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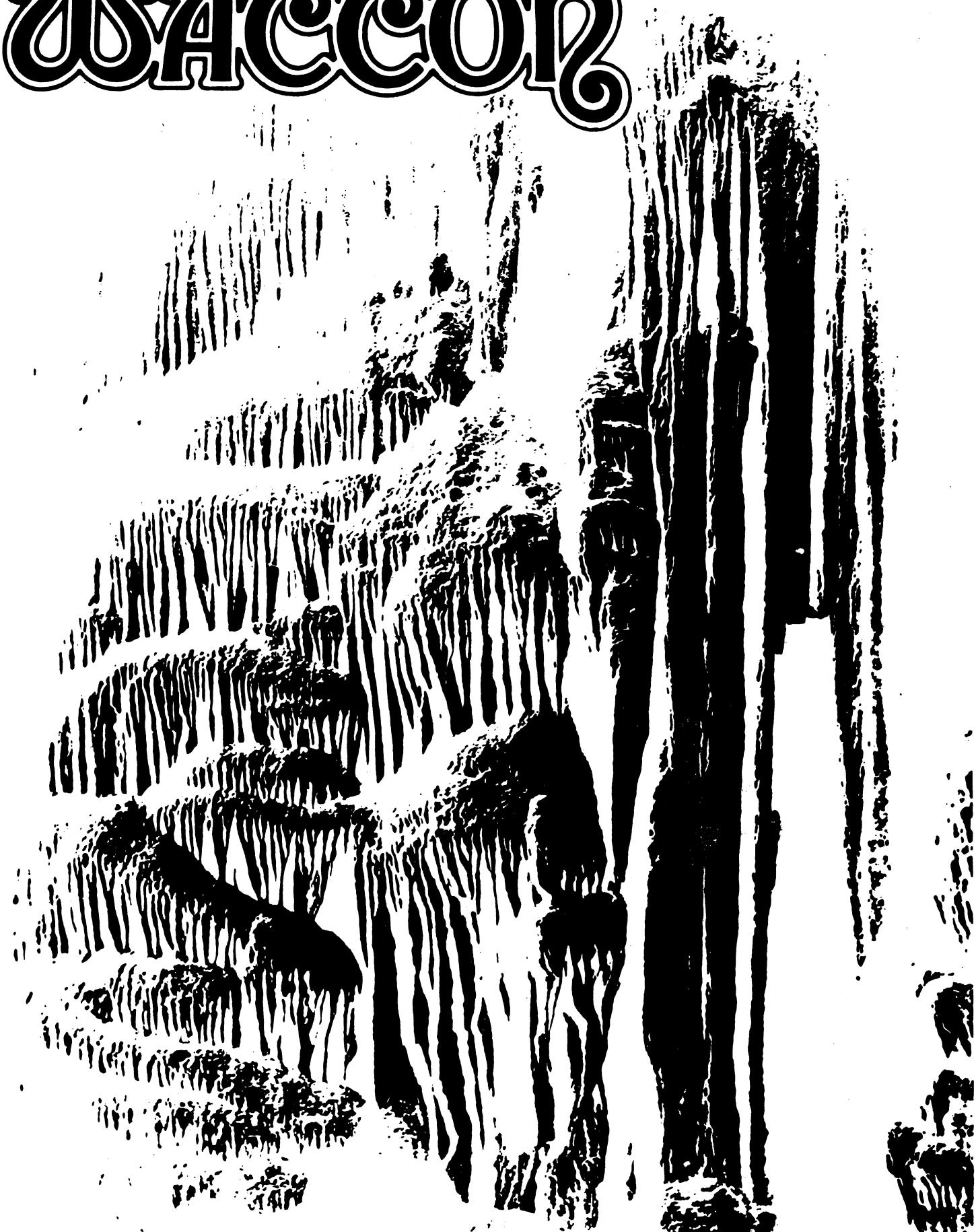
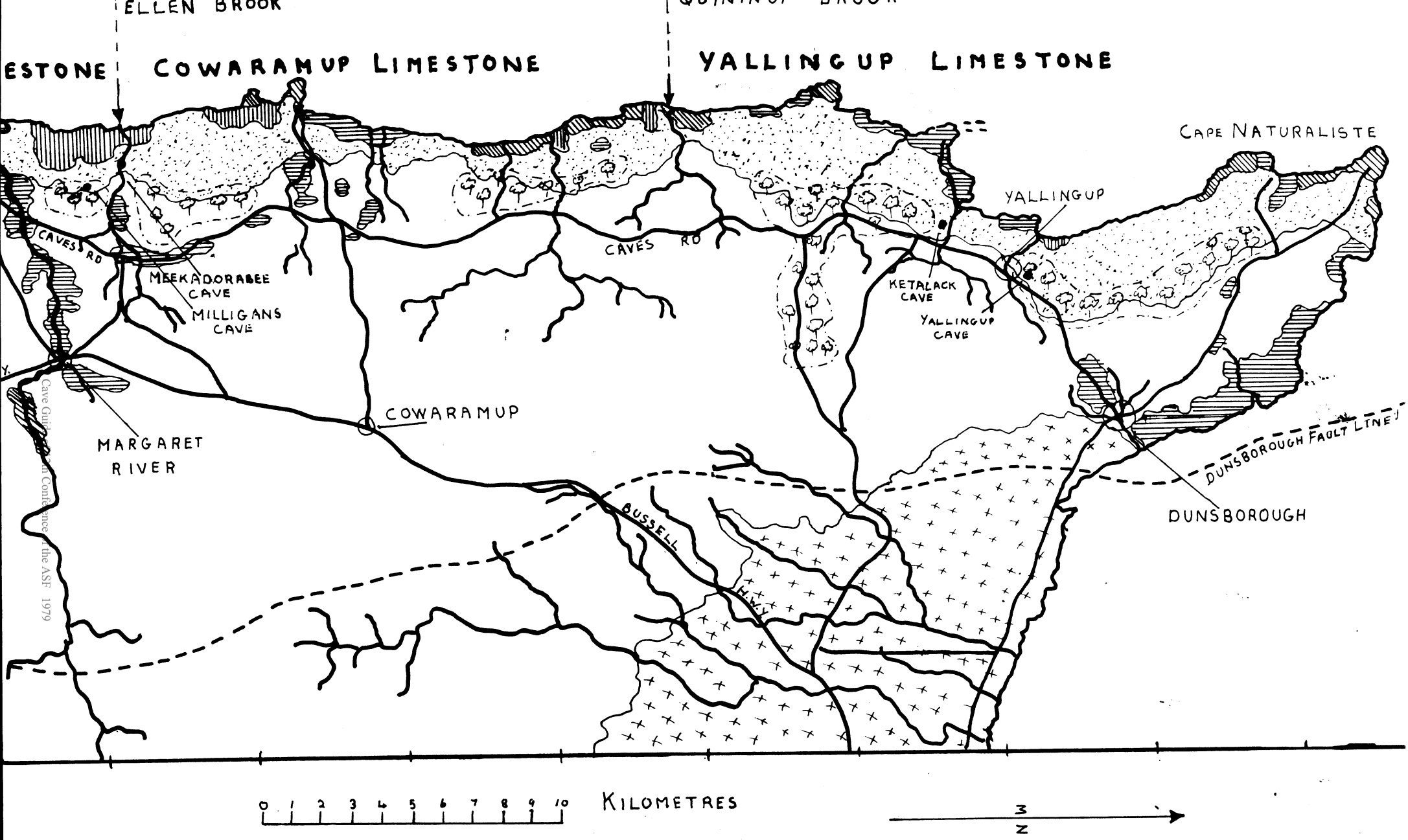
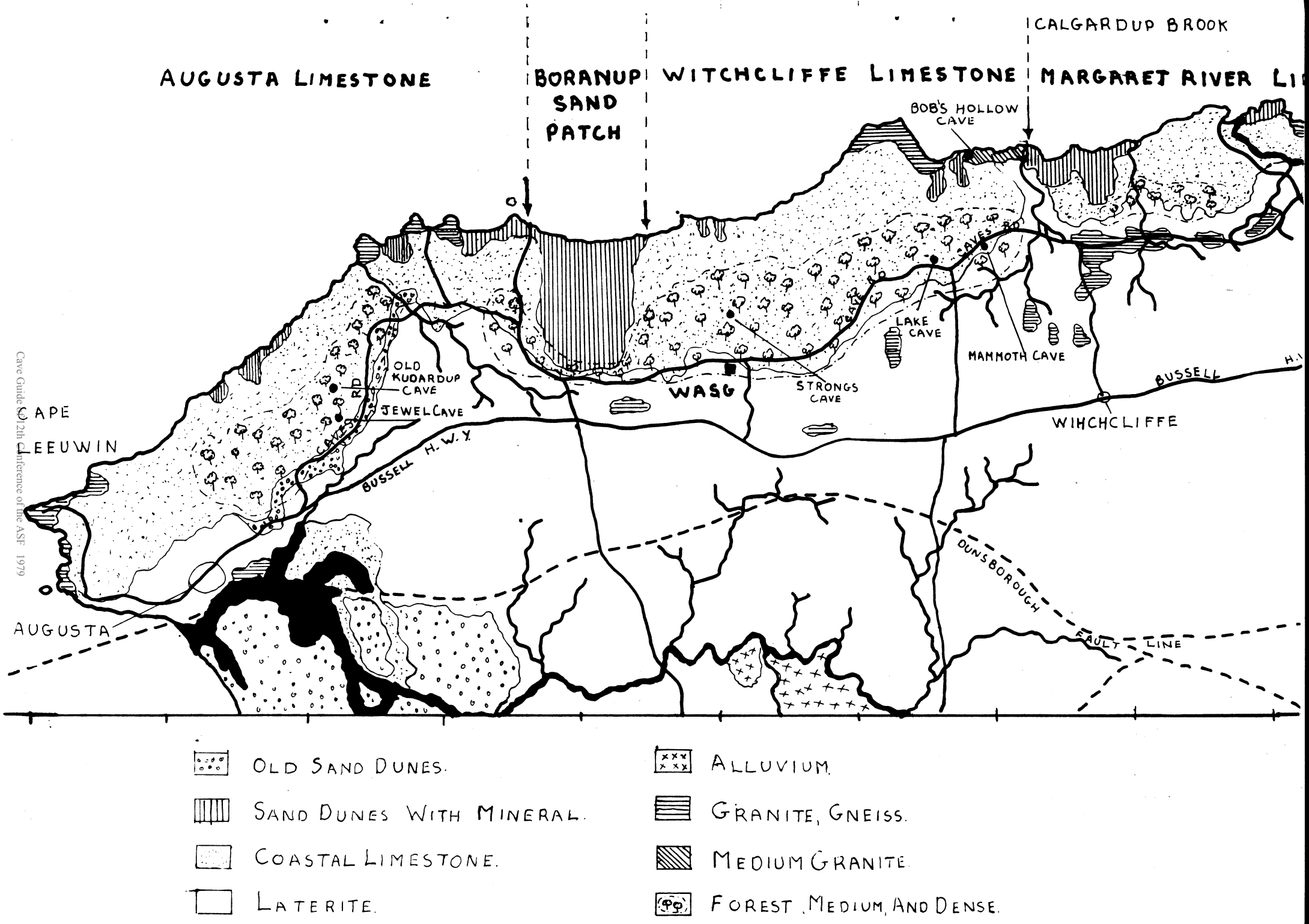
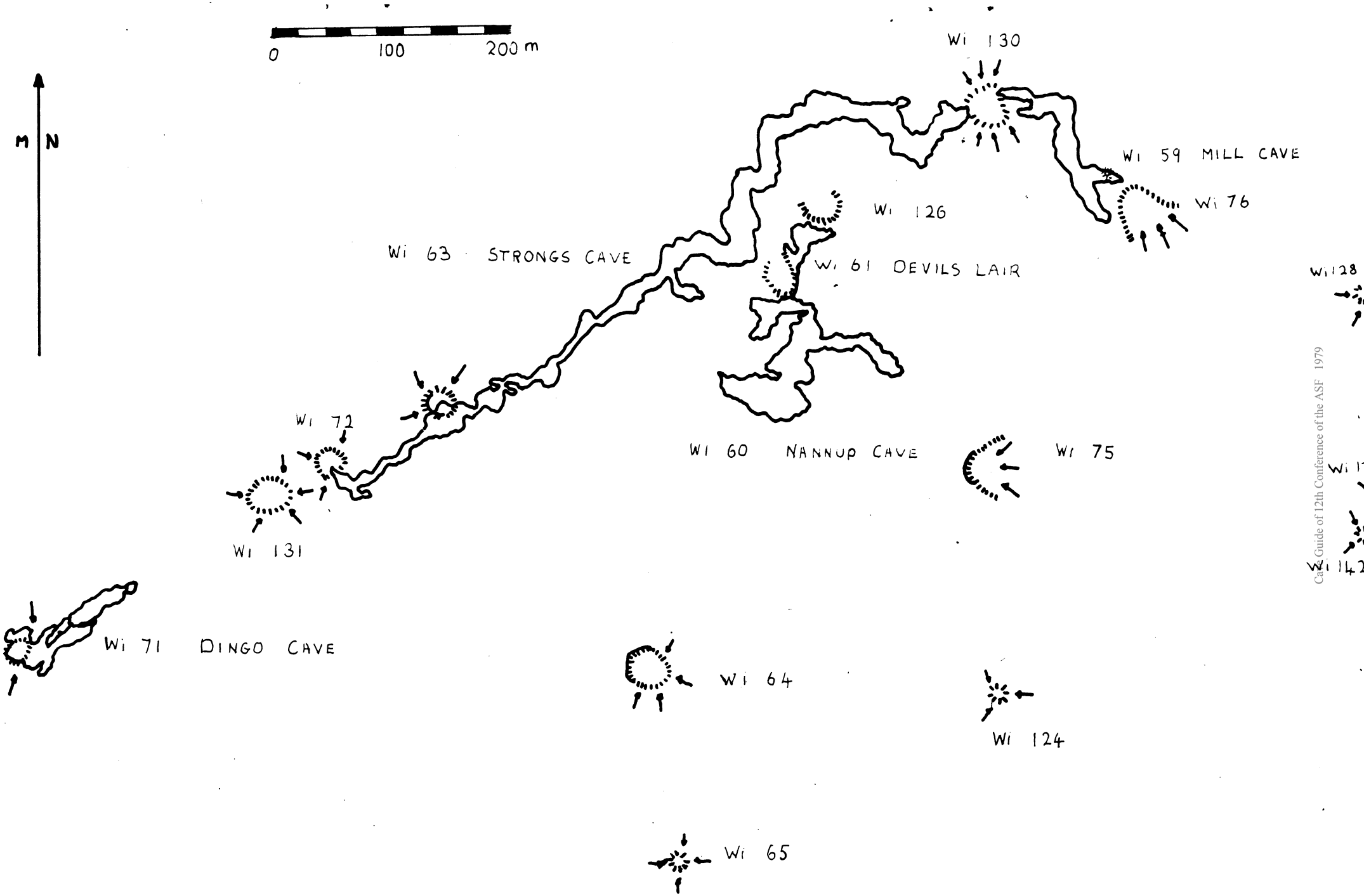


GUIDEBOOK TO CAVES OF SOUTHWESTERN WESTERN AUSTRALIA







WACCON

GUIDEBOOK TO CAVES OF SOUTH-WESTERN WESTERN AUSTRALIA

published by

WESTERN AUSTRALIAN SPELEOLOGICAL GROUP

NEDLANDS

DECEMBER 1978

INTRODUCTION

This publication is intended to provide information and background to people interested in the caves of the south-west of Western Australia. Participants at WACCON, the 12th Biennial Conference of the Australian Speleological Federation, 1979, in Perth, W.A., will find it of value in various areas for field trips. The south-west areas treated are from Augusta north to Eneabba.

Many people have contributed to the production of this booklet. Barry and Frank Loveday have been responsible for an incredible amount of research to produce the information on the Leeuwin-Naturaliste Ridge, except for the Augusta area. Barry compiled the area map just for this publication. Barry and Frank also produced most of the other maps. Peter Bell wrote the Augusta information and produced the maps of Jewel and Old Kudardup Cave. Peter has been responsible for the production of the front cover, a picture from Old Kudardup Cave. Rauleigh Webb wrote the Eneabba information. Kerry Williamson wrote the geological notes and the information for all other areas not previously accounted for. Printing of the maps was by the Community Recreation Council. All other printing was by W.A.S.G.

It is hoped you will find the publication of use and interest and that it will aid your enjoyment of the caves in Western Australia.

CONTENTS

GEOLOGY AND GEOMORPHOLOGY

South-west of Western Australia

Coastal Limestone

The Coastal Limestone is believed to have formed 100 000 to 300 000 years ago. At that time, extensive glaciations caused the lowering of the sea level as much as 60 metres below present levels. The south-west of W.A. is one of the windiest sections of temperate coastline in the world. The high wave and wind energy results in a fast flux of sand-sized particles from the sea to the beaches to the active dune belts beyond. These particles are mainly calcareous and of biological origin, viz. mainly mollusc shell fragments, fragments of the calcareous red algae, and the microscopic skeletons of Foraminifera. Other particles are derived from the erosion of the basement rocks and the reworking of soils. These are mainly quartz in the Leeuwin-Naturaliste Ridge, with some feldspars, garnets and heavy minerals.

This sand, over several incursions inland, blew into large dunes up to 200 metres above sea level. These dunes became stabilised by vegetation and the contemporaneous processes of soil formation, lithification and karstification began to occur. The lithification or solidification of the dunes is caused by rainwater, during the wet season, dissolving out part of the carbonate of lime which is then carried downwards to the watertable or the gneiss basement. During the dry season, reprecipitation of this carbonate of lime produced a very hard caprock near the surface, with less well-cemented limestone below and a leached quartz sand above. With time, the quartz sand developed into mature soils ranging from humic loams to terra rosas with ferricrete. These processes continue at the present.

One factor important to the development of caves in this area is the ease with which the northward-migrating dune belts helped by prevailing winds threw barriers of dune sand over the courses and valleys of small streams which lacked the flow of water in summer necessary to resist the encroaching sand. More perennial streams such as Turner Brook and Yallingup Brook modified the dunes to form gorges of construction (Jennings, 1968).

North of Perth, even very large rivers (for example, the 160 km long Arrowsmith River) are very seasonal in their flow and could be blocked by the encroaching dunes. This has resulted in some very large streams sinking and forming large cave systems, for example, the river entering the Stockyard Gully system has been measured at 40 cusecs.

The streams whose downstream courses had been crossed by the dune belts would continue to flow through the porous dunes along their old courses, though some ponding would produce swamps. These vegetation-choked swamps would, with time, play an important role in contributing to the aggressiveness of the stream waters.

When the dune belt solidified into limestone a cavity could form above the stream. This cavity was widened and undercut by the stream until it became too wide for the roof to support the weight of limestone above. At this stage a collapse occured producing a collapse dome or in some cases the collapse followed lines of weakness such as dune bedding or soil horizons. The weakness of the Coastal Limestone results in a preponderance of collapse forms, both doline and cave passage, often of considerable size.

While the dune was solidifying, tree roots going deep within the sand would act as conduits for the flow of percolation water. Sand around these roots would not lithify, leaving a tube of loose sand through the solid rock. If a collapsing cave intersected such a tube, the sand plus some surface soil would fall into the cave producing a soil cone and a shaft or solution pipe. Many caves are entered by such pipes.

As the Coastal Limestone consists of sand grains cemented together, water can move downwards between the grains whereas with impermeable crystalline limestones this percolation is restricted to the joints. Thus, straws, stalactites, etc., can occur over the whole roof of a cave, and the preponderance of small pores favours the formation of helictites. The minimal role played by joints (if any) in downward percolation of water disfavours

the formation of rimstones as concentrated flows of such waters are rare. The sloping roofs reflecting dune bedding favour the formation of shawls of which there are many fine examples.

North of Perth stalagmites are more common and obvious. A recent suggestion (Dick Van der Roest, pers. comm.) is that a temperature gradient between roof and floor may be responsible in these shallow caves below a sparsely vegetated hot surface.

The common occurrence of sand grains in the caves, derived from soils and stream dissolution of calcarenite, favours the formation of oolites. The complete life history of an oolite nest from initiation to final cementation has been observed over the last 20 years in the Easter Cave dig.

Asphodelites, a peculiar flower-like splatter formation formed on cave floors by very saturated drip waters, have been described from Calgardup Cave, Blackboy Hollow and Deepdene Cave by Bridge (1972).

Halite exudation which plays a very important role in the Nullarbor caves is of less importance in the south-west but forms undercuts in seaward facing gorges and peels the skin off stalagmites in Quinninup Lake Cave.

Extensive moonmilk forms are common around entrances in Coastal Limestone caves. This is the combined result of the multiplicity of percolation pores and the seasonal wetting and drying of this area of the cave. In the north where the climate is more seasonal, the zone of wetting and drying is more extensive and consequently the zone of moonmilk is more extensive.

The rocks underlying the limestone affect drainage patterns and hence the mode of formation of caves. The Leeuwin-Naturaliste limestones are underlain by Granite-Gneisses and Granulites at least 660 million years old. Streams are swiftly flowing and confined more or less to their gneissic river valleys. In contrast, the limestones of the Swan Coastal Plain overlie softer Tertiary sediments and in most cases this contact is below local watertable levels. Streams are thus not confined to valleys and complicated hydrological systems past and present result from collapse diversion of cave streams.

Surface karst forms are rare, being precluded by soil cover and lithology. Linear karren are rare in poorly cemented calcarenites, but in some indurated caprocks small sections of rillenkarren occur, for example, Yallingup Cave entrance. Splash and rain-pitted karren are common on exposures especially near the sea. At the slope of the younger Augusta limestone onto the older, and on remnants of similar limestone in northern Witchcliffe, areas of karst pavement with local runoff pipes occur. Extensive karst pavements occur in the Eneabba area.

Geology and Geomorphology of the Leeuwin-Naturaliste

The Leeuwin-Naturaliste Ridge Coastal Limestones stretch for 80 km atop a ridge of Granite-Gneiss and Granulites which show considerable local variations in relief for W.A. The cave areas in this ridge, from south to north, are Augusta, Witchcliffe, Margaret River, Cowaramup and Yallingup.

The Witchcliffe area and the three areas north of it are typified by stream cave systems whereas the Augusta area is typified by shallow nothephreatic maze caves. Recent extensive mapping, some geomorphological and geological interpretation and the beginnings of a hydrological investigation have given rise to a fairly complex (but tenable) hypothesis for the formation of the Augusta caves which further work shall put to the test.

Witchcliffe cave streams drain swamps. Further north, the basement has a greater relief and catchments and streams are smaller. Hence active streams are rarer and inclined fissure caves more common.

HISTORY OF THE LEEUWIN-NATURALISTE

Between Cape Naturaliste and Cape Leeuwin lies a belt of dune limestone some 80 km long and 7 km wide at the maximum, intersected only in places

by various streams and rivers and certain geological features such as the Boranup Sand Patch. In this area can be found more than 200 speleological features and caves.

Over a period of more than 100 years, this area has been explored and surveyed by numerous groups of early settlers and surveyors and later, in the last 20 years, by members of the Western Australian Speleological Group.

The earliest reports on exploration of caves were mentioned in a report in the newspaper *The Inquirer* dated 1848 by a Mr Turner of Augusta giving a detailed description of some caves explored in that area near Augusta. One such cave could possibly be the Old Kudardup Cave which has on excellent display of historic cave graffiti on its formation. During the 1880s and 1890s more major caves were discovered when the forest was cleared by the M.C. Davies Timber Co. and also by the Bussells who were early settlers in the district. Caves in these areas have also been found to contain the names of early settlers written on the formation.

The turn of the century saw the establishment of the Caves Board by J.W. Hackett for the purpose of managing the caves for tourism. Between 1901 to 1914 more than 14 caves were developed for tourism and recreation and several other caves were partly developed but were never opened. The first caves in the south-west to be developed with electric lighting were Yallingup Cave in 1903 and later Northcote Grotto in 1905 while the caves in the Margaret River area were still being lit by magnesium lamps.

The Government commissioned Marmaduke Terry in 1900 to survey all speleological features above ground between Yallingup and Augusta. This above ground survey is the basis for the W.A.S.G. Cave Lists in the south-west today. Later in 1902, Yallingup Cave was also surveyed by Terry and a proposal for a shaft to a cave in Yallingup Gorge was put forward but later this plan was abandoned.

During the years 1907 to 1909 the Caves Board promoted an extensive advertising campaign with lectures and slides and printed pamphlets of a descriptive character. These were sent to tourist centres throughout the world advertising the caves of the south-west.

In 1910 the Caves Board was partly abolished and in 1914 it was fully integrated into the Licence and Liquor Board which was in control of the State Hotels. Many of the tourist caves became neglected and although the caretaker of the caves, Tim Connolly, appealed for money for repairs, it was denied.

Slowly over the next two decades from 1920 onwards, many of the installations in the tourist caves were damaged or destroyed by bush fires or by neglect through lack of funds.

Two events were important in this period. Lake Cave flooded in 1924. This required the contracting of mining engineers to construct a shaft to drain off the flood water after the flooding so the cave could again be opened for tourism.

In 1928 visits to the caves had reached over 2000 people per year. In 1936 a huge bushfire swept through the caves reserve, burning and destroying most of the entrance ladders to Bride's Cave forcing the closure of this cave to possible use by the public.

From the early 1930s to 1950, much caving and exploring was done by Rudduck, including the entering of the downstream section of Strongs Cave in 1938. By the 1950s, only five caves were open to the public, of which three of these are still open today.

Cavers exploring in the Augusta area in the late 1950s discovered the majestic Jewel Cave system which has 3 km of passageways. This cave was developed for tourism and opened to the public in 1959 by Sir David Brand, thus closing Moondyne Cave nearby.

Around this time, the same small group of cavers, some of whom were later to form the nucleus that was to become W.A.S.G., discovered some major extensions in a cave nearby called Easter Cave. These discoveries promoted the founding of W.A.S.G.

Later in 1960, it was members of this same fledgling caving group that discovered and explored Labyrinth Cave. This gave rise to increasing activity by cavers and W.A.S.G. went from strength to strength, with the discovery of the upstream section of Strongs in 1960 and the Christmas Star extension in Crystal Cave in 1968.

In the last decade, major finds have been Terry Cave, Winjans, Boya Booka, Beenup and many more. Major extensions have been found in Easter Cave, including the CEGSA extension found in 1976 during the survey of this very extensive system. It is hoped that many more finds will be made in this area in the next decade.

AUGUSTA

Augusta is the Mecca of W.A. speleos for here can be seen the most heavily decorated and some of the longest caves in W.A.

Covering an area just over 16 km long from Cape Hamelin in the north to Cape Leeuwin in the south, the Augusta caving area, designated AU, contains a belt of coastal limestone consisting of Pleistocene deposits laid down during glaciation periods. Some characteristics of the aeolianite are sharp jagged limestone which has been greatly eroded by high rainfall, very heavy vegetation (Karri *Eucalyptus diversicolor*), heavy undergrowths and many speleological features and caves.

Climate. The climate here is Mediterranean, humid and receives a high annual rainfall followed by a short summer drought. Temperatures often rise to 40°C, so if you can't keep your cool in the caves every day, the local beaches will offer a pleasant alternative to even the most dedicated caver.

Tourism. Tourism is an important industry of the Leeuwin-Naturaliste Ridge, so if you can spare a day from caving, go touring as there is a lot to see. Within the Augusta area are:-

Cosy Corner: A great beach, sheltered and ideal for children. While you're there, check out the limestone outcrop on the beach to the south of the car park. It contains many blowholes spurting water up to six metres on rough days.

Leeuwin Light: Built in 1890s by M.C. Davies and Co. entirely out of local limestone, it is the tallest lighthouse in W.A. Check at the lighthouse for inspection times.

Leeuwin Water Wheel: Built in the 1800s to supply water to the lighthouse and Augusta, the wheel is now completely covered with calcite from the spring which flows over it. The Leeuwin Water Wheel Spring (AU 26) flows all through the year, but so far no cave has been found, so if you have time for a walk, ...

There are many more places to see both in the Augusta area and in other parts of the Leeuwin-Naturaliste Ridge, for example, Cape Naturaliste, Yallingup Beach, Canal Rocks and Prevally Park. For more information see the Augusta-Margaret River Tourist Bureau in Margaret River.

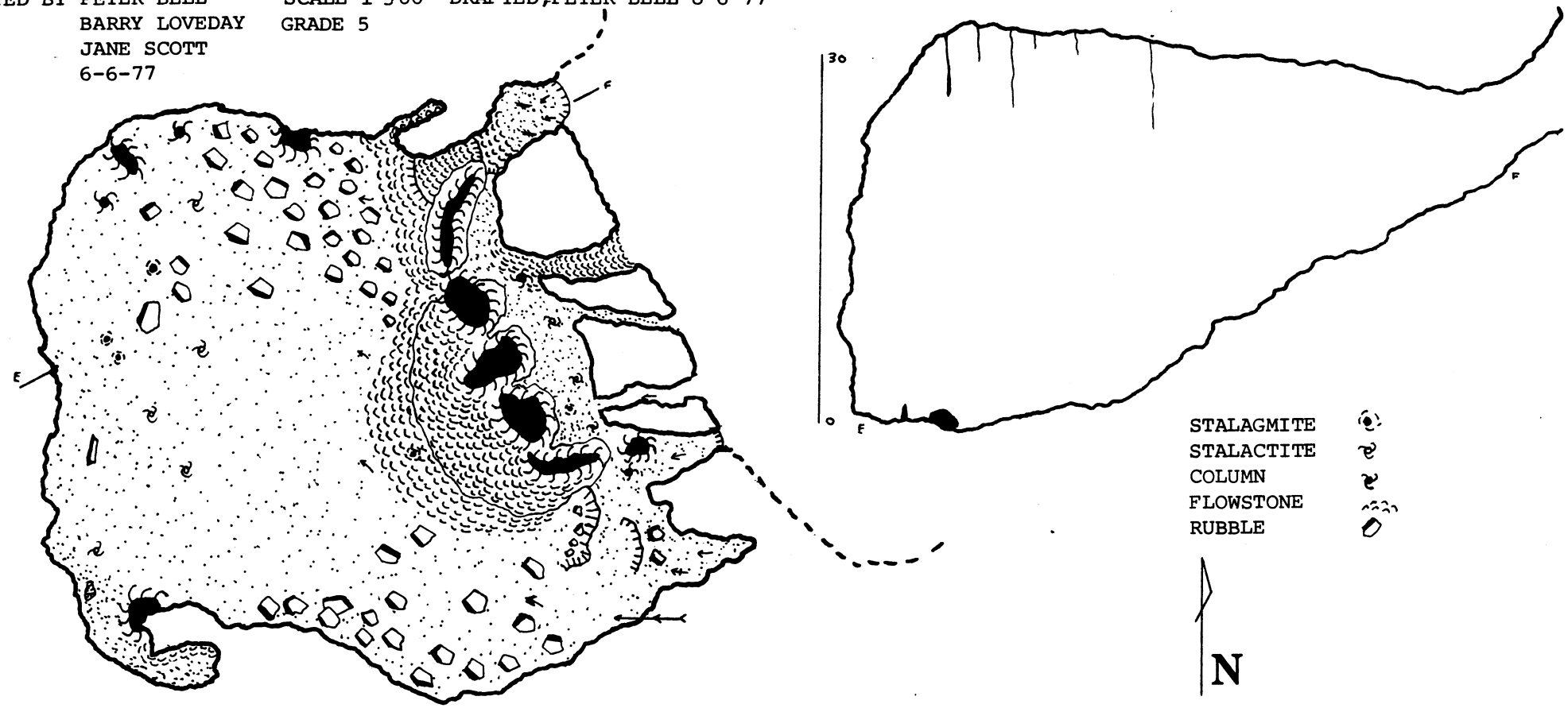
The caves. There are 29 known speleological features and caves in Augusta. The possibility of finding more is certain, the only limiting factor being the dense forest around them and the generally small entrances to the caves. Most of the caves have solution pipe entrances, and a few have large collapse entrances. The caves are phreatic and can be divided into two categories.

1. Caves reaching water table: These caves are complex in their layout. There are four known caves in tiis category, namely, Easter, Jewel, Moondyne and Labyrinth. If one looks at the walls, ceiling and formations of these caves, it can be seen that the rise and fall of the water table has been considerably responsible for their formation. The depth of these caves is approximately 42 metres at water level. They are all heavily decorated, predominantly with straws. They have many complex interconnecting passages. These caves show a vague north-east trend due to the underlying Pre-Cambrian gneiss. One common feature of these caves is that they are multi-level, having as many as four different levels. It is these levels that explain the presence of caves not reaching water table.

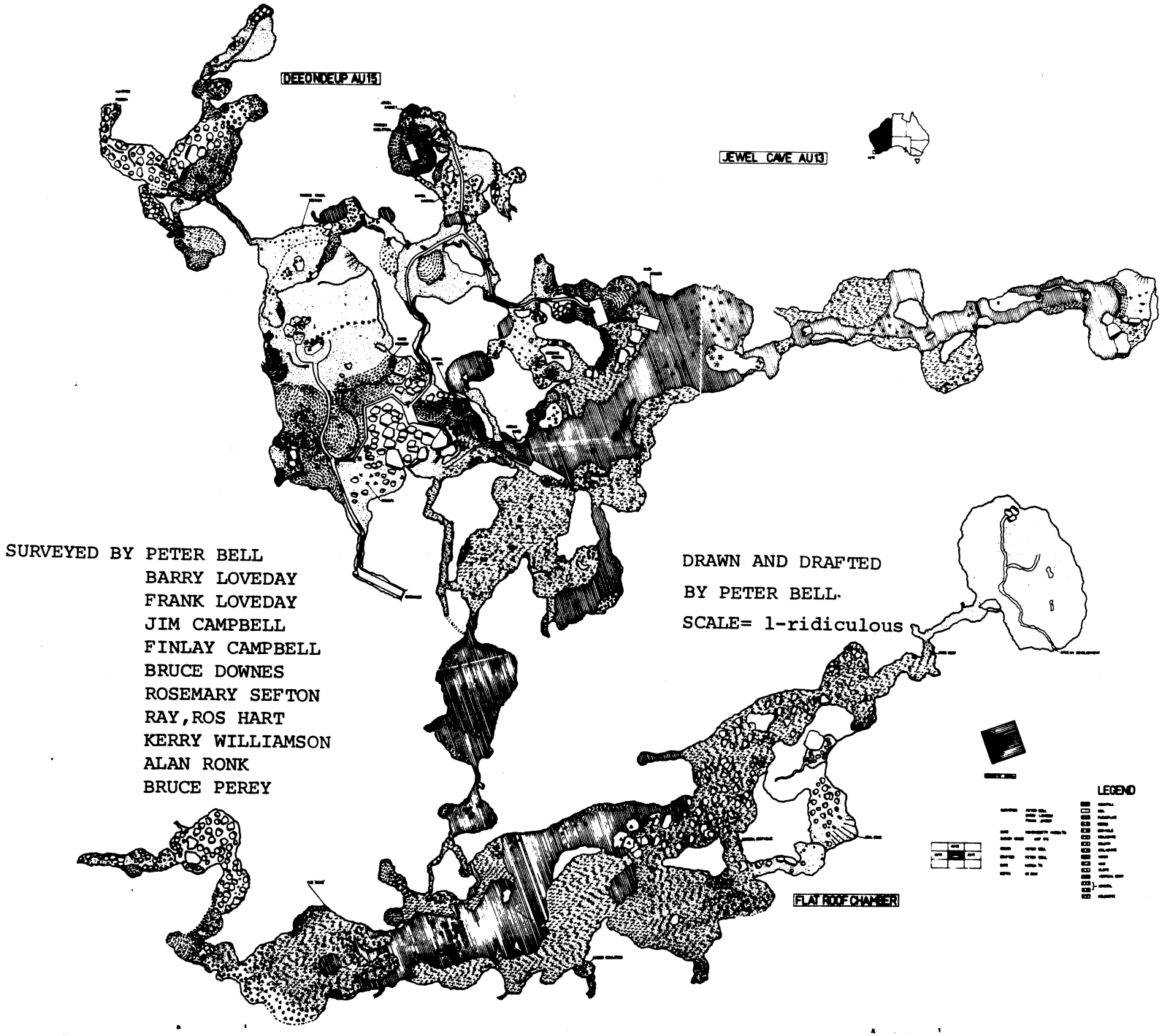
SURVEYED BY PETER BELL
BARRY LOVEDAY
JANE SCOTT
6-6-77

SCALE 1-500 GRADE 5

DRAFTED, PETER BELL 8-6-77



KUDARDUP CAVE AU 9



2. Caves not reaching water table: These caves are generally much smaller and are usually vertically developed, for example, Harleys Cave and Bat Cave. These caves are surely consolidated for extension into bigger systems as they are probably remnants of higher water levels. As cave development would still have occurred while water level fell, it is possible that there are small tunnels, now blocked by soil, which lead to lower levels. Evidence supporting this is the discovery of Easter Cave. Originally a small sand-floored chamber, digging at the lowest point broke into a system over 8 km in length at a lower level.

Formations in the caves. Straws and helictites are the most common type of formation to be found in the caves of Augusta. In such caves, as Easter, Labyrinth and Jewel, there are literaly thousands showering from the ceilings, some reaching up to four metres in length. Some are completely transparent and almost all are active. They present a challenging task to photographers.

Helictites in amazing forms are to be found in all the caves, but the most spectacular are to be found in Easter Cave where some grow horizontally out from the wall for 60 cm or longer. Excellent displays of columns and stalactites can be seen in most of the Augusta Caves. Old Kudardup possibly has the best display, its columns being over 18 metres high. Large formations like the above are particularly common in these caves, perhaps due to the high rainfall and humidity. They are nearly always found in the upper levels of the caves.

Calcite crystals can be seen in three of the caves. Jewel Cave has some fine crystal pools which can be seen on inspection of the cave. Deeondeeup which is part of Jewel Cave has the best display. Here a wall of the cave some 18 m high is completely studded with crystals up to 10 cm in length. Easter Cave has Tiffanys, an old crystal pool 4 m long and 1 m deep. Crystals up to 10 cm long cling to all parts of the pool.

Deepdene Cave AU 1. This cave is noted for its massive formations. Consisting of two large chambers, the cave is just over 100 m long and 35 m deep. The two chambers are heavily decorated with columns and stalactites. When visiting the eastern chamber, take note of the old rimstone pools, some of which are over 1 m deep. Deepdene was developed to a small degree as a tourist cave around 1900. It was never opened to the public. Although only a small cave, a typical photographic trip can last several hours so be sure to take water with you. While in the cave, examine the walls. Deepdene is packed with small helictites. No special equipment is needed to enter Deepdene Cave, which is all horizontal.

Harleys Cave AU 6. Surveys have proved that Harleys Cave, which is about 100 m from Labyrinth on the surface, comes to within 1 m of Labyrinth underground. There is limited photography in the cave, the main attraction being the entrance pitch, a fifteen metre solution pipe which opens out into a large bell-shaped chamber with excellent acoustics. A small extension on the southern wall will lure the more sporting caver. A series of vertical squeezes leads to a small well-decorated chamber. It is at this point that it is carved closest to Labyrinth. Typical time in Harleys would be no more than two hours. Equipment needed is 15 m ladder and rope as there are good belay points nearby.

Old Kudardup Cave AU 9. Formed on the high slopes of the new dunes, this cave is one of the most interesting to see. The cave is a large single chamber with no side extensions. It has formed in massive dimensions, over 30 m deep with a ceiling 30 m above the cave floor, massive columns have grown up to 18 m high near the entrance. Photographically, Old Kudardup Cave can offer impressive shots of the columns. Most of the roof decoration is too high to be photographed. Old Kudardup Cave is recommended to everyone, just to see a really nice easy cave.

Jewel Cave AU 13. Jewel cave is a complex phreatic cave 2 km long of which only 40% has been developed for tourism. Opened to the public in 1960, Jewel Cave has been thoughtfully developed to show the cave off to visitors and not to make just the easiest path. Lighting is all natural and indirect. Formations in Jewel are identical to Easter and Labyrinth.

Formations are excellent. A straw measuring about 580 cm is the longest in a tourist cave. There are many flowstone canopies, including the famous Organ Pipes. Myriads of straws can be seen reflected in the lake at the lowest level of the cave. The price of a tour is reasonable and the tour lasts for one hour. Photographers are encouraged, so take your cameras and get some rewarding shots.

Easter Cave AU 14. Easter Cave is the longest and most heavily decorated cave in the south-west. A typical trip lasts 8 hours so supplies of food are necessary. The entrance is a 12 m shaft which is best laddered. This opens into a large sand-floored chamber. At the lowest point of the chamber, a small crawl leads to the system. From here on it is walkable most of the way. As you enter the crawl, look to the right for cave pearls. These are 20 years old and began growing when the tunnel was dug through. The Epstein Section contains the most well-known formation in the cave, the Epstein Sculpture, a helictite of massive size hanging from the ceiling.

Labyrinth AU 16. Labyrinth is a phreatic maze of interconnecting passages. Entry is as with Easter, a 12 m shaft best laddered. The formation is excellent, straws being the dominant feature. Labyrinth has two main trends, north-west and south-west. Both are photogenic with the south-west having the edge. A visit to the Winged Eagle's Nest is worthwhile. Labyrinth is also very sporting. There are a few sumps and lots of mud squeezes. Most of the trip is spent walking or crawling along phreatic tubes containing water and mud.

Moondyne Cave AU 11. Moondyne is an old tourist cave which was closed in 1958. It has recently been the subject of an exercise in cave restoration. A concentrated effort by W.A. S.G. has seen the introduction of track-marking, removal of old stairs and the cleaning of formation. Fortunately a lot of the damage has been reversible and Moondyne still retains its beauty and is excellent for photography. The cave has good displays of columns and helictites.

Consisting of two large chambers, Moondyne is the smallest of the four caves which reach the water table. The lower chamber, which was once an old crystal pool, is completely covered with calcite flakes. This is known as the Snowflake Chamber and contains some side extensions with fine displays of helictites. Carbon dioxide levels are often high in this chamber.

The upper chamber is in complete contrast to the lower containing many large columns and stalagmites, and also some very long straws. Rumours of a 7+ m straw are yet to be verified. Moondyne Cave is one to be enjoyed by all cavers.

There are very few active surface streams and places to obtain water in the Augusta caving area during summer. Take supplies of water on all field trips. Temperatures are bound to be high and considerable distances must be walked to reach caves. If at any time you are separated from a party and become lost, always head east and you will arrive at the Caves Road.

WITCHCLIFFE

The most extensive caving area in the south-west is the Witchcliffe area, stretching from south of Calgardup Brook to the Boranup Sand Patch. This sector contains over 135 speleological features of which 40 are major caves. The campsites of several caving groups can be found in the Boranup area of this section. From these sites most of the caving activities are conducted.

A good proportion of the stream caves are to be found in the northern part of this area. The best example of these is the Mammoth chain, consisting of three large cave systems formed by the same stream but separated only by the collapse of limestone. Mammoth Cave is the inflow and is also a tourist cave. It is followed by Terry Cave, then Conference Cave. Recently a new chain of caves, which is slightly to the north, has been found. This is believed to be where once the stream flowed and could possibly be an older stream system. Terry Cave is the only cave in this system which requires equipment, that

is, a 15 m ladder and rope to descend the main entrance pitch. The other five caves in this area are also well worth a visit and require no equipment but a guide is needed to locate them.

A little over 1 km to the north of Mammoth Cave is Calgardup Cave which used to be an old tourist cave. From here one can take the Bobs Hollow Track to the beach (4 WD is advised). Here one can see Bobs Hollow Cave, the only example of an efflux cave to be found in close proximity to the sea so far known in this locality. Inland from Bobs Hollow is Connollys Cave, this being the longest known stream cave in the Witchcliffe area. It is an excellent sporting cave consisting of well over 1000 m of passageway known and still room for exploration. There are vertical squeezes and also a number of good mud crawls to be found. It requires more than six hours to see this system properly. A guide is required to find this cave and a 12 m ladder is needed to descend the entrance pitch.

South of Mammoth Cave are Lake, Brides, Giants and Golgotha Caves. Brides Cave is a large doline approximately 100 m across. This is an excellent cave for SRT fanatics and has a pitch on the deep side of over 50 m with a cave at the bottom. These caves are easily found from Caves Road. Golgotha Cave is 1 km south of Brides Cave on Caves Road. Also in this area are several other caves of interest.

Eight km south of these caves is the Boranup Camp Site. Very little is known about the area between Golgotha and the campsite as only one large cave has been found, namely Green Cave, and several fissure caves. These fissure caves were rediscovered recently near Blue Rock Road. They are believed to be formed by the action of water from a swamp opposite undermining the limestone, causing it to collapse forward in large blocks forming deep fissures in the limestone.

From the Boranup campsite, many fine caves can be visited as some are within a short walking distance from the campsite. These are Dingo, Nannup, Mill, Strongs, Crystal, Arumvale Caves and Arumvale Pipe plus numerous smaller caves and karst features. Strongs is the finest stream cave in the area.

Strongs Cave is an excellent cave to visit. It has a small circular doline with a vertical shaft at the bottom leading down to a rubble pile and then down to the stream. Downstream from the entrance, the passage is low, and of the 80 m of passage, only 50 m can be comfortably traversed. From the entrance to the upstream section, the Western Australian Museum's palaeontological dig must be walked around and a hole negotiated to get to the lower chamber. Several other rockpiles and crawls are passed through, including the Snowflake Passage, before reaching the main stream passage. Moving upstream past the rapids, which consist of gneiss bedding covered with tree roots, one comes to the Devil's Horns. This is a helictite formed on the bottom of a straw. The next point of interest from here is the calcified bones in the wall on the left-hand side if proceding upstream. Around the bend from here is the Judge's Wig. This is a large impressive mass of crystalline formation of pure white calcite which stands out well against a dark background. On from here is one large rockpile and then the terminal chamber in which the world's longest straw can be seen. Surrounding it are some equally long tree roots, making it difficult to distinguish the straw. A soil band can be seen in the roof throughout the cave. This is thought to be where one dune has settled and soil has been allowed to form, and later more sand was blown over forming another dune.

Not far from Strongs Cave is Devils Lair, situated in the Nannup doline. The Department of Palaeontology of the W.A. Museum, under the direction of Dr Duncan Merrilees, has been excavating in this cave for some years. The results of this dig are extremely interesting, indicating the presence of aborigines in the south-west for a greater time than previously supposed. Nannup Cave itself is worth a visit being an old abandoned stream cave with some good formation. Also some historic graffiti can be seen on the formation. Dingo and Mill Caves are not far away. These two caves were formed by the same

stream that carved out Strongs Cave, and are separated only by collapses. Mill Cave is upstream of Strongs Cave and a 10 m ladder is needed for the entrance. A shallow lake in the main chamber is dominated by a large tree root similar to those in Strongs Cave. Two hours is ample to study the cave.

Dingo Cave is downstream from Strongs Cave. The entrance can be free-climbed with the aid of a rope. A new low section was recently discovered. In this section, a good selection of speleothems can be seen and a camera is a must. This is a good sporting cave with crawls and climbs.

Arumvale Pipe and Arumvale Cave are about 3 km south of the campsite. The pipe is 23 m deep and is the best abseil into a cave in this area. This cave is a small stream cave, 160 m in length, terminating in a large chamber filled with rock. Three hours is quite adequate in this cave. Arumvale Cave is further up the hill. The entrance is very unstable and several ladders are needed to reach the bottom which is at a depth of 57 m from the surface. A camera should be taken as the formation is excellent. The total length of the cave is 500 m, the first 200 m being dry and well-decorated. The last 300 m requires immersing in mud and water as one must enter the stream and crawl the rest of the way to the end of the cave in the stream. Four to five hours are required to see this cave. Extreme caution must be exercised at the entrance pitch.

While stopping at the campsite, it is a must to drive through the Karri forest to the Boranup lookout. Also a trip to the beach is worthwhile. The Boranup Sand Patch is a recorded aboriginal site. For those who do not want to go caving, a day here is well spent and it is near an excellent beach.

MARGARET RIVER

The area north of Witchcliffe is Margaret River, starting at Calgardup Brook and finishing at Ellensbrook. Again, this is only a small karst area containing 20 known karst features of which six are major caves. Four of these are old tourist caves.

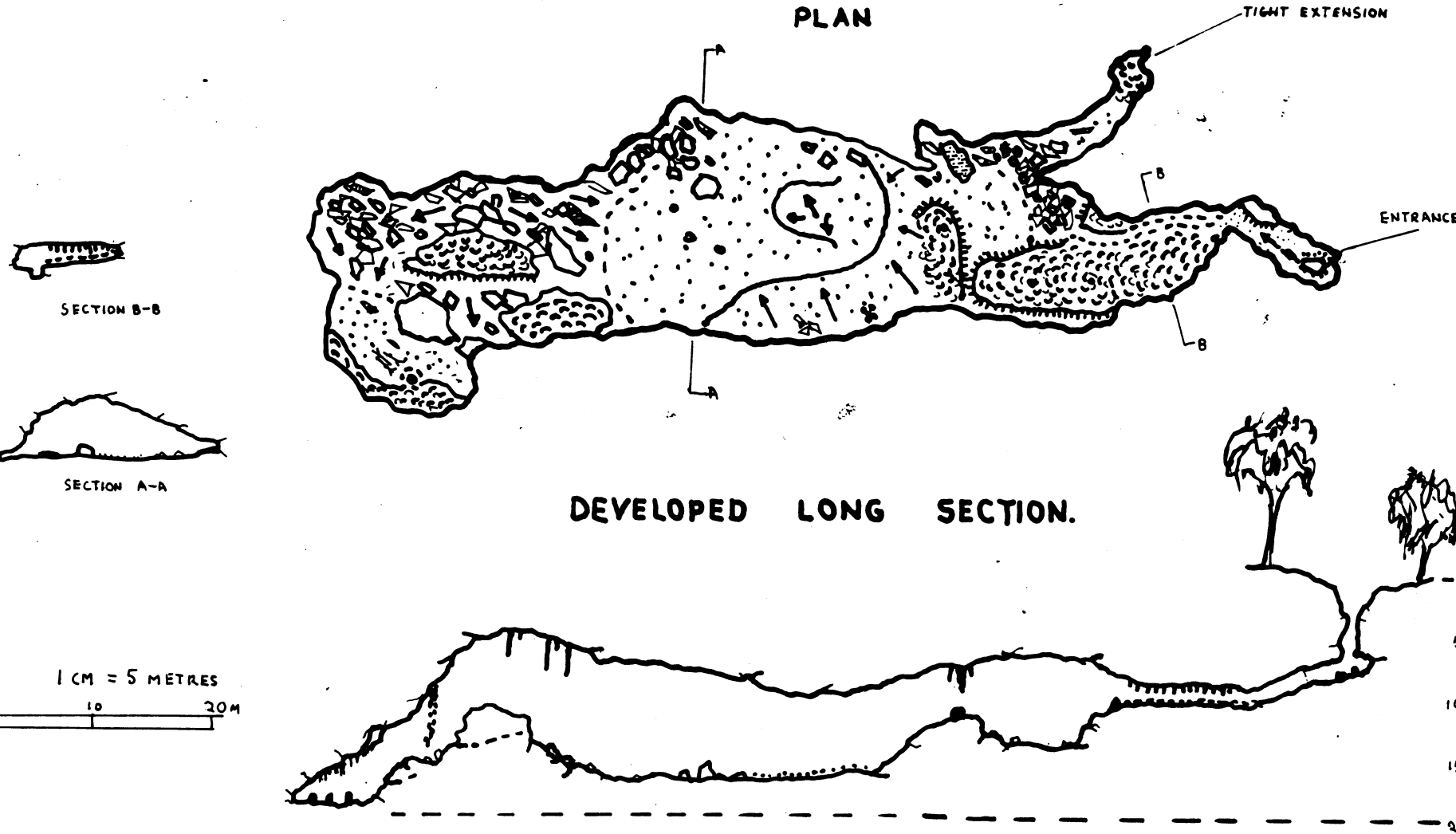
Milligans Cave MR 19 can be visited while you are making a trip to Meekadorabee Cave. Equipment is needed to descend into the cave as it has a 7 m entrance pitch. This cave was once used as a tourist cave at the turn of the century. A descent into the cave passes through a fairly heavily decorated section on the left before reaching the main chamber. The floor of the main chamber consists of sand and rock with some bone material. Proceed onwards round a large rockpile to the terminal chamber which contains some good examples of calcified tree roots. A guide is needed to find this cave.

Further south near the mouth of the Margaret River are two other caves of some importance, both completely different. One of these is Walcliffe Cave MR 4, an old ex-tourist cave found by Grace Bussell in 1870. This cave is situated at the back of Wallcliffe House on the edge of a paddock and is easily reached from the road. This cave has been vandalised badly and many old names can be seen written on the formation.

Situated in the limestone hill overlooking Prevally Park Caravan Site is Beenup Cave MR 20. This cave is a recent discovery and is locked, the keys being held by W.A.S.G. This system is a classic inclined fissure cave and is heavily decorated. The entrance was dug out by the subgroup in March 1975. The cave itself is over 300 m long, most of which is vertical, but no equipment is needed. This cave is worth visiting. The terminal chamber ends in a rockpile and the floor is of a rich black loam washed in from outside. The possibility of extending this cave is good. Approximately 100 m away is a large doline known as Rainbow Cave. This is worth a visit just for photography. Foxhole Cave MR 9 is not far away and could be visited if a guide knows where it is. This cave has three chambers, one of which is well-decorated and the terminating chamber contains scattered bones of many small animals. For those feeling in a holiday mood, the rest of the day can be spent lazing on the beach!

Blackboy Hollow and Witchcliffe Caves

MILLIGANS CAVE. MR 19.



SURVEYED : P. H. CAFFYN 15SEP73
J. SCOTT
K. WILLIAMSON

DRAWN : P.H. CATTYN 16SEP73

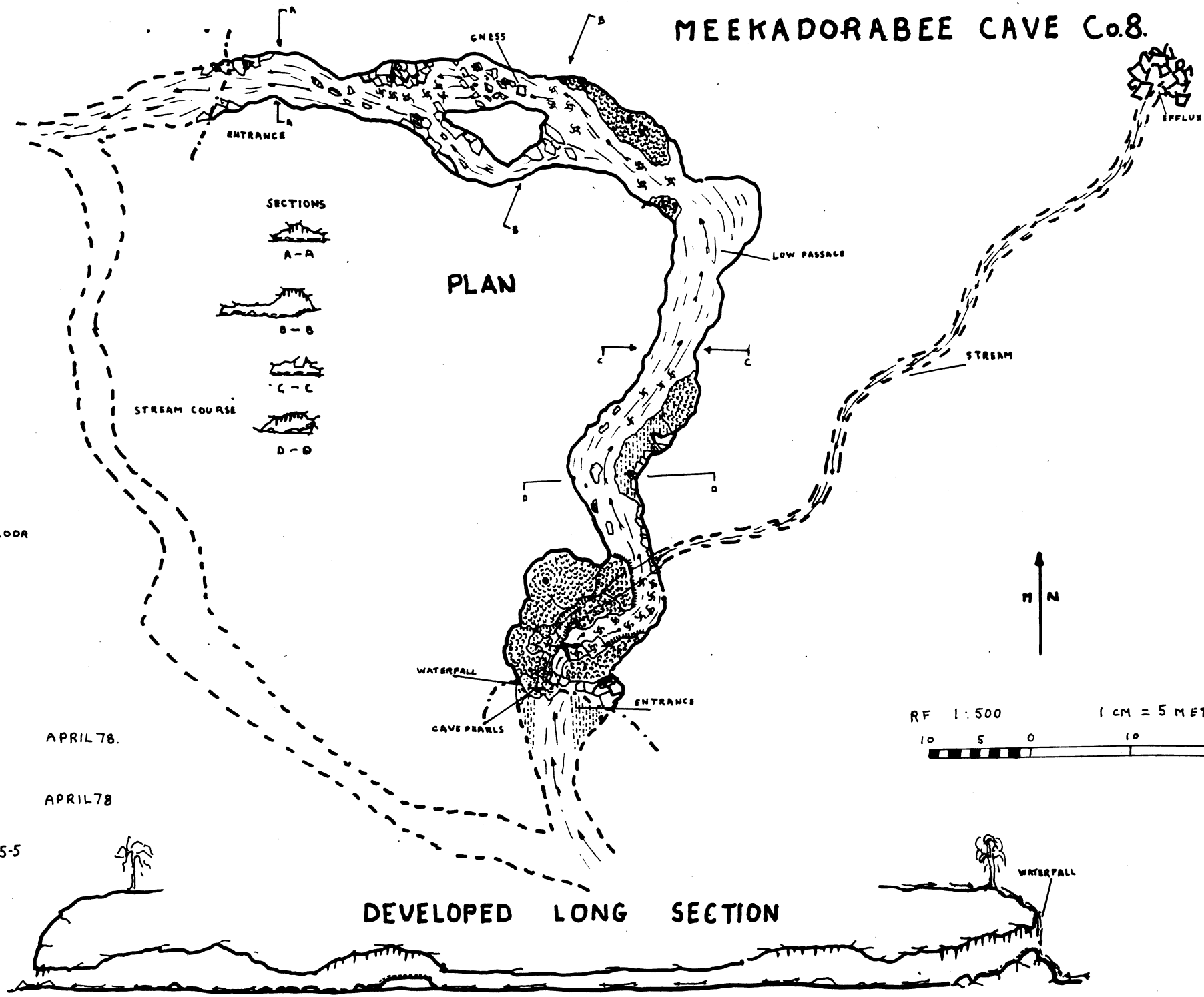
SURVEY STANDARD: CRG GRADE 5.

STALACTILE
STRAWS
TREE ROOTS
STALACTITES
ROOF COLLAPSE BLOCKS
VERTICAL CHANGE IN FLOOR LEVEL
SLOPE DIRECTION

ROOF COLLAPSE BLOCKS
SAND
MUD
FLOWSTONE
STALAGMITE WITH FLOWSTONE
OLD TOURIST TRACK
ROCKFALL EDGE

TOTAL PLAN LENGTH = 85 M
TOTAL DEPTH = 20

MEEKADORABEE CAVE Co.8.



LEGEND

- PROJECTED OUTLINE
- BEDROCK WALL
- CONJECTURAL OUTLINE
- VERTICAL CHANGE IN FLOOR
- LARGE ROCKS
- ROCKFALL, TALUS
- EARTH, MUD
- FLOWING WATER
- FLOWSTONE
- STALAGMITES
- STALACTITES
- COLUMN
- CAVE PEARLS

SURVEYED: B. LOVEDAY, F.R. LOVEDAY, B DOWNES — APRIL 78.

DRAWN: F R LOVEDAY, B LOVEDAY — APRIL 78

SURVEY GRADE: A.S.F. 5-5

could be visited in the one day for those who feel energetic. Parking the car at the Boodjidup Brook, one would need to walk for approximately 2 km to reach each of these caves. Blackboy Hollow is considered the finest cave in this area. A guide is needed to find the cave, and equipment is needed to negotiate the 6 m entrance shaft into a large chamber. This cave was an old show cave. The old pathways lead down into a magnificent lower level of immense proportions. Formation in this chamber is excellent. Deeper into the floor of this chamber can be seen the old stream course.

Witchcliffe Cave is an interesting walk from the car. It has a magnificent setting above Boodjidup Brook where it opens into Devil's Pool. A cliff-face at the head of the valley at the west end of the pool and on the north side of the stream contains the cave entrance. An overhang contains a 2 m drop down to water. Old wooden tables and a small stream, which resurges some 7 m down a steep slope, can be seen. Stairs lead to the cave entrance above the overhang. Many old columns in two small chambers divide the cave and add to its interest. This is an old tourist cave and a guide may be needed to locate it.

COWARAMUP

The next area is Cowaramup stretching between Ellensbrook and Quinninup Brook. This narrow belt of limestone has very little cave development in it that is known. Quinninup Lake Cave is one of the better systems to visit. Situated near the beach at Quinninup, this cave is reached by a pleasant walk along the beach and across the sand dunes. A small colony of bats has been observed here for some years. This is quite important because this is the only known cave in the Leeuwin-Naturaliste Ridge in which bats have been recorded. The cave contains two small streams. One of these can be examined by climbing down through the entrance rockpile. The other is seen in the south-eastern section by looking down a hole under some flowstone. These streams seem to be at different levels and resurge some distance below the cave entrance to form a lake. This lake is trapped behind the dunes and it is assumed that the water percolates beneath the sand into the sea. The cave is well-known by the public and has suffered accordingly. But the cave still has some fine decoration in the deeper recesses of the system.

Further to the north-east is Snake Pit Cave CO 6 which is believed to be part of the same system. Equipment is needed to descend the 23 m vertical entrance pitch. When the bottom is reached, a medium-sized chamber is seen, its floor covered with sand and rocks.

Cowaramup Cave is also worth a visit. A guide is needed to find this cave as very few people know its location. It is found in a valley within which a dune has arisen and through which a stream flows, forming a small but interesting cave containing a small waterfall.

Another cave to inspect in this area is Meekadorabee Cave CO 8 situated on the Ellensbrook Stream. This is a good example of a cave which is formed by the action of a stream cutting through an arm of limestone overlying a valley. The entrance is well-endowed with tufa and calcified rushes. A waterfall also flows over the entrance, seeping through the roof forming an excellent display of cave pearls on the flowstone below. The trip through the cave is very wet but short as the cave is approximately 100 m long. It is a pleasant walk to the cave from the car and if spare time is available, it is worth walking to the beach to see the early historic property built by the Bussells which is now part of a national park.

YALLINGUP

The Yallingup area has some of the thickest limestone of the Leeuwin-Naturaliste Ridge, but despite this very few large caves or extensive systems have been found, probably because there are very few streams to allow for the development of large systems.

One example of a cave in this area is Katelack Cave YA 26. This system is a typical example of an inclined fissure cave found in dune limestone. This cave is approximately 36 m deep.

No equipment is needed for entry into the system. The cave is in an open field on the edge of some thick bushland. This cave has two small entrances and is well worth a trip. To reach the lower level, a slot-type squeeze must be negotiated and from here a rubble slope leads down to the final crawl into the bottom chamber. The upper part of this chamber has some fine formation. There are several extensions to be found in this cave while crawling around. The total trip should not take more than three hours. Two other caves which could be visited while in this location are Seven Sisters Cave YA 3 and Barbilla Cave. Both of these caves have good formation. By driving several kilometres along the road, one can spend a pleasant afternoon at the beach near Canal Rocks.

Yallingup Cave itself is well worth a visit. It is currently a tourist cave. A palaeontological dig was carried out in this cave over a period of five years by a member of W.A.S.G. The formation in this cave is excellent and there are several sections to visit. It is the largest cave system known at present in the Yallingup area. A short walk from this cave leads to Yallingup Gorge. This is a karst feature worth visiting as there are several caves in the area, YA 12 and YA 29 being two of them.

Driving from Yallingup to Bunker Bay, one can visit a number of interesting sea caves and other karst features. One of these sea caves is YA 14, a cave which is developed in medium-grained granulite, beach conglomerate and aeolian calcarenite. It also has a hole in the roof in which one can see the bedding planes.

On the way south along Caves Road, Northcote Grotto can be visited. In this cave a stream can be seen flowing in the lower sections, this being one of only two caves in the area in which a stream is visible.

LOWER WEST COAST

This limestone area extends from Cape Naturaliste to Perth, a distance of 250 km. There are two significant concentrations of caves in this distance at Blackwall Reach and at Mandurah. In other places the limestone is too soft and friable to support cave systems (Bastian, 1964).

The Mandurah caves occur along the southern and western edge of Peel Inlet, a drowned river valley. The caves are all typical inclined fissure collapses, in some cases reaching water level, for example, Morfitts Cave. There are springs along the edge of the estuary. The caves are well-decorated and make a pleasant diversion from a trip between Perth and the Leeuwin-Naturaliste.

Blackwall Reach contains two of the most interesting caves in W.A. displaying features of mechanical (that is, wave) erosion, vadose stream action and nothephreatic spongework. The two main caves are generally 100+ m muddy crawls and open on to the south bank of the Swan River where it makes a narrow passage through the north/south Coastal Limestone belt near Fremantle. Night trips to these caves are easily arranged.

YANCHEP

The cave area is contained mainly within the Yanchep National Park but extends south to the semi-residential Wanneroo area. There are two tourist caves in the National Park, namely, Crystal and Yonderup Caves, plus numerous, mainly small wild caves. The limestone here is only 10 m above water-table resulting in frequent collapses. This restricts the size of the stream caves. Caves are of the small, crawly inclined fissure type. To go to Yanchep and not find new unrecorded caves requires a concerted effort.

Caves occur mainly in the western section of the park. The exception to this rule is Gibb Cave YN 140, entrance to which is gained by a narrow solution pipe. The cave is large and well-decorated for Yanchep and well worth a visit. Beware of falling boulders!

Other notable caves in the park are Yanchep Cave, with its obvious cave fauna, old bat domes and large chambers; Mambibby Cave which has been subject to extensive vandalism, both official and unofficial; Loch Over-

flow with a well-decorated new extension, and which takes water from Loch McNess; Cactus Cave, Surprise Cave and several as yet unnamed caves, all of which provide interesting crawls and some fine speleothems. The ducks of the almost water-filled Water Cave provide a cooling end to a hot summer's day at Yanchep. Also to be noted in this cave are the Galaxias (fish) and Gilgies (freshwater crayfish) plus the iron-stained Trog's End flowstone.

GEOLOGY AND GEOMORPHOLOGY OF YANCHEP

East of the Yanchep area is a vast area of sandplain at the base of the Darling Fault Scarp. This area serves as a catchment for the Gnangara water mound, a feature of great importance in the future of Perth's water supply. The slope of this mound increases in the area of the Yanchep Caves and the water moves mainly as streams down this gradient.

The numerous enclosed water-logged depressions and lakes within the karst no doubt play a role in recharging karst water and may themselves be the result of a series of cavern collapses and stream diversions. Springs have been seen in the sea west of Yanchep.

MOORA

This area contains a limited number of caves developed in highly silicified Proterozoic dolomitic limestones of the Moora group.

Caves show high degrees of structural control along joints. There are three notable caves.

Coorow Cave M 1. The longest cave in the area with more than 0.5 km of passages. The joints have been infilled with quartzite and this remains as a sheet across the cave after the limestone has been corroded away.

Bishops Hole M 7. A 33 m pitch gives access to a few chambers reaching a total depth of 36 m.

Jingemia Cave M 6. 20 m deep pit, good abseil, geologically and meteorologically interesting. This cave has been mined extensively for guano.

NAMBUNG

This area is mainly within the confines of the Nambung National Park. Caves and other speleological features have the prefix SH for South Hill River, an area which includes some features north and south of the Park.

History: The 120 m above sea level sand dunes of this area were recorded by 17th Century Dutch navigators. In 1839, caves were first noted in the area by a member of Sir George Grey's ship-wrecked party on their 500+ km walk back to Perth. In the 1900s, guano was mined from the caves, at first spasmodically by local farmers add then by an ill-fated scheme organised by the then Minister of Agriculture. A temporary reserve was placed over the valley of the Nambung River in 1927 to protect the caves. At the time of the phosphate mining, the Pinnacles, only a few miles south, were not mentioned, possibly because they were covered with sand. However, it was these karst features which prompted the formation of the present Nambung National Park in 1966. The first speleological activity occurred in 1962 and since then the area has seen intermittent bursts of activity. A comprehensive caves list and accounts of the area and caves was published in 1973 (Shoosmith, Poulter). The National Parks Authority have gated delicate caves in consultation with speleos.

Geomorphology: The Nambung River sinks in a series of lakes and inflow points caused by repeated deflections of the river by active dunes. The complicated hydrology of the Nambung has been described in Shoosmith (1974) which tells of 1 km long lakes appearing virtually overnight and of solution pipes spouting columns of water.

Though there are a few caves which are solution tunnels which flood to the roof, for example, Brown Bone Cave, most are inclined fissure collapse caves often well-decorated. In Quandong Cave there is a preponderance of volcano-like stalagmites formed over small soil cones from solution pipes which are not calcite-filled.

The spectacular Pinnacles are the result of subsoil karst erosion (Lowry 1973), the soil having been deflated after the stabilizing vege-

tation had been killed by the encroachment of active dunes.

Caves and potential: A recent fire has opened up a large area previously inaccessible due to very thick scrub. Recent trips have become bored of finding new caves. The few entrances so far explored have given access to long sporting caves. Much mapping and exploration is envisaged in the immediate future.

The inclined fissure caves of the Park, for example, Cadda Cave SH 18, Weston Cave SH 2, Thousand Man Cave SH 7 and Pretty Cave SH 9 to name a few, offer good potential for photography, mapping and exploration.

ENEABBA

History. This area extends from the Green Head Road in the south to the Irwin River in the north. The area first received attention from speleologists when W.A.S.G. explored River and Arramall Caves in 1960.

In 1963, Jennings visited the Stockyard Gully caves. On this trip E 1 to E 10 were described and positioned. Of these, Stockyard Bridge, Stockyard Tunnel and Stockyard Cave, together with Aiyennu Cave and Beekeepers Hole were the most significant.

In 1969, D.C. & J.W.J. Lowry squeezed through a rockfall in Weelawadji Cave and added 1 700 m of passageway to the known 300 m of cave (Lowry 1969). Since this discovery, no new major finds have been made in this area.

Geomorphology. The limestone of this area is an older aeolian calcarenite than that of the lower south-west.

The Stockyard System is formed by the Stockyard River which flows almost all of the year. The gorges between Stockyard Bridge and Stockyard Cave are explained by cave roof collapse (Jennings, 1971:100). The actual cave is prone to flooding as evidenced by the large logs jammed high in the roof and the mud levels above the logs. Classic karst pavements are typified by Aiyennu Cave (Caffyn, 1973) where the calcarenite has collapsed, resulting in soil subsidence, leaving the kankar peppered with solution pipes.

The overflow of Lake Arramall has formed the two major systems of River and Arramall Caves. Arramall Cave contains the largest chambers which are the result of roof collapses. River Cave still contains the basic phreatic passageways which finally bifurcate and choke off with mud.

The Weelawadji system contains abandoned stream passages of varying dimensions from the 35 m wide entrance chamber to the small 4 m wide phreatic tubes some 500 m into the cave. The whereabouts of the stream that formed the cave is not obvious although it was thought to be part of the Arrowsmith River system (Lowry, D.C., pers. comm.).

The only cave minerals collected from the Eneabba area are samples of Brushite and Gypsum from Weelawadji Cave and these samples are held by the Government Chemical Laboratories.

Stockyard Tunnel E 1. The cave is approximately 200 m long, requiring no gear, and can be completed at a leisurely walk. Its main features are its size and the meandering of the stream. Bats may or may not be present.

Stockyard Bridge E 2. A bridge between E 1 and E 3. The stream flows beneath a large rockfall. Swallows flying under the bridge are common, many of them nesting in the solution pipes in the roof.

Stockyard Cave E 3. The cave is approximately 800 m long with large chambers being its main feature. The mud-coating on most blocks in the streamway make for interesting slides while trying to move along the streamway. Bats are sometimes present.

Aiyennu Cave E 9. Forty metres of ladder and/or rope are required on the entrance pitch. Of the 100 or so entrances, the largest one on the southern side of the karst pavement is usually used. The nearest tie off is a "twig" some 10 m from this entrance. If SRT is used, some protection is required at the lip.

The rockpile below the entrances dips to the north and south where the stream is sighted but sumps after a

short distance.

Arramall Cave E 22. This system extends for 1.8 km as mapped by P. Caffyn in 1973. The main trend is mainly walking passages over breakdown. At one point the cave passes beneath the Brand Highway and vehicle noises can be heard. An interesting feature is a green plant growing shoots under lightless conditions some 200 m into the cave.

River Cave E 23. The cave has never been mapped but is approximately as long as Arramall Cave. Very little roof collapse has occurred in the cave and hence the phreatic passages are easy to move in with the flat sandy floor being traversed mainly at a stoop. The end of the cave is a number of small phreatic tubes which choke off with mud. Many leads off the main trend have not been checked. One which was is still going. The potential is good.

Weelawadji Cave E 24. A large circular collapse doline heralds the entrance to the largest known chamber in the Eneabba area. From there the passages beyond are developed with some form of structural control with rockfalls at intersections. This cave is locked at the end of the entrance chamber to protect the cave fauna, the good secondary calcite deposits and the untouched guano piles. Also as this system is no longer active, it is very delicate.

Fauna. A large amount of collecting has been done by J.W.J. Lowry in the Eneabba Area. She has kindly prepared the Table 1 which indicates some of the fauna found in Arramall, River, Weelawadji and the Stockyard Gully Caves.

LATERITE AND GRANITE CAVES

Most of Western Australia is a precambrian granite shield erosion surface of great age. Outcrops are rare and extensive areas of laterite, representing a now dissected erosion surface, are common. In places, granite outcrops through the sandplain as mound-shaped bodies, some only metres high to some such as Peak Charles 650 m above sea level.

Laterite caves occur at Kojonup, Chittering and Boscabel at the edges of breakaways or mesas. Cave formation seems to be initiated in a variety of ways, including water and wind action and the action of eucalypt roots (Lake & Lefroy, 1972). Mapping of these caves has always had to be done by triangulation as the presence of haematite makes magnetic instruments useless.

Small caves, caverns and springs occur in the granite outcrops. Halite exudation and removal of particles by wind is probably the main cause of these cavities. In the south, the possibility of modified Eocene sea caves should not be dismissed. The large tafoni boxwork filled caves of Peak Charles may be of such a mixed origin.

REFERENCES

Bastian, L.V. (1964). Morphology and development of caves in the southwest of Western Australia. *Helictite 2*, 105-119.

Bridge, P.J. (1972). Asphodelites, an unusual speleothem from Calgardup Cave. *The Western Caver 12*, 169-171.

Britton, E.B. (1974). *J. Aust. Ent. Soc. 13*, 85-87.

Caffyn, Paul. (1973). Notes on the geology and geomorphology west of Lake Arramall. *T.W.C. 13*, 133-134.

Jennings, J.N. (1968). Syngenetic karst in Australia. *Contributions to the study of karst*. J.N. Jennings & P.W. Williams. A.N.U: Canberra.

Jennings, J.N. (1971). *Karst*. A.N.U: Canberra.

Lake, Peter & Ted Lefroy. Laterite cave in the Upper Chittering. *T.W.C. 12*, 68-77.

Lowry, D.C. (1969). Weelawadji Cave E 24. *T.W.C. 9*, 95-98.

Lowry, David C. (1973). Origin of the Pinnacles, Nambung, W.A. *A.S.F. Newsl. 62*, 7-8.

Species	Common name	E 1-3	E 22	E 23	E 24	Comments
Baiami volucripes	Spider	?	✓	✓	✓	Other species occur including one blind species in E 22 and E 24.
Protochelifera cavernarum	Pseudoscorpion	✓	✓	✓	✓	Associated with guano. There are other small species.
Laevophiloscia yalgoonensis Vandel 1973	Wood louse, pill bug, slater	✗	✓	✓	✗	Also tiny blind troglobitic isopods in E 22 & E 23.
Laevophiloscia unidentata Vandel 1973		✗	✓	✓	✗	
Laevophiloscia richardsae Vandel 1973		✓	✗	✗	✗	There are several other species in all caves.
Scutigeridae (Family)	Centipede		✓		✓	E 22 has a species with red legs and yellow-spotted body in twilight zone and a blind species (different) in the dark zone (very rare).
Collembola (Class)	Springtails	✓	✓	✓	✓	
Lecanomerus flavocinctus	Beetle	✓	✓	✓	✓	Abundantly established in E 1-3.
Pseudoceneus sollicitus	Beetle	✓				
Tripectenopus occultatus Britton 1974	Beetle		✓			Blind but pigmented. Has not been found alive since 1969 - could be extinct (that is, it was washed into the cave) or very rare.
Shawella douglasi	Cockroach	✓			✓	Reduced eyes and pigment. Unidentified blind species, eyes present but white, in E 22 and E 23.
Apis mellifera	Honey bee	✓			✓	E 24 - very ferocious (1974, 1978). E 1-3 not active 1974.
Litoria moorei	Frog		✓			Other species in E 3, E 24.
Hirundo neoxena	Welcome Swallow	✓	✓	✓	✓	Important trogloxene at entrances.
Chalinolobus morio	Chocolate Bat	✓			✓	

Species	Common name	E 1-3	E 22	E 23	E 24	Comments
Eptisicus pumilus	Little Bat				✓	Occasionally seen.
Macroderma gigas	Ghost Bat	Locally extinct				Many piles of fossil guano in E 24 and possibily in E 22.

TABLE 1

Occurrence of selected fauna in the Stockyard Gully Caves (E 1-3), Arramall Cave (E 22), River Cave (E 23), Weelawadji Cave (E 24)

Poulter, Norm (1973). Nambung National Park, W.A. *A.S.F. Newsl*, *62*, 5-7.

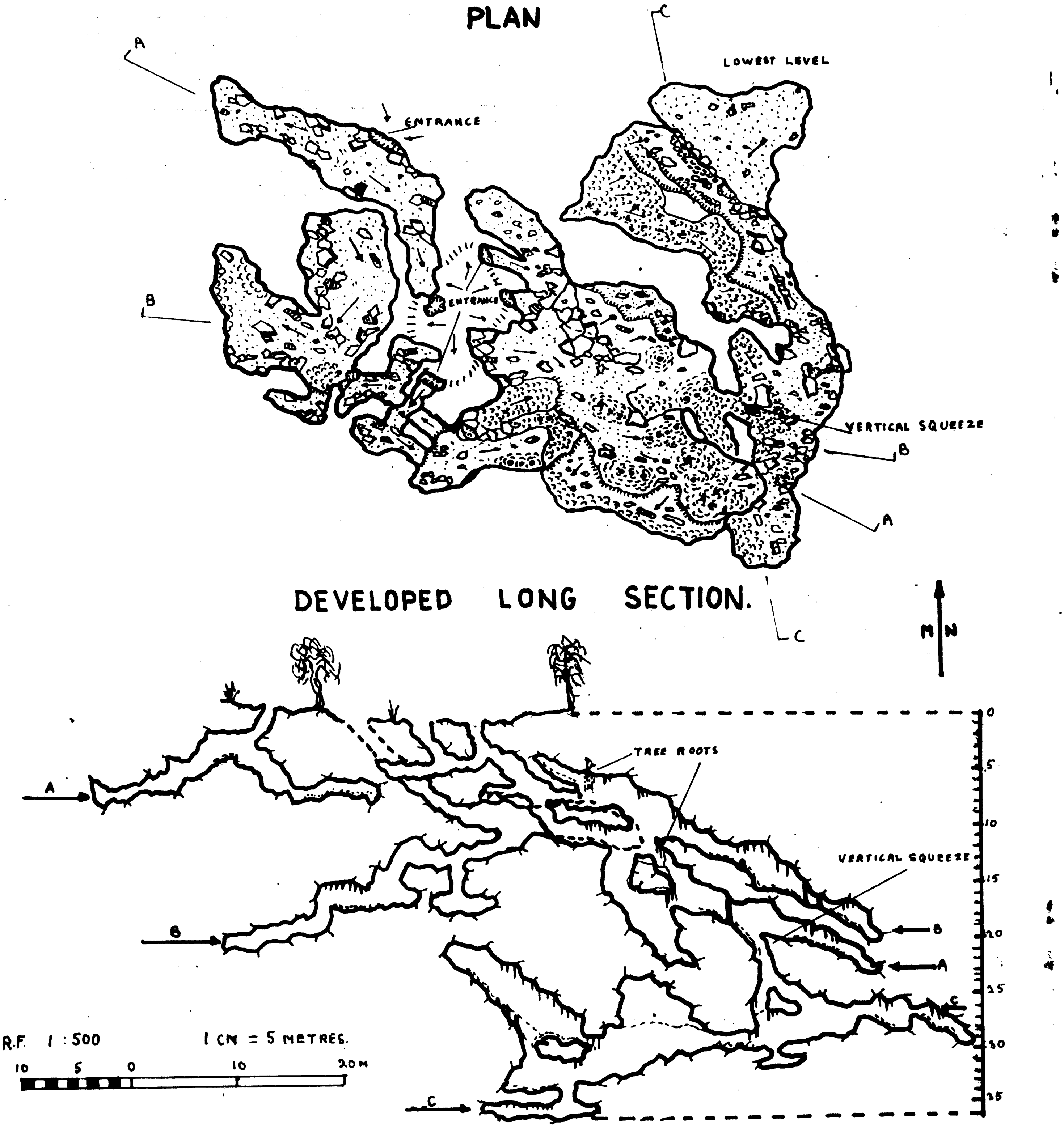
Shoosmith, R. (1973). South Hill River Issue. *T.W.C. 13*, 1-31.

Shoosmith, Bob (1974). Hydrological observations at the Nambung River. *T.W.C. 14*, 122-123.

Smithers, C.N. *Aust. Ent. Mag.* 2 (3): 45.

Vandel, A. (1973). Les Isopodes Terrestres De L'Australie: Etude Systématique et Biogeographique. *Mêmoires du Muséum National D'Histoire Naturelle, Série A, Zoologie, 82.*

KETALACK CAVE   YA26 -YA27



SURVEYED : B. LOVEDAY MARCH.78
F.R. LOVEDAY
B. DOWNES

DRAWN : F.R. LOVEDAY MARCH.78
B LOVEDAY

SURVEY GRADE : A.S.F. 5-5

LARGE ROCKS,
ROCKFALL, TALUS
SAND
ROOTS
FLOWSTONE
STALAGMITES
STALACTITES
COLUMN

PROJECTED OUTLINE
CONJECTURAL OUTLINE
BEDROCK WALL
CHANG OF FLOOR GRAIENT
VERTICAL CHANGE IN FLOOR
VERTICAL HOLE DOWNWARDS
VERTICAL HOLE UPWARDS
DIRECTION OF SLOPS