				290

SOUTH WESTERN PROVINCE

Silurian limestone

System.	Length.	Number.	Prospects.	Distance.	
Yarrangobilly[X]	40,000	50	excellent	310	2
Coolamine[X]	6,000	8	very good	320	
Caves Ck.	100	2	fair	320	5
Lower and Middle Devonian limestone.					
Cave Flat	1,200	1	0, flooded permanently	210	
Narrangullen	1,000	2	fair	220	5
Wee Jasper	8,000	5	slight	250	
Coodravale - Goodradigbee	800	2	slight	255	
Coolamine in part-see above.					
Buchan Victoria	15,000	15	good	443	

CENTRAL WESTERN PROVINCE

Middle Ordovician limestone.

System.	Length.	Number.	Prospects.	Distance.	
Cliefden[X]	10,000	8	fair	190	
Walli-Belubula	2,000	2	some	210	
Carromodine	2,000	4	some	200	
Cargo	3,000	3	some	195	
Upper Ordovician limestone.					
Molony	500	8	almost 0	200	
Wellington	1,500	8	almost 0	220	
Silurian, Devonian, and uncertain.					
Abercrombie	1,500	5	slight	185	
Borenore - Boree	1,000	2	slight	180	
Rosedale	1,000	5	slight	150	
Cudgegong	300	2	0	165	1
Apple Tree Flat	200	2	some	160	
O'Connell				150	2
and some others.					

NEW ENGLAND PROVINCE.

Middle Devonian limestone

System	Length.	Number	Prospects.	Distance.
Isis River(Timor and Allston)[X]	5,000	10	some	250
Crawney[X]	300	2	slight	260
Barry Station	400	1	0	290
Moore Ck.[X]	100	1	0	295
Sulcor	400	1	0	295
Ashford	1,000	2	good	452
Texas Qld.				494

MACLEAY PROVINCE.

Permian limestone.

System.	Length.	Number	Prospects..	Distance.	
Yessabah[X]	1,500	30	0	332	
Sherwood[X]	50	1	0	331	
Temagog	200	1	0	340	
Moparrabah[X]	2,000	1	0	348	
Sebastopol	300	4	fair	350	
Willi-willi	800	6	fair	356	
Haydenville[X]	200	1	fair	366	
Carrai	400	1	slight	366	1
Stockyard Ck.	500	2	good	366	3
Kunderang Ck.			good	380	3
Comboyne	100	2	0	240	

and several promising outcrops.

? Carboniferous limestone.

Biddy's Harbour	400	1	0	180
Gloucester	1,200	3	0	185

LORD HOWE ISLAND.

Pleistocene calcarenite.

System.	Length.	Number	Prospects.	Distance.
Ned's Beach	? 500	1		

SUNDRIES.

Holes that are not limestone caves, sea caves or sandstone rock shelters.

The Big Hole, 280 feet deep, Krawaree, Devonian Quartzite.
Sancho's Hole, 100 feet deep, Walbrook, Silurian Phyllite.
Sandstone stream caves:

1. Polona Brook, National Park.
2. Ku-ring-gai chase.

One contains the Cowan Ck. and is 200' long, the other a small tributary and is 150' long.

Doubtful Cave Localities.

These are:-

(A) Limestone areas rumoured but not known to contain caves.

(B) Caves reported in the old records and never heard of since, some may be synonyms of known areas.

West Blue Mountains.	Tugalong (A) W. of Joadja
South East.	Etrema Gorge (A)
	Delegate River (A) =? Snowy Riber (B)
Victoria.	Deddick River (A)
	Limestone Ck. (Upper Murray R.) (A).
South West.	Arranarrung (B) - possibly a synonym for Yarrangobilly
	-possibly Section Ridge Lst. Dev.
	-possibly Tufa overhang on the Tumut R.
	-possibly on Mongola Ck., a tributary of the Tumut, not found on modern maps.
Central West.	Pouronby (B) = ? Rosedale.
	Stuart Town (A)
	Queen's Pinch (A)
	Mt. Bocobal (A)

Caves within 500 Miles of Sydney.

Compiled by G. Hunt.
Drawn by J. Steele
Reduced by D. Drummond.

? Central West. Benglen (B)

Alum Ck, (B)

Impenetrable - Central West.

Burran-burran (B) - filled with dead sheep.

Finch's Caves (B) - reduced to one 30' fissure.

In addition sandstone rock shelters occur in huge numbers throughout the Sydney basin, and may reach 40' x 15'.

A Further Comment.

The possibility of finding further outcrops of caverniferous limestone is not good, due to the efficient coverage of the state by Trickett and Jones. During the interval 1800-1914 N.S.W. was very cave conscious, and this resulted in a high degree of co-operation from Shire Authorities and miners. However the standard reference (Carne and Jones) is not infallible as many seem to think. The Birkenburn sinks outcrop was missed as was the outcrop reported by A. White on the Drum River. The chances of a completely new system in unrecorded limestone are restricted to the upper parts of the Macleay, and the S.E. province particularly round Krawaree.

CAVE ANIMALS.

Barbara Dew.

Since S.U.S.S. began caving its members have spent considerable time underground in many parts of Australia carrying out all sorts of activities ranging from surface exploration to detailed underground surveys, from fun and sport to quite advanced scientific projects. One of these projects which has been going on for many years is the interest shown by some members in zoology.

Cave dwelling animals are grouped into four divisions which are as follows:

TROGLOBITES - The "full timers" which only live in the areas of total darkness and are not found on the surface.

TROGLOXENES - The "part times", like the bats which use caves for roosting and breeding purposes. They have to leave the caves to feed.

TROGLOPHILES - Those which are found both on the surface and in caves. This is especially true of those forms found near the entrance.

ACCIDENTAL TROGLOXENES - These "accidental visitors" have usually fallen in from the surface and will almost certainly perish.

These four groups are found in different areas or zones, with a certain degree of overlap. The two zones being the region of total darkness, and the "twilight zone"-the area to which daylight penetrates.

Animals recorded from the two zones by various S.U.S.S. parties represent many faunal groups and collections have been made from many different cave systems throughout the Commonwealth of Australia.

Unfortunately many of the reports are very vague and are of little scientific use except in recording the presence of certain animals so making a further trip necessary. It is to be hoped that in the future

members will be a little more co-operative and bring specimens back rather than very vague stories, of what is worse, no reports at all.

It is proposed that this article will summarise the various animals that have been reported, listing animals under cave areas and biological groups, so that if other creatures are found a series may be brought back.

Animals are divided into two major divisions, the Vertebrates and the Invertebrates, and these are further divided into a number of groups or phyla distinguished from each other by specific characteristics. As is to be expected, by far the commonest are the Invertebrates.

INVERTEBRATES

The Phylum Platyhelminthes (flat worms) have only been reported twice, both from Jenolan. The Mammoth specimen was pale pink and about 3" long, while that from a hole near Wiburd's Lake Cave was a beautiful pale lemon yellow "monster" nearly 9 inches in length, with a pinky-brown head.

The phylum Mollusca (Shells) have been reported on three occasions. Unfortunately the earlier report did not mention if the specimen was alive, but the two most recent finds reported dead shells. The following species have been identified:
Strongesta walkeri (Comboyne); Meridolum depressum and Strongesta sp. (Casteret, Jenolan) and (Southern Limestone, Jenolan).

The huge phylum Arthropoda (Insects, crustacea, spiders and their allies) is well represented. The Crustacea, which are one of the most interesting groups have been reported four times. Two of these

were the Terrestial Isopods (slaters) reported from Wombeyan and Wellington. Two species of fresh water crustacea have been identified from Caves: these are Atya striolata (Gloucester Caves) and Paratya australiensis australiensis (Buchan). This latter species was almost certainly carried in from outside where it was quite common.

The Arachnida have rather more numerous reports, the majority being spiders, which have been reported from Abercrombie, Buchan, Colong, Comboyne, Croesus, Jenolan, Marakoopa, Nullarbour, Wyambene, Wombeyan and Wellington. Identification was often obscure, but the following species have been identified:-
Mimetus maculosus, Theridion sp., Stiphidion sp., Theridiosoma sp. (Colong) Pholcidae sp. (Wellington), Cribellate spp., Gradungula sp., Cycloctenus abyssimus (Jenolan) and (Wyambene). Ectatosticta troglodites (Tasmania) Sparassidae sp. (Comboyne).

Opiliones (Harvestmen) Holonuncia cavernicola have been reported from Wyambene and Wombeyan.

Mites. These include the free living forms Cillibia coprophila, Coproglyphus dewae, Neotrombidium neptunium, N. gracilare from guano (Wombeyan) and numerous parasitic forms on bats (see under bats).

Pseudoscorpionida have only been reported from Wombeyan, Cliefden and Southern Limestone Jenolan.

The class Insecta contains reports on well known forms like Wetas, and the almost unknown Psocids. Wetas, the species as yet undescribed, can be found at Abercrombie, Buchan, Binni, Cliefden, Liena, Newdegate, Jenolan, Marakoopa, Mt. Fairy, Wombeyan and Yarrangobilly. These are all Rhaphidophoridae sp. As well Pachyhamma sp. occurs at Baldock's cave (Tasmania).

Other insects include the cockroach Ischnoptera australis (Comboyne); a long horned grasshopper (Tuglow). Glow worms (Croesus and Marakoope); Psocids (Wombeyan); Moths - Monopis sp. (Jenolan, Wombeyan and Wee Jasper) and Hofmannophila pseudospretella (Jenolan) and a Coleoptera (bettle) Ptinus exulans (Jenolan).

VERTEBRATES.

Among the vertebrates several classes have been reported and except for the bats most, if not all, are accidental visitors which will certainly perish. If one omits the live sheep found in the Bullio at Wombeyan the animals are small and mostly cold blooded. The greatest number of reports concerns frogs, of which five species have been recorded. These are as follows:- Mixophyes fasciolatus and Hyla lesueurii (Wyambene), Mixophyes fasciolatus (Wombeyan), Lymnodynastes dorsalis and Hyla sp. (Wellington) Lymnodynastes peronii (Tuglow). Frogs have also been reported from Jenolan, Mt. Fairy, Yessbah and Croesus, but no species have been given.

There is only one report of lizards, a Gecco Phyllarus Millii from Wellington.

Snakes have been encounted on four occasions and the descriptions are - Brown (Wee Jasper), Red-Bellied Black (Pseudechis paraphyriacus) Yarrangobilly). Tiger (Nullarbour) and the red-naped Aspidomorphus diadema (Wellington).

Birds have been found in only one cave, the cave owl of the Nullabour, although swallows do nest in the overhangs of several caves.

By far the greatest number of reports concerns bats, (see S.U.S.S. 6 (2) 7), and it is to be regretted

that the reports often gave little information and only rarely were species mentioned. Bats have been reported from Abercrombie, Borenore,+ Bungonia+, Cliefden,+Camooweal, Moore Creek, Mudgee District, Timor+, Wellington+, Yessbah+. Those marked + are probably Miniopterus schreibersi as other trips have reported this bat. Miniopterus schreibersi, the common cave bat has been reported from Bungonia, Borenore, Cliefden, Colong, Mt. Fairy, Timor, Narrangullen, Tuglow, Wellington, Wee Jasper, Wombeyan and Wyambene in N.S.W., and Buchan in Victoria.

Rhinolophus megaphyllus the Eastern horse-shoe bat is not as common, and has been identified from Wyambene, Wee Jasper, Comboyne and Bungonia in N.S.W., and Buchan in Victoria.

Myotis adversus was seen only once, at Narrangullen

Other reports concern a long eared bat (Borenore) a "fossilised" bat? (Colong) and a bat skeleton (Croesus).

The two most recent finds have been from Jenolan where two new cave dwelling species were reported; these are Pipistrellus tasmaniensis and Nycticeius orion. Members are urged to watch for and to bring back reports of unusual or different bats.

The most interesting report was the discovery at Buchan of both M. schreibersi and R. megaphyllus as this extended the range by several hundred miles. To quote the report from the Australian Museum "The two specimens of bats collected at Buchan Caves, Gippsland, are of interest in providing a southward extension of range of the two species. The R. megaphyllus was previously recorded South to the Murrumbidgee River; the Bent-winged has not been recorded far south of

Sydney". At the time (Dec.'55) the bats were plentiful and easily caught. Since then the Bent-winged has been recorded as far south as Narrocourt South Australia.

In the caves of the south eastern part of N.S.W., we usually meet only one species, the common bent winged bat Miniopterus schreibersi, so called because the third finger is greatly enlarged and bent back on the wing. This bat is quite distinct and cannot be easily confused with any other species. It occurs through the eastern states from Darwin and New Guinea to Narracourt in S. Australia. It may occur in thousands in both caves and man made structures like mines.

The only bat that could possibly be confused with it is the small bent wing. M. australis, which differs in size, colour and distribution. To date this smaller bat has not been found south of the Clarence and Macleay Rivers, but it is worth watching for; and any suspicious bat should be reported.

Another regular cave dweller is the larger and more vicious Eastern Horseshoe bat (Rhinolophus megaphyllus). These bats do not occur in such large numbers and very little is known of their habits.

The fourth cave bat is the large footed Myotis (Myotis adversus). The breeding colony at Narrangullen has vanished due to regular disturbances by parties from Yass. The new breeding cave of this species would be a great find.

The four cave bats most likely to be found can be distinguished by the following key and any that do not fit should be sent in for checking. But remember bats are protected fauna, and the bat

should be kept alive so that it can be released. It is unnecessary and illegal to kill bats. Illustrations to the key appear at the top of Plate 2, page [illegible].

KEY to the Common Cave Bats.

1. Third finger greatly enlarged and bent back.....2
   Third finger not greatly enlarged and bent back..3
2. Forearm greater than 1¼ inches.....M. schreibersi
   Forearm less than 1½ inches .....M. australis
3. Muzzle elongated and simple, foot large, calcaneum (heel spur) very long nearly reaching tail.....Myotis adversus
   Muzzle squat, and decorated with nose leaf folds, tragus absent .....Rhinolophus megaphyllus

When recording bats it is well to mention species, numbers and sex ratio. Note if they are active or dormant, and if sick and dead bats are present report the fact as soon as possible. Bats can be easily identified by a skull, so if you cannot catch a bat to identify it, try and find a skull. In searching for bones it is surprising what else may turn up.

In the study of bats, carried on by various society members the following ecto-parasites have been reported and identified from M. schreibersi (Bent-wing).

Mites: Pteracarus chalinolobus, Trichonyssus womersleyi Spinolaelaps miniopteri, Ichoronyssus aristippe, Spinturnix psi and Cheycetia sp.

Ticks: Ixodes simplex simplex and Ixodes Vespertilionis

Parasitic flies: Streblidae - Nycteribosca amboinensis, and Nycteribidae sp.

Parasites from Rhinolophus megaphyllus (Eastern Horseshoe) are the Streblidae - Nycteribosca minuta; and from Pipistrellus tasmaniensis - Nycteribidae sp. at least 6 mites and an Argas tick, possibly a new species.

These parasites spend some of their life cycle off the bat host and these stages may be found on the cave roof (in the case of the Nycteribidae) as small black oval pupae cemented firmly to the limestone. Ticks may be found in cracks or among the guano.

LIST OF ANIMALS FOUND IN EACH CAVE AREA.

Below is the list of the caving areas visited by S.U.S.S., parties in which zoological finds were reported. Unfortunately, most are vague and it cannot be stressed enough that a great deal more work could and should be done. Nowadays we have an expert to identify spiders, and he is engaged in preparing a paper on Australian cave spiders, and all information would be of great value.

Abercrombie - Bats, spiders, wetas

Borenore - Bats - Miniopterus schreibersi and a long eared bat.

Bungonia - Bats - Miniopterus schreibersi and Rhinolophus megaphyllus

Camooweal - Bats

Cliefden - Bats - M. schreibersi and Pseudoscorpions, flies and beetles. Mite Neotrombidium gracilare.

Colong - Bats - M. schreibersi. "fossil bat", spider Mimetus maculosus, Theridion sp., Stiphidion sp Theridiosoma sp.

Comboyne - Bats - R. megaphyllus, Mollusca - Strangesta walkeri, spider, - Sparassidae sp? Cockroach

Jenolan - Bats - M. schreibersi, Nycticeius orion and Pipistrellus tasmaniensis, land planarians; Spiders Mimetus maculosus; pseudoscorpions, Mollusca Strongesta sp and Meridolum depressum. Insects, wetas, Moth - Hofmannophila pseudospretella and Monopis sp
Beetle - Ptinus exulans

Moore Creek - Bats -

Mt. Fairy - Bats - M. schreibersi, Frogs, wetas.

Mudgee District - Bats

Narrangullen - Bats - M. schreibersi, Myotis adversus

Timor - Bats - M. schreibersi R. megaphyllus

Tuglow - Bats - M. schreibersi, Frog-Lymnodynastes peronii and long horned grasshopper.

Wee Jasper - Bats - M. schreibersi, R. megaphyllus and Moth Monopis sp. Mites - Neotrombidium gracilare

Wellington - Bats - M. schreibersi, bat sp. Spider Pholocidae sp. Isopod - Slater. Snake red-naped, Gecco Phyllurus millii, Frogs - Hyla sp. and Lymnodynastes dorsalis.

Wombeyan - Bats - M. schreibersi. Frog - Pseudoscorpions. Spiders - Cribellate sp. Gradungula sp. Insects - Wetas, Psocids. Mites (guano) Cillibia coprophila Coproglyphus dewae, Neotrombidium neptunium, N. gracilare Isopod - slater. Opilionid - Holonuncia cavernicola. Frog - Mixophyes fasciolatus.

Wyambene - Bats - M. schreibersi, R. megaphyllus, Frogs - Hyla lesueurii and Mixophyes fasciolatus. Opilionid - Holonuncia

cavernicola. Spiders - Theridion sp. and Cycloctenus abyssimus.

Yarrangobilly - Black snake, wetas.

Yessbah - Bats, frogs.

In other states, reports are usually even vaguer.

Buchan - Bats, M. schreibersi, R. megaphyllus Spiders, wetas, fresh water prawn - Paratya australiensis australiensis

Nullarbour - Bats, Spiders, Birds (cave owl)

Tasmania - (various caves) wetas, cave cricket - Pachyhamma sp. Glow worms (mycetophyllid midge). Spiders including Ectatosticta troglodites.

Members can get some idea of what has been reported from the various areas and undoubtedly this list can be greatly increased. There are far too many records of a vague nature e.g. spiders or bats. So next time a visit is planned to one of these areas (or any other) bring in specimens so that an up to date record can be made, and a specific name decided upon.

KEY FOR IDENTIFICATION OF CAVE ANIMALS.

Very few professional zoologists go caving and only a few cavers have anything but the vaguest idea of the classification of the animal kingdom. Everyone knows large animals like bats and frogs, but when it comes to the invertebrates it is a very different matter. Below is a very simplified key, which with careful use can be used as a guide, to divide the "finds" into groups. Some illustrations appear in PLATE I, page 22 .

The phylum Arthropoda contains the majority

Plate 1

A - E Ectoparasites of bats

A Streblidae - (Bat fly) x 8

B Nycteribiidae - (Wingless fly) x 10

C Spinturnix - (Mite) x 60

D Ixodes sp. (Tick) x 10

E Argas sp. (Tick) x 9

F - I Fauna frequently associated with guano

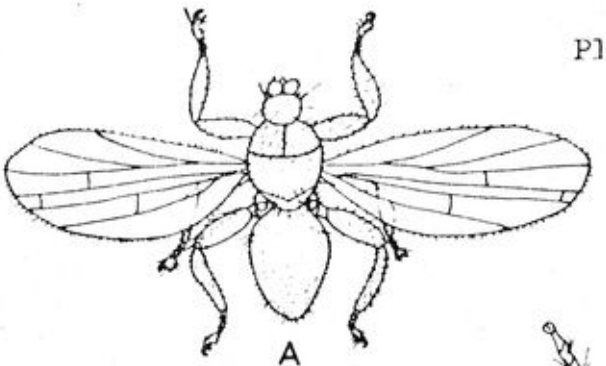
F Opilione x 2

G Spider x 3/4 considerable sign range

H Weta x 3 considerable sign range

I Pseudoscorpion x 35

Plate 1



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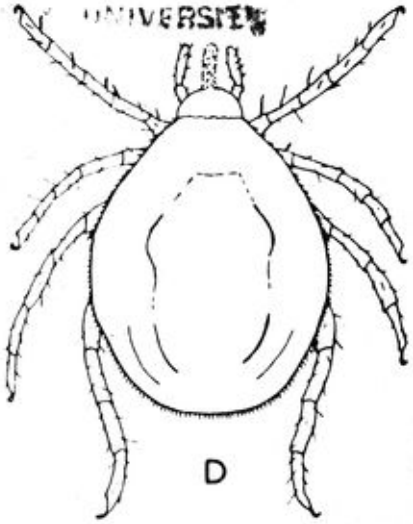

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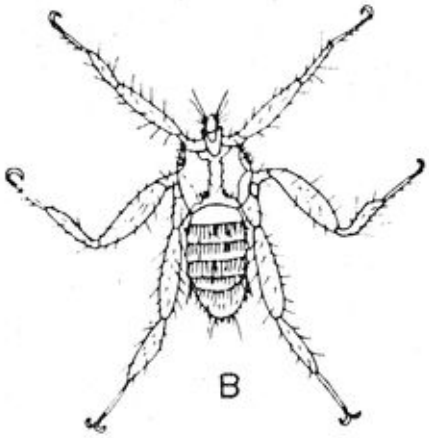

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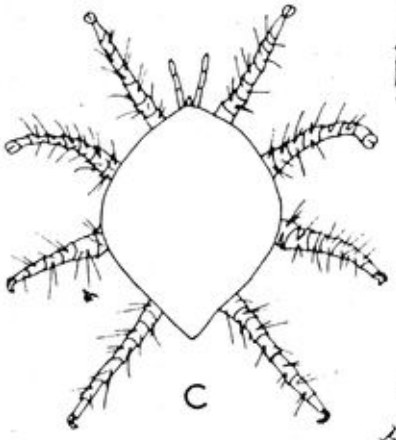

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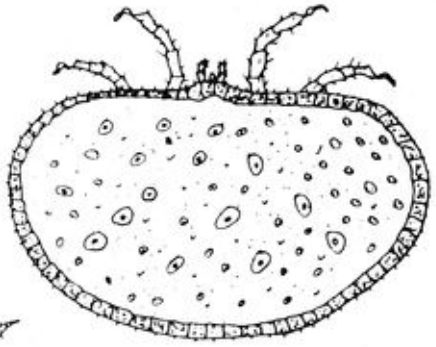

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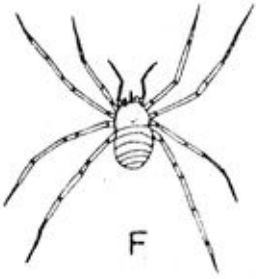

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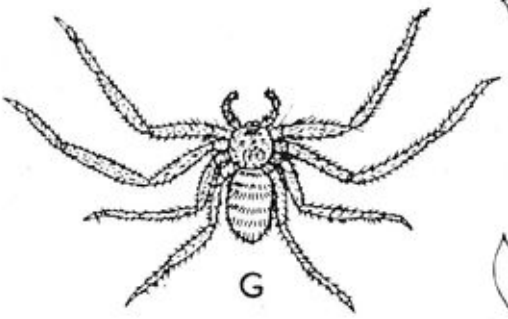

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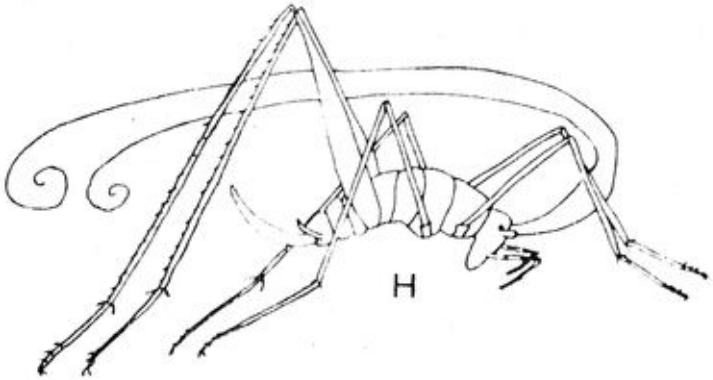

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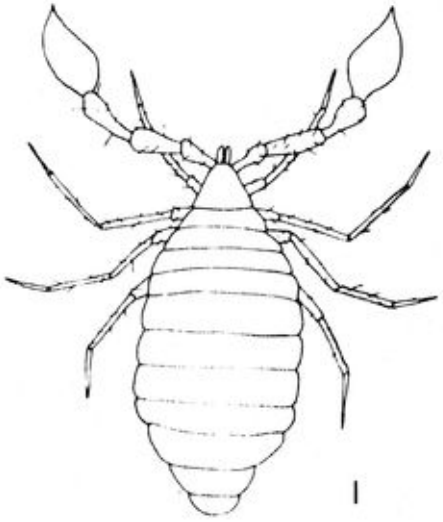


I

of cave invertebrates. All the members have jointed legs and chitinous exo-skeleton.

1. With 6-8 legs, body divided into distinct parts 2
   With more than 8 legs, body may or may not be divided into distinct parts 3
2. With 6 legs body divided into 3 parts .. Insecta
   With 8 legs (6 legs in larval ticks and mites) body divided into 2 distinct parts ..... Arachnida.
3. With more than 20 pairs of legs, body elongated and no distinct parts .... Myriapoda
   With less than 10 pairs of legs, body divided into 2 parts ..... Crustacea

- - - - - - -

Archnida - All members except larval ticks and mites have eight legs. The body is divided into two parts, a "head" (cephalo thorax) and an abdomen. Antennae are absent. They may be free living or parasitic. There are four common orders which may be distinguished as follows:

(1) Abdomen rounded or elongated 2
    Abdomen dorso-ventrally flattened 3
(2) Abdomen segmented ..... Opiliones (Harvestmen)
    Abdomen Not segmented .... Araneida (Spiders)
(3) All legs alike, tiny claws at ends.. Acarina (Ticks, Mites)
    All legs unlike, first leg with a prominent claw ..... Pseudoscorpionida

- - - - - - -

Myriapoda Centipedes and Millipedes

One pair of legs to each segment ..... Centipedes
Two pairs of legs to each segment (except the first three) ..... Millipedes

CRUSTACEA.

7 pairs of legs, terrestial, eyes not prominent .. Isopoda (slaters).

5 pairs of legs, aquatic, eyes prominent ..... Decopada (prawns)

INSECTA - All insects have six legs and the body is divided into three parts, head, thorax and abdomen. They vary greatly in size and shape, and will prove the most difficult to identify. Bring the specimen back for further detailed study, making sure to keep the material cool.

HOW TO COLLECT ANIMAL DATA.

While caving, especially in out of the way areas or places not usually visited by members of the society, every effort should be made to collect material and to bring specimens back to Sydney.

Very little is required in the way of equipment and if members really cannot find a small jar or tube these can be provided. The tubes can be easily carried in the top pocket. If and when specimens are found they should be collected at once and not left until the return to the surface, as they will probably be forgotten or not found again.

All material should be labelled at once with the name of the cave, depth, area, date and collectors name. A piece of paper placed in the tube with the specimen is a convenient way of labelling.

Specimens should be placed individually in tubes, so that they will not crush and eat each other. It is not necessary to collect dozens of the one species, two or three are usually all that are required but do try and include mature adults if possible. It is usually quite easy to distinguish the sex of wetas, and spiders. All examples of pseudoscorpion, slaters, beetles, moths flies etc., should be collected unless they are present

in hundreds.

The best method of transporting and preserving most insects is 70% alcohol, the exception being moths, and some other winged Diptera. It is a very good plan to carry a few tubes of 70% alcohol while caving.

WHERE CAVE ANIMALS ARE MOST LIKELY TO BE FOUND.

The most profitable area for detailed search is among deposits of fresh guano. Guano provides an ideal food supply for many insects and the home for insects and spiders which prey on the smaller members. A very interesting study could be made of food chains and life cycles in such a heap of guano. Animals collected from guano include such things as mites, wingless flies, beetles (8 species at least) moths, pseudoscorpions, wetas, spiders (2 or 3 species) harvestmen etc. (Figures of many of these will be found on Plage I, page 22). Next time you come across a heap of guano, pause for a few minutes and have a good look, but remember that the creatures are usually very small, and hard to see. If you do not have time to make an examination then bring back some of the material in a plastic bag.

Rotting wood and leaves carried in by flood water often provides a food supply and home for many invertebrates, especially slaters, millipedes and spiders.

Pools of water, especially if they are isolated, are well worth detailed examination, as cave crustacea are not unknown, and a report with specimen would be of great interest to the various experts.

Finally if you have any material for identification or any questions about collecting, the author

may be contacted, either through Box 35, The Union, or personally in her room at the University.

BONE DEPOSITS IN CAVES.

by D.C. Drummond.

Deposits of innumerable small mammal bones have been found at many of the better known caving areas of New South Wales. It would be reasonable to suppose that such deposits are more widespread and they may possibly occur at the majority of cave localities. The form of a deposit varies between small piles of bones on the floor of a cave or in the bottom of a fissure, to definitely layered deposits covering an area of many square feet, or to even fully fossilised breccia where the bone material is replaced by and entombed in rock forming minerals. Perhaps the best example of this latter type is at Wellington. Obviously deposits may be of different ages and may represent different chapters in the history of distribution of the various animals throughout the state, and may give a clue to their movements in relation to changing environment.

Information that may be gleaned from bone deposits.

The obvious starting point is to try and extend the ranges of living species, that is to try to find out from fossil material the areas over which a particular species used to be found as compared with the area over which it is found today. Eudromicia. cf. lepida the Tasmanian Pigmy Possum has turned up at Buchan, and the Tasmanian Devil at Boranup, W.A., Portland, Vic., and Mount Hamilton, Vic., Radio carbon dating has shown that a Victorian Devil died between 550 and 750 years ago. The Marsupial Wolf, now almost extinct, had proven relatives at Wellington and across southern Australia. These species show a restriction of range perhaps due to a climatic-vegetative change forcing them south, or equally likely to the relative success of "competitors" on

PLATE 2. LOWER PART.

MANDIBLES OF MAMMALS OF CAVE BONE DEPOSITS.

MARSUPIALS.

PHALANGERIDAE. Possums & gliders.

P1. Acrobates pygmaeus - Feathertail Glider
P2. Cercartetus nanus - Pygmy Possum
P3. Burramys parvus
P4. Petaurus breviceps - Sugar Glider
P5. P. norfolcensis - Squirrel Glider
P6. Pseudocheirus peregrinus - Ringtail Possum
P7. Schinobates volans - Greater Glider
P8. Trichosurus vulpecula - Brushtail Possum

PERAMELIDAE. Bandicoots.

B1. Isoodon obesulus - Short-nosed Bandicoot
B2. Perameles nasuta - Long-nosed Bandicoot

MACROPODIDAE. Kangaroos etc.

M1. Bettongia penicillata - Brush-tailed Rat-kangaroo
M2. Potorous tridactylus - Potoroo

DASYURIDAE. Carnivorous marsupials.

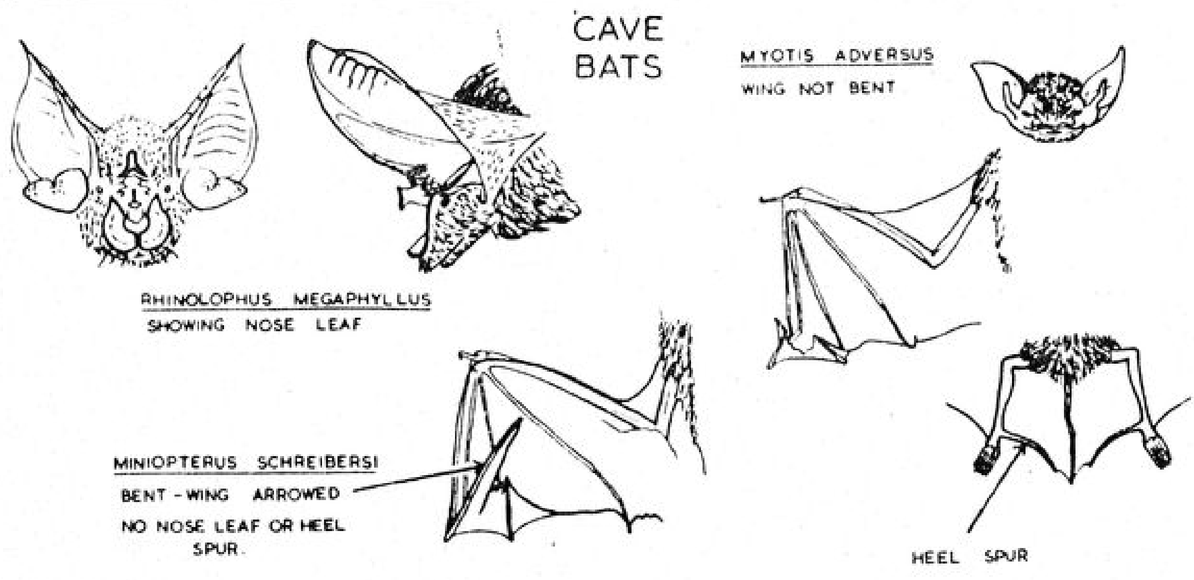
D1. Sminthopsis sp. - Marsupial Mouse.
D2. Antechinus flavipes - Yellow-footed Marsupial Mouse
D3. A. swainsoni - Swainson's Marsupial Mouse
D4. Phascogale tapoatafa - Brush-tailed Phascogale
D5. Dasyurus quoll - Eastern Native Cat
D6. Dasyurops maculatus - Tiger Cat

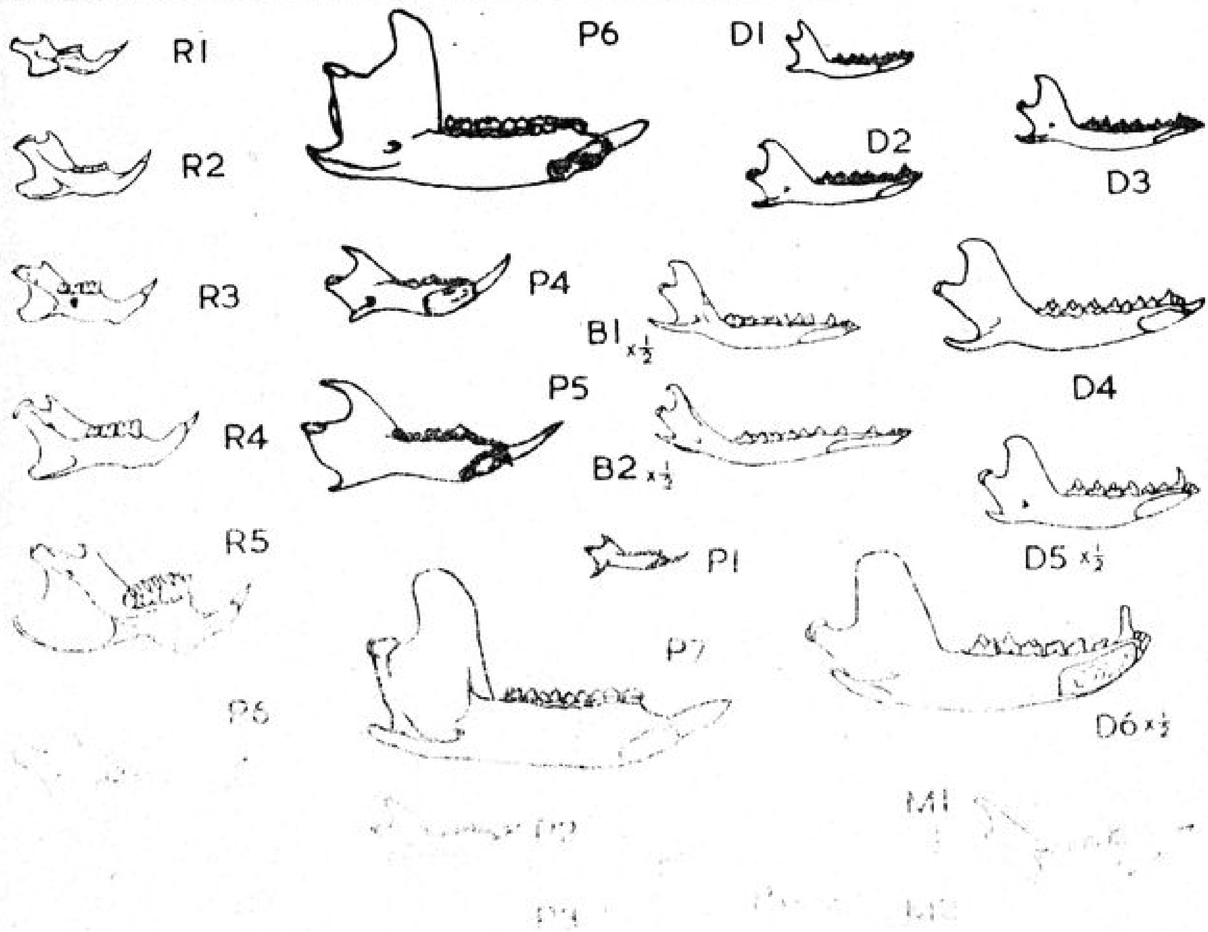
RODENTS.

MURIDAE. Rats & mice.

R1. Mus musculus - Domestic Mouse
R2. Gyomys novaehollandiae - New-Holland Mouse
R3. Gyomys fumeus - Smoky Mouse
R4. Pseudomys australis - Pseudo-Rat
R5. Mastacomys fuscus - Broad-toothed Rat
R6. Rattus sp. - Rats
R7. Conilurus albipes - White-footed Rabbit-rat.

All mandibles approximately natural size except where indicated. R1, R2, & R3, are slightly out of scale. Their molar rows should measure 3.4, 3.9, and 5.2 mm. repectively





the mainland forcing them into isolation, or to some other reason. Restriction is probably often the starting point of extinction of a species which has become less fit to survive in the changing environment in which it finds itself. Such restriction may not be only on a large scale, such as the above, where animals are now confined to Tasmania, but may be much more local in nature. One of the many animals taken by early European explorers and since believed extinct was Leadbeater's Possum. This shy nocturnal animal is in the habit of hiding behind tree trunks as soon as it hears the least disturbance. However, since the advent of the internal combustion engine it has learned that cars are harmless creatures which don't climb trees and has taken to watching them go past by peeping round the sides of its hiding place. This was its undoing as its eyes shine in the headlights and so it was rediscovered. That Leadbeater's Possum was once more widespread is shown by bones from Buchan, and its restricted range suggests it could be a candidate for final extinction in the near future.

Among the numerous other species represented by cave bones now extinct in N.S.W. but present when the white man arrived, are rodents, for instance the Rabit-rat (Conilurus), the New Holland and the Smoky mice (Gyomys novae-hollandiae, and Cyamys fumeus respectively) and the Pseudo-rat (Pseudomys australis) whilst others are now rare, and similarly with the marsupials. Not all such extinctions are attributable to the white man. One animal he probably just missed, as it were, was the possum Burramys parvus which is now represented by bones from various sites in S.E.

Australia. This might be a useful indicator that one is dealing with a pre-European period, but fairly recent deposit, as Burramys occurs alongside many modern species.

A moment of thought will easily convince the reader that a bone deposit does not represent all the species present in an area over a period of time, nor yet all the individuals of a single species. It merely consists of those bones available to the deposit from perhaps a variety of sources, minus those which have since been removed. The proportions of bones of the various species reflect these factors and nothing more, or in other words one cannot make firm inferences as to the former distribution and abundance of animals directly from bone deposit data. However, there are definitely different types of deposit. Inside caves, often far inside, one comes across small piles of bones from one animal which are presumed to be the remains of a beast which got in but which could not get out again. These are usually Rock Wallabies or Larger Possums entirely and may be classed as accidental visitor deposits. Piles of broken bones of all sizes mixed with mud and stones sometimes even fossilised, such as occur at Wellington, may be called washed-in or alluvial deposits, whilst others where individual animals may be recognised are more likely to be death-trap deposits as at the Mount Hamilton lava caves Victoria where many species from the extinct "marsupial-lion" (Thylacoleo) and Giant Kangaroo, to the tiny introduced mouse (Mus musculus) may be found. Another type is the vertebrate trogloxene deposit which includes any remains left by animals which may normally live part of their lives in caves and which die there, for instance bats, but also the troglophile wombats, occassional snakes and lizards. There are no vertebrate

troglobites in Australia. Perhaps the commonest type of deposit here in N.S.W. is the predator deposit which only occurs in the twilight zone, and which will be discussed more fully later but which consists entirely of small mammals or the young of larger ones.

Thus there are at least five major types of bone accumulation when classification is by origin, and these may be further subdivided by characteristics of composition etc. Clearly, since these five types do differ, the inference is that it is unlikely that any reflects the composition of the fauna of the region.

At first glance it would seem that all types except the alluvial deposits should contain a finite number of animals, and this suggests that there should be for instance, the same number of left mandibles (lower jaw bones) as right mandibles, and the same number of left limb bones as right limb bones and so on. This has never been found to be the case. Naturally if we are studying one species we are limited to those bones that can be distinctly recognised as belonging to that species, and this virtually restricts one to a discussion of mandibles (lower jaws) and maxillae (upper jaw bones) alone. For a typical example take the Broad-toothed rat, Mastacomys fuscus at Y50 where, in a sample of many thousands of bones (of many species), 28 left mandibles were found and 21 right mandibles, but only 9 left and 8 right maxillae. Maxillae are more delicate than mandibles and so fewer have survived or assuming that the deposit originally contained the same number of each of the four bones, there has been differential removal of maxillae, perhaps by sorting

by water or breakdown of the bones themselves. A closer examination showed that of the 28 left mandibles, only 17 had all their teeth, and only 1 was complete, and similarly of the 8 right maxillae only 4 had all teeth and 2 were complete. Differential presence of the bone types is therefore related to differential breakage of bones. This can be extended in the hypothesis that bones of the smaller more fragile species are likely to be relatively under-represented in any typical multi-specific deposit.

Summarising so far; any bone deposit is representative only of those species available to it and not of the fauna as a whole, and is commonly of one of five basic types. Assuming that many deposits consist of a finite number of individuals, the expected proportions of various bone types have been shown to be modified by sorting procedures including at least bone breakage, and the further hypothesis that small delicate species are under-represented has been made.

Predator Deposits.

Predator deposits have been examined more closely than others in recent times. Norman Wakefield's work at Buchan suggests two common types of predator deposit, those due to owls and those due to Native Cats. Evidence that some are due to owls is fairly good because many "casts" are found among the bones which are found in piles below roosting ledges. Owls swallow prey whole and then cough up the bones and fur and so on as a "cast" which often maintains its coherency and sausage-like shape. The problem was which owl was responsible? Only the Barn Owl (Tyto alba) and the Masked Owl (Tyto novae-hollandiae), live in caves, and it is supposed that only the Masked Owl would be capable of dealing with such large prey as occurs in the Mabel cave deposits. Another possibility would be the Winking Owl (Ninox connivens) but this does not

have a cast enclosed by a membrane as at the Mabel and Pyramids Caves, and it lives in trees. The Sooty Owl (Tyto tenebricosa) according to Wakefield is a further possibility but nothing is known of its casts. The field would appear to be narrowed to Tyto tenebricosa and Tyto novae-hollandiae.

Superficially the evidence for Native Cat deposits seems less satisfying and depends on the similarity of places of deposition to Native Cat dens, the presence of adult and juvenile Native Cat (Dasyurus Quoll) bones whereas only small Tiger Cat (Dasyurops maculatus) specimens were found. Evidence that the deposits were not due to an introduced species e.g. the fox, is the absence of other introductions e.g. the rabbit, and the presence of species which rapidly died out after the coming of Europeans.

Supposing one knows what the predator was, is this any advantage? First, if sufficient is known about the habits of the predator and the country round the animal's home, then a fair idea may be built up of the sort of areas in which it liked to hunt. Following from this the deposits are composed of those animals available to the predator in the hunting grounds which it caught in order of preference. All that follows from this is the presence or absence of the species in its hunting grounds. However, if the deposit is layered then an idea can be formulated of the relative availability of preferred foods over a period of time. At Y50 for example the surface layer contains the Feather-tail Glider (Acrobates pygmaeus) and the Pygmy-Possum (Cercartetus nanus) in a ratio of 1:7 respectively whereas in the third layer down the ratio was 7:5. This may show a reversal in

relative availability, and possibly in relative abundance in the local area (although the sample is insufficiently large to confirm this), and it could be evidence of the lack of a predator's preferred food, or none of these things. One interesting point is that even though a deposit may be mixed, so that layering is absent, picking out the "red" bones may suffice to distinguish the old from the new. The bones may be of different colours due to differential replacement by minerals with time.

A comparison between deposits is more difficult as local conditions complicate the matter although it would provisionally appear (again from Wakefield's work at Buchan), that there are real general differences between "Owl" and "Native Cat" deposits. It follows that it is most important that precise habitat descriptions be given for the country surrounding each site.

It might be said that comparisons between deposits and of layers within deposits would give information on the successive changes in vegetation due to climatic change over periods of time, and this has been suggested by various authors. However, I cannot agree that there is yet enough information to support this sort of speculation, it is well known that in any area there is a large variety of habitats existing side by side, particularly in mountain country, and whilst immediate vicinity changes might be inferred, certainly no more than this should be attempted at the present state of knowledge.

Age of Deposits.

The last point to be made in this section concerns the age of these bones. This is relatively simple, the age of all deposits so far examined is unknown, and by their nature they probably span many years, some authors

guess thousands of years. Deposition may have been discontinuous. What evidence is there to ascertain age? Accidental visitation continues today, since 1960 new possum and snakes, and lizards, and newly-dead bats are often found, similarly there is no reason why death-trap deposits should not be being formed today. No dates have been put to the earliest occurrence of any species in any of these groups.

Predator accumulations as such will no doubt go on being formed so long as there are suitable predators, but in practice it has been supposed that the end of accumulation of the latest deposit so far found was during the last or at the opening of this century. This is based on the supposed absence of introduced species within the body of the deposits although it has been admitted that rabbit bones have occassionally been found loose on the surface. Further, it is not possible at present to distinguish introduced Rattus from native Rattus species. It is true that distinction within the genus may sometimes be made to a reasonable degree of certainty, but it would be a brave man who would say that no introduced species existed in a deposit. Sudden reduction in numbers due to the arrival of disease and "competitors" introduced by white-man is the hypothesis for assuming the deposition to have ended at the turn of the century although I can see little reason why deposition should not have ceased long before or even after this. That deposition continued for some time seems to be indicated by the sheer volume and depth of bones, by the fact of layering in some accumulations, and by the scattered presence of red bones in deposits which are assumed to have been mixed. Redness is assumed to be indicative of age, and the extinct

SMALL MAMMALS REPRESENTED IN BONE DEPOSITS IN CAVES. % PRESENCE AT LOCALITIES LISTED

Latin Name	Common Name	Probable Present Status N.S.W.	Preferred Habitat	BUCHAN Pyramids - Owl White bones	BUCHAN Pyramids - Owl Red bones	BUCHAN M28 Native Cat	YARRANGOBILLY Y50 Surface	YARRANGOBILLY Y50 Layer 3 down	WOMBEY Surfa
Marsupials									
Phalangeridae - Possums and Gliders									
Cercartetus nanus	Pigmy Possum	Uncommon S.E.Coast	S	6	14	3	4	4	4
Eudromicia cf. lepida	?Tasmanian " "	Tasmania	S	-	1	-	-	-	-
Acrobates pygmaeus	Feathertail Glider	Uncommon Eastern ½	SW	4	9	0.7	0.5	5	7
Petaurus breviceps	Sugar Glider	Common Coastal	S	2	2	21	0.5	-	t
Petaurus norfolcensis	Squirrel Glider	Uncommon Eastern ½	S	t	t	4	-	-	-
Gymnobelideus leadbeateri	Leadbeater's Possum	rare Victoria	S	t	2	-	-	-	-
Burramys parvas		extinct		-	2	-	-	-	-
Trichosurus vulpecula	Brush-Tailed Possum	abundant	WSP	-	-	t	-	-	-
Pseudocheirus peregrinus	Ring-Tailed Possum	Common Coastal	RSW	1	1	13	1	1	-
Schinobates volans	Greater Glider	abundant Eastern ½	S	t	t	1	-	-	-
Peramelidae - Bandicoots									
Isoodon obesulus	Short-nosed Bandicoot	Uncommon Coastal	S	-	t	5	0.5	1	-
Perameles nasuta	Long-nosed Bandicoot	abundant Coastal	RS	1	1	5	t	-	0.8
Macropodidae - Kangaroos etc.									
Potorous tridactylus	Potoroo	rare coastal	RSW	t	t	2	-	-	-

Dasyuridae - Carnivorous Marsupials									
Antechinus flaripes	Yellow-footed Marsupial Mouse	abundant Eastern ½	RS	22	20	6	6	3	6
Antechinus swainsoni	Swainson's Marsupial Mouse	uncommon coastal	RS	3	3	3	6	-	-
Sminthopsis sp.	Marsupial Mouse	common	not R	-	-	-	8	10	19
Phascogale tapoatafa	Brush-tailed Phascogale	uncommon Eastern ⅓	RSW	t	t	2	-	-	0.8
Dasyurops maculatus	Tiger Cat	uncommon coastal	R	-	-	t	-	-	-
Dasyurus quoll	Eastern Native Cat	uncommon coastal	S	-	t	1	-	-	-
	TOTAL PERCENTAGE MARSUPIALS			40	57	68	21	24	37
Rodents									
Muridae - Rats and Mice									
Gyomys novaehollandiae	New Holland - Mouse	probably extinct	WS	5	t	t	t	1	5
Gyomys fumeus	Smoky Mouse	probably extinct	S	9	14	2	12	18	11
Pseudomys australis	Pseudo-Rat	probably extinct	WP	20	3	10	5	2	14
Mus musculus	Domestic Mouse	common	PWS	-	-	-	-	-	-
Rattus sp.	Rats various species	abundant	SW	15	24	5	56	50	29
Mastacomys fuscus	Broad-toothed Rat	very rare	S	9	2	11	7	4	-
Conilurus albipes	White-footed Rabbit-Rat	extinct	W	2	t	6	-	-	4
	TOTAL SAMPLE NUMBER			1255	2127	548	375	136	241
	Sources of Information	Marlow Wakefield Tate		Wakefield			Drummond		

Preferred Habitat Symbols: R=Rain Forest, S=Sclerophyll, W=Woodland, P=Plains (after Marlow)

[illegible] reported only to occur as fossil material at Bathurst, Wakefield 1960. It has been suggested that B. parvus dates back to the Pleistocene. Discontinuity of deposition is I think indicated by bedding planes which occur at Yarrangobilly.

Finally, what is the age of the Wellington fossil breccia? Beyond the fact that it contains many now extinct mammals, many of large size, (which is supposed by some to indicate Pleistocene origin), it is clearly a thoroughly mixed deposit. Until radio-carbon dates are available this exceedingly interesting question must remain unresolved.

Data available at the present time and an appeal for further information.

The final part of this article consists of a presentation of available data on some of the predator-like deposits within 500 miles of Sydney. This restriction is justified as predator deposits are thought to be sufficiently related to be comparable whilst information on other deposit types is as yet more fragmentary. Present status and habitat of each species is also indicated for reasons of interest and comparison (see table). One of the reasons for production of this article is that the author hopes that responsible speleologists will co-operate by informing him of the whereabouts of bone deposits. The lower part of Plate 2 has been included to give some idea of the kind of material that is being sought. Most of the outline drawings are approximately natural size, though the larger ones, for reasons of production expense, have had to be reduced by half as indicated. It is as well to remember that, with the larger species, only young are liable to be caught, so allowances must be made for

size. All drawings have been made directly from specimens many of which were generously lent by the Australian Museum. As may be seen from the plates some species are distinctive, but most are quite similar to each other so that expert identification is a necessity. Do not destroy or indiscriminately disturb any deposit you may find (as this may irrevocably annihilate valuable evidence) but rather, determine the general nature and exact location of the deposit and inform the relevant scientists concerned.

Acknowledgements

Thanks are due to Jack Mahony of the University of Sydney for advice on identification and to Basil Marlow of the Australian Museum who allowed me to draw specimens from the Museum collection.

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A PRELIMINARY REPORT ON A COLLECTION OF MARSUPIAL FOSSILS FROM WELLINGTON CAVES, N.S.W.

By Jeannette Partridge and Alan Thorne
Illustrations by Louise Mueller.

For cavers with a geological or zoological interest the search for fossil remains can often be an additional source of adventure and excitement. We are fortunate to have an extensive range of caving areas, stretching through the central west of N.S.W., where a wide variety of Pleistocene marsupial fossils are found. Perhaps the largest and most representative deposit is at Wellington Caves, which were etched from typical limestone on a site some 230 miles NW of Sydney and 8 miles south of Wellington by the Bell River, which now flows about half a mile from the caves. The first serious collection of this fossil fauna was made in 1836 by the explorer T.L. Mitchell, who sent the specimens to England where they were described by Sir Richard Owen at the Hunterian Museum. In his book "Three Expeditions into the Interior of Eastern Australia", Mitchell quotes a letter from Owen containing the first scientific descriptions of many of these specimens. No further serious work has been done on the marsupial fauna since Owen's pioneering studies.

One theory that has been put forward for the presence of the Wellington deposits is that during the time of the cave deposits, and possibly at their formation, widespread floodings occurred. Numbers of marsupials of all types were supposedly marooned on high ground and drowned in the rising flood waters. These animals were washed into the caves and deposited in the settling mud. It has been shown that there is no temporal stratification in the deposit. From this it is inferred that a succession of floodings occurred,

which produced a washing in and out and a thorough mixing of the contents of the caves. This is also shown by the high degree of fragmentation of the bony remains in the deposit today.

Some idea of the range of fossil fauna to be found at Wellington was gained by a party of eight from the Sydney University Zoology Department, who camped at the site in May, 1963. Although only short periods were spent in the main Bone Cave, large numbers of fragments were recovered. The deposit is relatively soft silted material with some calcification, not only of the bony remains, but of the deposit itself. The bones were found in extremely large numbers projecting from the walls and roof of the passages and were extracted with fine chisels and dissecting needles. Many teeth and smaller fragments were found by sifting the thick floor layer which has been built up from previous excavations.

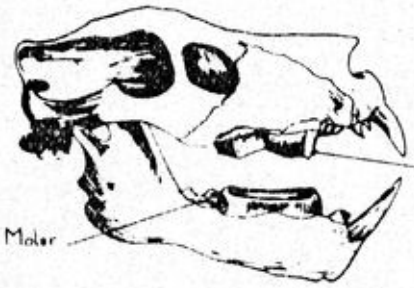
Although most of the bones were incomplete, one Macropod (kangaroo) tibia almost 15" long was extracted in its entirety. The party also extracted several almost complete Macropod jaws and innumerable Macropod teeth. Fragments of other ground-living marsupials were found, including Thylacoleo (Marsupial Lion), Perameles (bandicoot) and also a species of the thylacine wolf (Marsupial Wolf) -- Thylacinus spelaeus (Owen). Another species, Thylacinus cynocephus, has been described in recent times as being restricted to Tasmania, and is thought to have possibly become extinct there during this century. A large wombat jaw fragment was found but no remains of Diprotodon, or of the extinct

giant wombats, including Phascolonus gigas, which were described from this cave by Sir Richard Owen. Various Diprotodontid fragments have been found from time to time in this cave by other workers. Small rodent fragments were extremely common, probably of rats, which, if the numbers found are any guide, must have been very abundant.

Large pieces of the breccia from the Bone Cave were brought back for laboratory study. In these were many smaller fragments too delicate to be chipped out on the site. These fragments, which included more teeth and several complete rodent lower jaws, were recovered by immersing the blocks in a weak solution of acetic acid. The calcified earth surrounding the bone was slowly dissolved away and by taking out the blocks, washing and drying them, painting the exposed bone with a glyptol mixture and re-immersing the blocks, the bony fragments were left in a sludge on the bottom of the acetic acid tanks. Each block, weighing about 10 pounds and up to a foot long, took nearly two weeks to dissolve completely with a three day routine of fresh acetic bath, washing, drying and painting.

Although not directly connected with the Wellington fauna, the fossil beds at Coonabarabran, a further 150 miles NW from Wellington, were also inspected. Here the fossils are found in a 30 ft. thick open-cut deposit of diatomaceous earth on the side of a mountain. The deposit was formed by diatoms, unicellular plants, in an extensive freshwater lake of Tertiary age. The siliceous skeletons of the diatoms settled to the bottom as an ooze, in which were trapped or covered various plants, insects and fish. Recently the remains of a bird were found in the deposit and were forwarded from

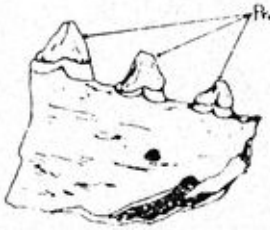
Occlusal View



Thylacoleo Skull

Carnassial Premolar

Molar

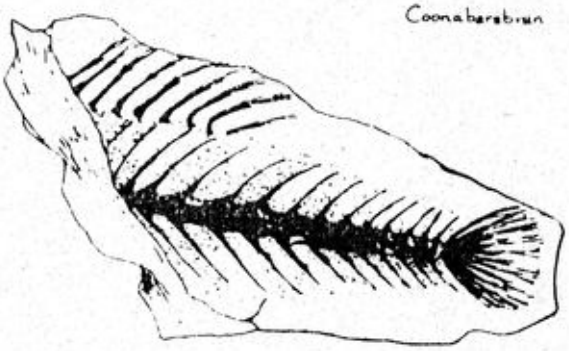


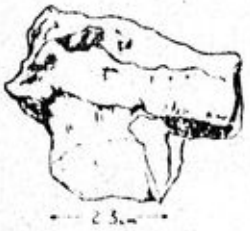
Premolars

A Thylacine (Marsupial Wolf) Jaw Fragment

Teleost Fossil in Diatomaceous Earth -

Coonabarabran





2 Sm

Half of Carnassial Premolar of Thylacoleo

Molar of Thylacoleo

the Australian Museum to the U.S. for description. In several hours simply by splitting the large blocks of very soggy earth, excellent fossils of the leaves of eucalypts and other plants were found, as well as more than a dozen specimens of teleosts (bony fish), well preserved but in most cases incomplete. The fish range from six inches to a foot in length. Only one species of fish has been described, but the total number present in this deposit has not yet been worked out.

It seems important that a comparison be made between the Wellington Caves fauna and the contemporary species of marsupials and rodents. The only animal group from the caves which has been discussed in any detail are the rodents, studied by Mr. J. Mahoney of the S.U. Geology Department. We would be grateful to have any fossil material found in the caves at Wellington and near-by areas in the hope of one day furthering Owen's work. We would like to thank Dr. N.G. Stephenson, of the Zoology Department whose enthusiasm originally inspired us to go to Wellington, for his advice in writing this article.