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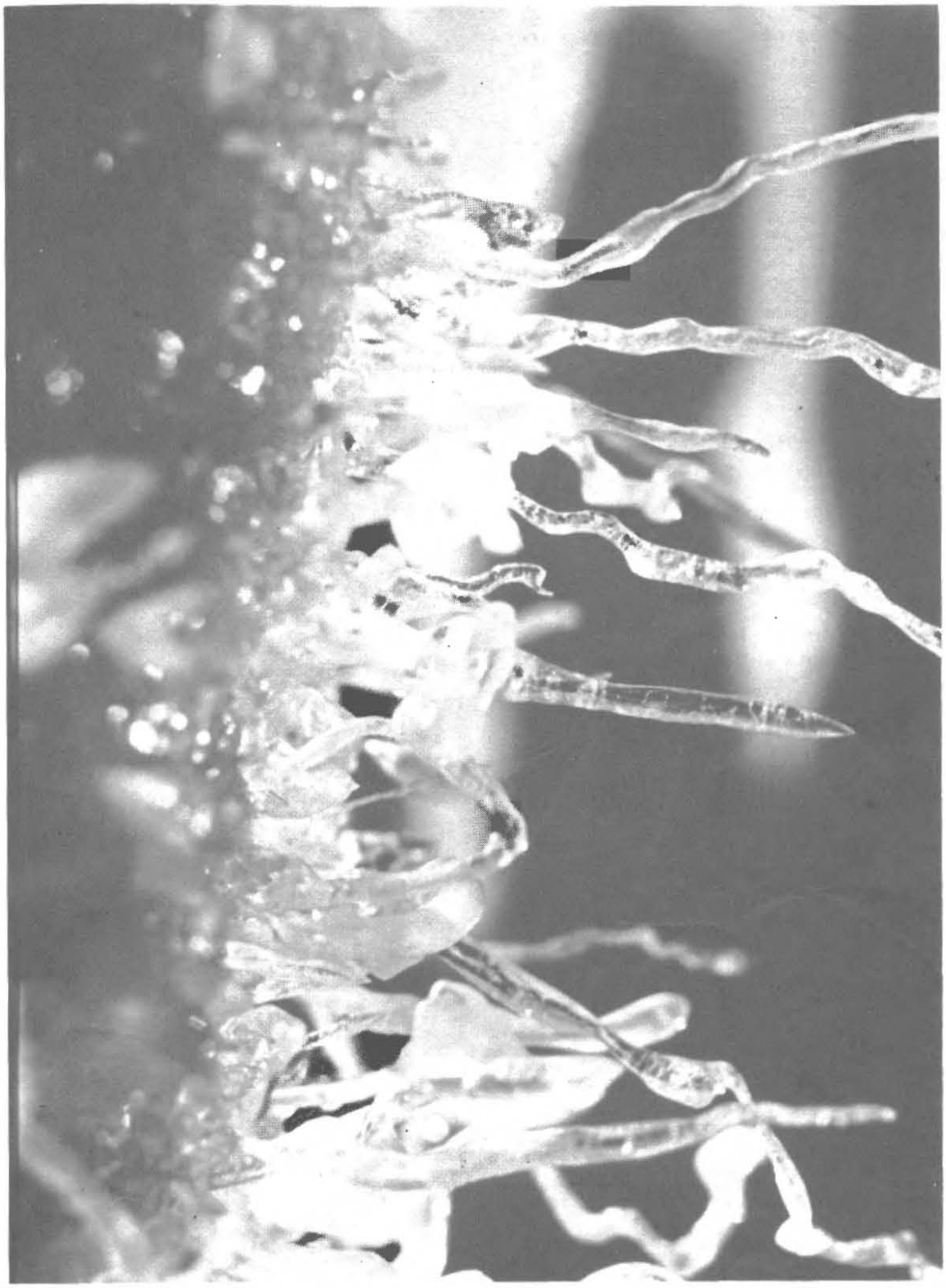
Summer, 1981, No. 94



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ISSUE 94 SUMMER 1981-2

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EDITORIAL

A late message from Rudy Frank, noting that the Senate Select Committee on South West Tasmania requires notification of intention to make a submission by 25 November, 1981, and the actual submissions must be received by 18 December, 1981. The address is : Secretary to the Committee, Mr. P. Barsdell, Parliament House, Canberra, ACT, 2600.

Rudy also notes that :

> A submission is merely a letter or document that expresses views of a person or organisation on an issue. It can range from a single page letter to a series of articles totalling many hundreds of pages. However, the shorter your submission, the more likely it will get read.....
>
> Anyone can write a submission either on their own behalf or as part of a club or organisation. To ensure your submission is read, be concise and include a summary of your arguments if it is more than a few pages long.
>
> An introductory section should state who you are, or if you are writing for a club, what the interests of the club are in the issue and how many members it represents. The rest of the submission should then describe what you think is important about the South-West and what you feel should be done about Tasmania's power supply problems..... Finally, remember you don't have to be an expert to make a submission. Politicians are interested in the opinions of ordinary people too, and this Enquiry is an opportunity to let them know that you care about the South-West.

Rudy has said very clearly what must be done by us, while there is time. The information sheet he has sent out should have been received by your club secretary. Who knows? We may even be pleasantly surprised by the results, if we do something about it.

This is absolutely the last *Newsletter* I shall be doing. So far, there are no firm takers for the position. The Committee meeting is in the January Australia Day weekend, where there should be a new editor.

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DEADLINE DATES FOR FUTURE ISSUES (Subject to change by the future editor.)

For numbers 95 and 9 respectively, the dates are 1 March and 1 May, 1982.respectivel

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ROCKY BOAT INLET, TASMANIA

Norm Poulter

Rocky Boat Inlet is an extremely small cove of approximately one square kilometre on the south coast of Tasmania, some 23 km west of Cockle Creek, the southernmost point of human habitation. The geology of the inlet is predominately conglomerate interbedded with dolomitic shales. There are several sea caves of possible archaeological significance located on the shoreline. This article attempts to describe some of the area's features and the hardships encountered when exploring in a region such as this.

There are two confirmed means of access;

1. fishing boat — The easiest but most uncertain method as the inlet is protected by numerous uncharted rocks and reefs as well as being unsheltered from bad weather from the south-west, making entry extremely difficult and possible only on calm days
2. walking — A dependable? but arduous method involving a two day trek of approximately 45 km along part of well known but extremely muddy South Coast Track.

An as yet untried possibility is to fly into the area, landing on nearby Prion Beach and walking approximately five kilometres back to the Inlet.

It appears that exploration of Rocky Boat Inlet was first reported in print by members of the Australian and New Zealand Schools Exploring Society (ANZSES) during December 1978 and January 1979. The Society was surveying the coastal area in the vicinity of New River Lagoon for aboriginal middens. In due course, they, Kenneally (1979)

> 'headed east to Rocky Boat Inlet, the base of the geology group. A search on the eastern side of the bay proved fruitless, but on the more sheltered western side two sites were revealed. One site (683768 SW Cape 8210 1:100 000) was an open midden on a rock base, the other (680767 SW Cape 8210 1:100 000) was in a large sea cave which had a huge rock in the mouth. A mound of dirt at the back of the cave contained abalone and charcoal.'

In 1980, the Tasmanian Caverneering Club received word of the existence of a cave containing an active stream passage in the Inlet from the owner/skipper of a crayfishing boat. Captain Chris Short, a qualified surveyor, is currently the only fisherman (with his 120 year old *Frolic*) willing to enter the Inlet (weather permitting) although it is reported that the Inlet was once used as a campsite by abalone fishermen.

TCC's first attempt to investigate the region was a seaborne assault by the Club's 'heavies' in August 1980. The story of the abortive trip is superbly described by Tomalin (1980).

My involvement with the second attempt to reach Rocky Boat Inlet began on January 31, 1981, when Albert Goede (TCC) and myself, together with two girls from the Tasmanian Archaeological Society attempted to walk to the area from Cockle Creek. Albert's hope of a successful land approach were high after the previous dismal seaborne approach (three days anchored at nearby Deadmans Bay owing to bad weather -and seasickness).

Such is human frailty that these hopes were soon to be dashed.

Within hours, despite the joy of a well-padded 13kg pack, one of the girls had subsided to an archaeic crawl on the easiest section of the two day journey. Next day, I arose with the comment that one of my lower calf muscles felt 'tight', possiblly caused by carrying an extra pack through a difficult coastal rockfall the previous day. The revised plan was that from this point- the South Cape Rivulet campsite- Albert and I would proceed to the Inlet, leaving the girls to withdraw to Cockle Creek after a day's rest. Shortly after leaving the campsite, groaning under the unaccustomed weight of an un-padded 24kg pack, it became evident that my leg injury was more serious than first thought- I had damaged a tendon. That, coupled with the fact that Albert was developing blisters caused by tight boots, dictated a return to civilization after we had reached the eastern foothills of the South Cape Range.

On the way to Albert's home the following day, we called in at the Hobart docks to see if the *Frolic* had left on another fishing trip, carrying the heavy equipment for our newly aborted expedition.

As luck would have it - it hadn't, and Chris was in a position to carry us back to Rocky Boat Inlet should we so desire. As luck? would have it, there was only one person in the position of being able to go back - me! The boat was due to sail at first light on the following day.

At noon, two days later, Chris, deckhand Mike and I sailed out of Hobart - without any fresh water, a situation rectified by a slight detour to Kettering. To those who delight in devouring crayfish, spare a thought for those who catch these delectable creatures. Did you know that crayfish boats are not even fitted with a loo?

On the morning of Thursday, February 5, under conditions of heavy cloud and moderate swell and much skill demonstrated by Captian Short, the *Frolic* made another successful entry into the incredibly small anchorage of the inlet with submerged rocks at times almost touching the boat's hull. At times like these, Mike prefers the depth recorder to be

switched off, so he doesn't know how close they come to disaster. A moderately seasick Norm was gratefully rowed ashore.

Chris Short came ashore to show me a good campsite beside a stream and conduct me to the main cave with its stream passage - an unusual arrangement for a sea cave. After dumping my gear on the conglomerate rock beach, together with some fruit and milk - a gift from Chris - we rowed across the inlet to the cave that Albert Goede had suggested be named Frolic Cave last August. The entrance zone was indeed huge and after a quick look up the stream passage, it was time for Chris to leave, as the swell was increasing, making it imperative to get the *Frolic* into open water. All too soon I was on a slight rise overlooking the Inlet and photographing the *Frolic's* departure.

The first task was to set up camp and have lunch. Afterwards, a trip along the southern side of the Inlet (Pt. Vivian) was in order to survey the best possible route for a track to link the Inlet to the South Coast Track approximately one kilometre away. The rest of the afternoon was taken up in constructing the track. A passing storm deposited light rain that night.

The following day, my objective was to investigate the cave that was closest to the ocean on the northern side of the Inlet. This was easier said than done and five hours were spent trying, without success, to get a look into the as yet un-named active sea cave.

I first approached the cave from near sea level- not an easy task as the tide was in and the sea quite rough. The low level route is fairly safe in rough weather until the final 10 metres or so, which is exposed to wave action, so should only be attempted at low tide and preferably in calm weather. At later times and from other parts of the Inlet, I gained the impression that it would be quite safe to enter the cave at low tide, although a 'wave watcher' would be a prudent safeguard.

There are two other ways of approaching the cave. A medium-level route involves a bit of rock climbing and ends up at the same point as the low-level approach, but this route could be used in inclement weather. A high-level route could also be used, but this would involve the use of SRT. The high and medium-level routes are in fact bedding planes about 6 metres wide and inclined at 30 to 40 degrees. The high-level route also gives access to the spur that makes up the western extremity of the Inlet and gives magnificent views of Prion and Deadmans Bay.

Frolic Cave is by far the most extensive cave in Rocky Boat Inlet with, according to my survey, some 82 metres of passageway. Thirty-one metres of this is in the dark zone and along the streamway. I do not think that the cave was formed by wave action but rather it is a stream cave with its entrance enlarged by the sea. There is now a wide expanse of rock between the cave and the current shoreline. The entrance zone is dominated by three large boulders. The two larger, forming the present entrance, have been an effective 'dam' causing the floor level, on which the previously mentioned 'midden' formed, to rise to its present height.

Despite the findings of the ANZSES party, I feel that the 'midden' is in reality a typical soil cone with the remains of no more than two abalone shells on its surface and three others shells on the floor nearby. The remains of five shells does not constitute evidence of a 'midden'. The passage behind the 'midden' (map, point 5) leads to a chamber showing daylight near its ceiling indicating another connection with the main entrance area, most likely at, or near, point 6. So as not to disturb the soil cone, I did not attempt to enter this region (5), save to collect some material that is listed elsewhere. The rock floor of the entrance zone was littered with fragments of conglomerate, notably quartz. None appeared to have been 'shaped' in any way. The walls show no sign of having been 'worked' for raw material.

Another reason to suspect that the cave may not be an archaeological site is that the cave would be cut off from the only access to the beach at high tide, even though the cave itself affords the best protection from bad weather in the immediate vicinity.

The stream passage is quite interesting, having a silt floor into which the stream has entrenched itself fairly deeply. Between points 9 and 11, the mud is covered with a moonmilk type deposit and the side passage (10) has the walls and ceiling covered with a gypsum-like material as well. The passage at point 11 is partially blocked by a large mud or mud-covered boulder. The mud is very thick. In the area bordered by the points 12, 13 and 14 , a higher-level floor is created by similar boulders, with the undisturbed sections being mud-cracked and covered with moonmilk similar to that found in parts of Exit Cave.

The Terminator does indeed terminate the cave, with the roof dropping down to within 20cm of the stream. At point 14 occurs the only calcite decoration in the cave in the form of two straw stalactites approximately 1.5 metres long. A crooked straw column some 0.6 metres long is nearby. Average roof height in the streamway was estimated to be three metres.

Solo surveying of the streamway was made easier by the use of Light Emitting Diode (LED) markers. I hope to produce a paper on this device at a later date.

Two species of slaters were collected from the entrance zone.

Fissure 1 (see map) appears to have been formed in conglomerate and is still being actively eroded to a certain extent. The angle of fault is 60 degrees. A cross fault is evident approximately five metres inside the entrance on the right hand side. The average passage width is 1.5 metres. Fauna: marine slaters, mosquitos and some evidence of the presence of spiders.

Fissure 2 (see map) appears to have formed in conglomerate and is still being actively enlarged and has a fault dipping at 67 degrees. The passage extends in for 6.9 metres where the ceiling descends to approximately 0.6 metres,then opens up into a small, roundish chamber for a further two metres. The roof height of this section is less than two metres, except for a small aven. A cross fault is evident about five metres inside the entrance and the passage width is approximately one metre. The area immediately in front of Fissure 1 and 2 is where Frolic Cave is cut off from the beach at high tide. Fauna: cave spider, marine slaters, giant mosquitos, evidence of the presence of other spiders.

Shell Shelter is a rock shelter where a large conglomerate block has fallen down 0.5 metres and moved forward one metre (see map) parallel to the shore. It is safe from wave action and is alongside the beach. The fallen block is some 7 metres long and partly obscured by vegetation and other large boulders. Entry is gained by a 'hallway' formed by the fallen block and a larger adjacent boulder. The passageway behind the block is covered by gravelly organic-rich deposits. Ti-tree and other types of vegetation have established themselves on top of the block giving a sheltered ledge. On this ledge there are some shell fragments although the vast majority of shell are on the floor of the passageway, especially at point 16. There is a distinct possibility that this shelter contains an archaeological deposit.

Sunday, February 8 was my last full day at the inlet, and as all the objectives had been completed, I thought it was going to be a day of rest - but I was mistaken. Not being a good fisherman, I decided to spend the entire morning catching lunch. This plan was ruined when, using a famous Tasmanian march fly for bait, I caught lunch in less than 30 seconds. Dragging an early lunch out as long as possible did not help, so I decided to explore along the rocks of Point Vivian resulting in the investigation of five more caves. As I did not have the surveying or camera gear with me, there is no way of accurately recording the information. The following descriptions are based on notes written later.

The caves are Midden Cave, Block Cave, Hole in the Wall (Cave), Arch Cave and Whata Cave.

Midden Cave has a reasonable amount of broken abalone shell in it and a pebbly conglomerate out front that would get weather protection from a large outcrop of rock a short distance away. The cave is a typical shelter although on the left hand side there is an obvious inflow of silt suggesting that running water may have played some part in its formation. Some small animal bones were present on top of the silt. Some were discoloured, probably as a result of leaching by soil water. Most bones seemed intact. The longest bones, possibly femurs , were approximately 100mm long. No skulls or teeth were seen. It is unlikely that abalone fishermen would have visited this or any other cave in the vicinity as it is not exactly easy to reach the cave - without a reason that is. There is a very small stream nearby, its water strongly discoloured by organic matter. Approximate dimensions of the cave are nine metres wide and four metres deep.

Block Cave is formed by a massive collapse. The cave has two entrances although the lower seems to be the only one that can be entered. The cave has abundant gypsum or calcite decoration and a small chamber that seems unenterable, the obvious path being blocked by decoration.

Hole in the Wall (Cave) is possibly formed along a bedding plane. Outside there is a fairly narrow sort of rock platform. The platform leads to a smallish hole on the left-hand side. A nice little cave but for some reason I don't remember too much about it although there seemed to be a reasonable amount of passage. It may still be actively forming.

Arch Cave has a very impressive arch with a downward extension I was unable to explore. Exploration will require some sort of climbing equipment. The descent would be mostly against a wall. A highly photogenic feature.

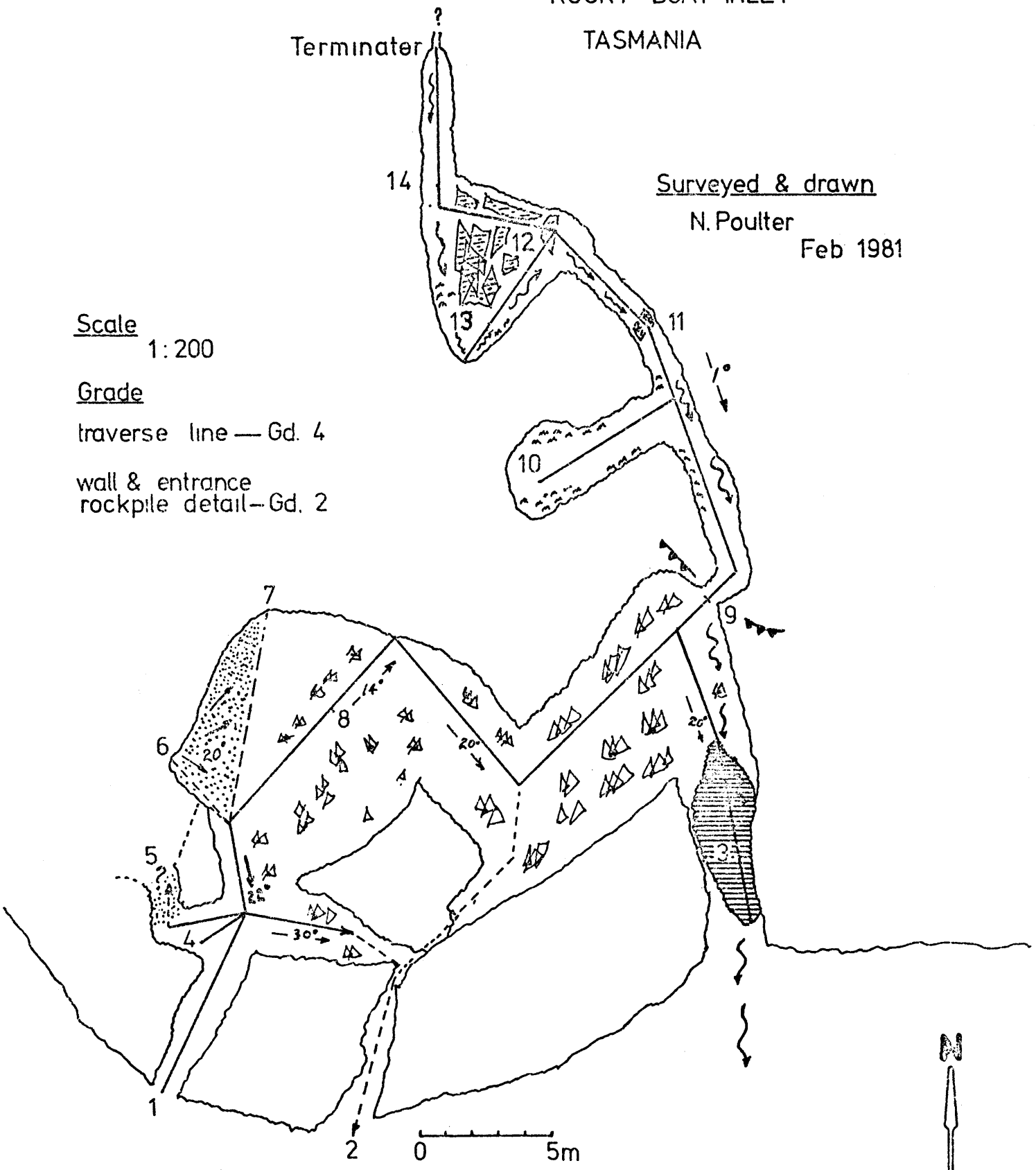
'WOW! Whata cave!', is exactly what I said when I saw the entrance and I can't think of a better name for it. This sea cave would have to be the most extensive on the southern side of the Inlet. The cave is adjacent to Arch Cave so there may be a connection. Entry is through a large abandoned upper entrance and it is possible to climb down to a lower, active level by several routes of varying difficulty. This cave is definitely active, so the lower level should only be entered at low tide and preferably when the swell is low. I was there during a 150mm swell. This cave is really impressive with large chambers. I experienced the thrill of hearing the swell thumping into the active entrances and seeing the surge appear in the pools that covered part of the floor.. The lower section is not directly open to the ocean, rather the surge enters via small tunnels. The loss of my day of rest was considered a small price to pay after seeing this cave. In fact, Whata Cave made the whole trip worthwhile. Whata Cave marked the end of my exploration of Point Vivian for three reasons; the terrain was becoming too difficult to negotiate with absolute safety, it would take a lot to eclipse the discovery of Whata Cave and evening was approaching.

There is at least one other active sea cave on Point Vivian. I saw it from the spur near the unnamed cave during the wild weather on the day after my arrival. The cave has an entrance at or close to sea level as well as a higher one.

FROLIC CAVE

ROCKY BOAT INLET

TASMANIA



Surveyed & drawn
N. Poulter
Feb 1981

Scale
1:200

Grade
traverse line — Gd. 4
wall & entrance
rockpile detail — Gd. 2

Instruments used
Suunto compass & clinometer
50m fibreglass tape
L.E.D. markers

Key to numbers:
see separate sheet

ROCKY BOAT INLET (Cont.)

The water rushes in the lower entrance, and does a U-turn before flowing out the upper entrance. Really spectacular to watch, even from the distance of one kilometre.

It became evident during my four day stay there that the majority of caves require no equipment save the traditional bash-hat and light, the exception to this being Arch Cave which would require a ladder (at least 10m) or SRT gear. However, when I scaled a low cliff to get to the medium and high-level routes towards the unnamed cave, as well as the unnamed spur that makes up the western edge of the Inlet, I used my 15 metre parachute tape on the return descent to increase the safety factor. I used the tape elsewhere for the same reasons.

One item of equipment I would consider essential is GLOVES. The weathered conglomerate all around the Inlet is 'murder' on your hands, and hands are really needed to circumnavigate a sheltered pool between Midden and Block Caves, as well as clambering up and over large blocks of conglomerate between Block and Arch Caves. So, if contemplating a trip to Rocky Boat Inlet, put a pair of gloves in your pack.

The two day walk back to Cockle Creek was a minor nightmare compared with the glorious sunny days at the Inlet. Within an hour of leaving the Inlet, a storm engulfed me and persisted down wind and rain which continued on and off for the rest of the walk out, predictictably clearing up the moment I reached Cockle Creek. Hoisting my 24kg pack up the 120metre high Shoemaker Point and 429 metre high South Cape Range was agony. I was, however, guided by two instructions given ten years apart. The first, by Jeanette Collins was that 'If you're going to get your feet wet eventually, get them wet and be done with it' or words to that effect. The other, from Albert Goede was 'Don't camp on the west side of the South Cape Range'.

Heeding that last piece of advice towards the end of the first day, I pushed myself up and over the Range in deteriotating weather conditions until I ran out of energy at Hardluck Creek. There was just enough space to pitch a tent (with difficulty) and there I stayed. Within an hour, my (enforced) decision to stop was justified - it poured. The spot was not exactly comfortable, but I stayed dry and recovered my strength for the trek out the following day. The track over the Range itself is the one spot where I was worried about injury as it is a real booby-trap of twisted tree roots, often submerged in liquid mud.

One question remains. Should I have gone? Should I have undertaken such a trip, to a remote area on my own, where, if injured, a week could have expired before help arrived, and then only after I was known to be overdue? It is one that I shall leave unanswered. Despite a bout of seasickness, I enjoyed the boat trip with Chris and Mike. I steered most of the way. I enjoyed the solitude and thetwo glorious sunsets at the Inlet. The results of the trip seem to justify the risks involved, although my field notes reflect that I was at risk on at least one occasion. Even so, my remotness from assistance tempered my actions.

Rocky Boat Inlet is still there, remote as it is, waiting for those better qualified than I, to check my findings and the opinions and assumptions I expressed - and make better maps. It took my legs three weeks to get over the two day walk out of that area. Now, from the relative safety of Perth - I would like to go back there again.

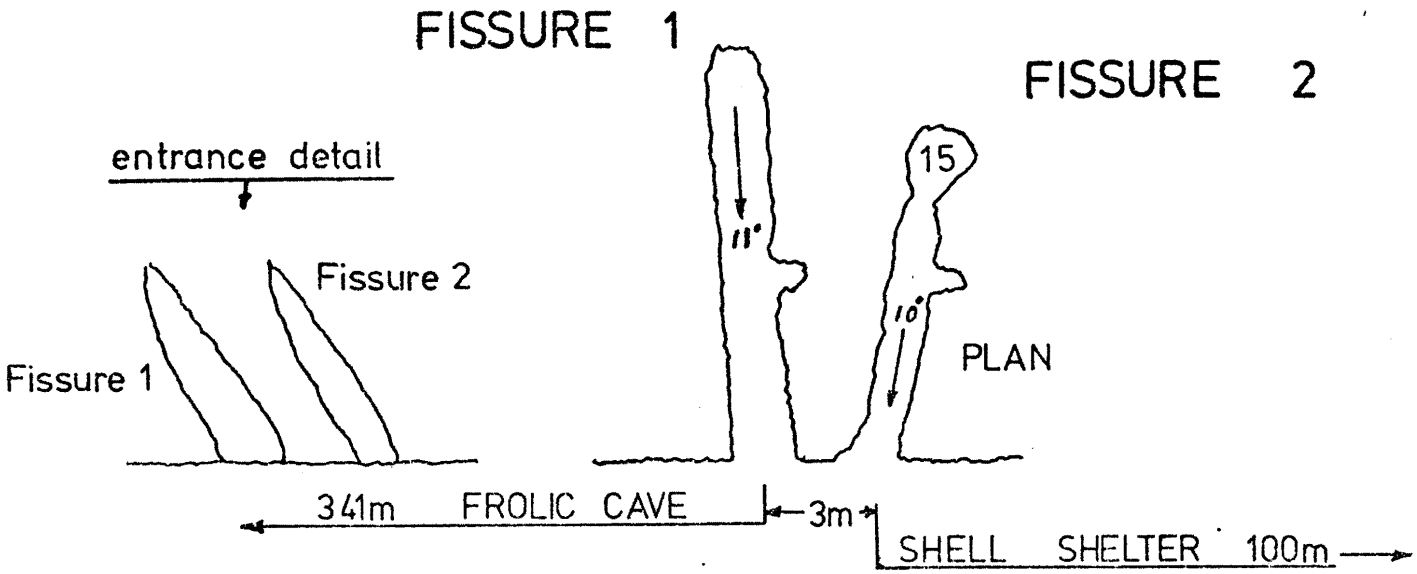
ACKNOWLEDGEMENTS

First I must thank Albert and Judy Goede, Therese Greenhill and Hilary Goede for their hospitality while Robert and I were in Tasmania. It was much appreciated. I must thank Albert for sparking my interest in Rocky Boat Inlet in letters prior to my arrival in Hobart, and giving me non-committing encouragement when I was debating a solo trip. Special thanks go to Hilary for taking care of Robert while I was away. Cheers and thanks to Chris and Mike of the *Frolic* for saving my feet (but not my stomach) in getting me to the Inlet, the gift of fruit and bringing out some of the gear. Finally, mention must go to Liza Healy, Narelle Watson and Albert for taking part in the earlier unsuccessful attempt in January. Tassie's a great place.

NOTES ON THE MAPS

The names I have given to some of the caves/shelters at Rocky Boat Inlet are suggested only and it is up to TCC to accept or reject them. I have been guided by suggestions made by Goede (1978) and hope the names stay as listed.

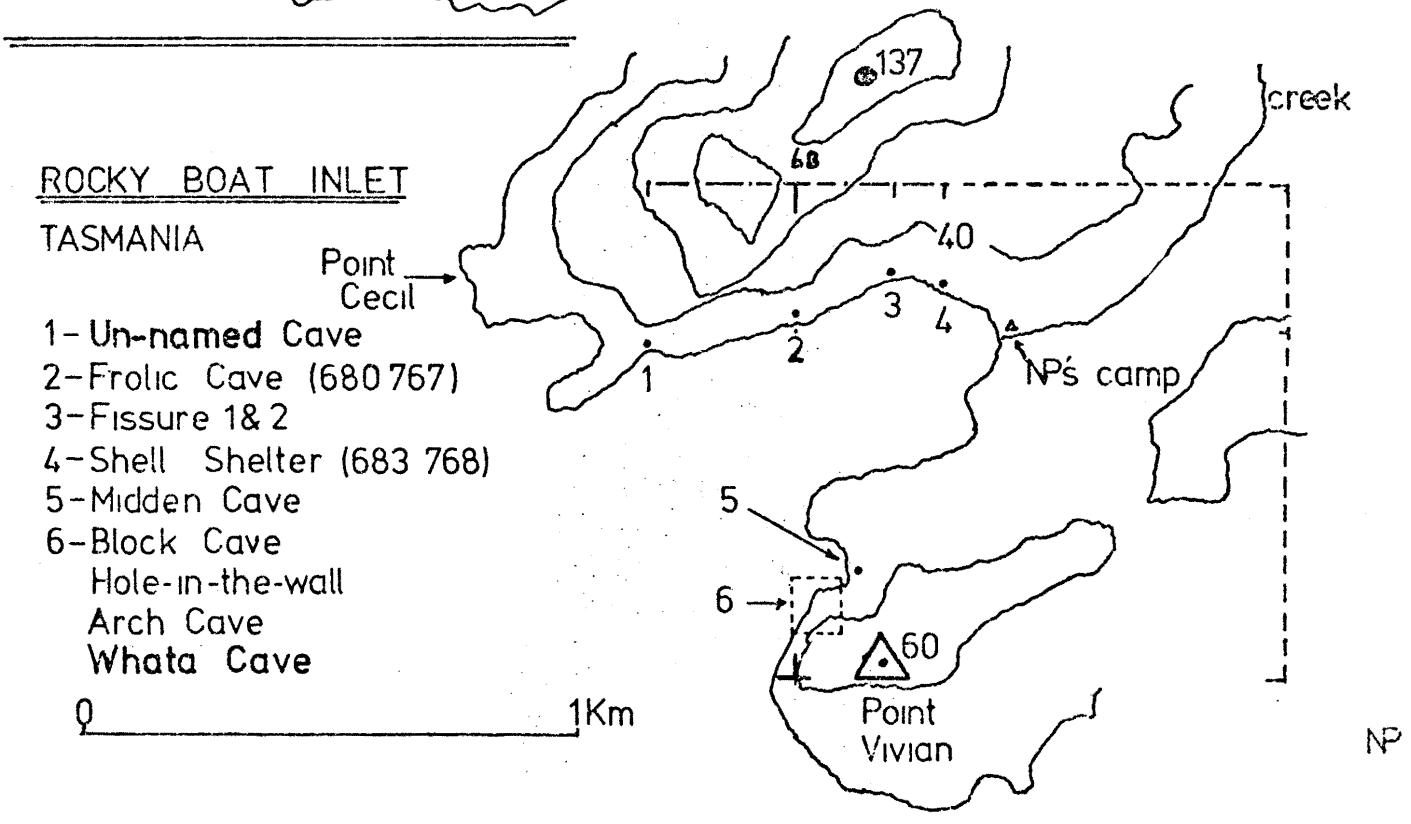
Surveying is not one of my fortés. However I am confident that the surveys shown are reasonably accurate, and so, am claiming Grade 4 accuracy along the traverse lines. The wall detail is diagrammatic only, although some separate wall measurements were taken. I do not hesitate to recommend that all caves be re-surveyed.



Surveyed & drawn
N. Poulter
Feb 1981

Scale
1:200

Grade
traverse line — Gd. 4
wall detail —— Gd. 2



ROCKY BOAT INLET (Cont.)

KEY TO MAPS

FROLIC CAVE

#1	Upper-level entrance	bit of a scramble to get up to the entrance.
#2	Lower-level entrance	gets in more quickly, also goes under two big boulders, coming out in the centre of entrance zone.
#3	'The Lake'	eastern edge of cave entrance. No entry unless you want to get wet.
#4	Location of charred wood	still in place.
#5	Small chamber	located at the back of the soil cone. Light can be seen at the top of the cone proving a connection with the entrance zone. Some small bones, dung and feathers collected from here. Gypsum-like deposits are present. Possibily not very extensive owing to the proximity of the exterior cliff-line in which cave is formed.
#6	Estimated top of soil cone	
#7	Limit of soil cone	and approximate location of an inclined? solution tube that emerges near the top of the cone.
#8	Shell fragments	located on main path - tread softly.
#9	Entrance to stream passage	and limit of daylight. Mud from this point to station 14. moonmilk present most of the way. Tread in existing footprints to preserve moonmilk and mud formations.
#10	Side passage	has moonmilk/gypsum coated mud floor and similar deposits on walls and roof. Keep to existing footprints.
#11	Large mud boulder	partially blocking passage.
#12	Survey point	(unmarked) on top of mud bank/blocks 1-1.5 m high.
#13		At this point, the terminating chamber widens and the undisturbed mud is cracked and covered with moonmilk/gypsum similar to that found in Exit Cave. Keep to existing footprints.
#14		Approximate site of calcite straws and column. Ceiling height here is about three metres.

FISSURE 2

#15	Small chamber	created by ceiling dropping down close to rubble floor.

SHELL SHELTER

#16	The largest deposit of shell was found here. No charcoal was observed. I did not disturb the deposit.
#17	Vegetation growing on top of fallen block which forms the shelter. The position i indicated by (17) shows the approximate western limit of shell debris found on top of the block.

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MAN AND KARST IN TASMANIA

Kevin Kiernan

INTRODUCTION

The comparative solubility of carbonate rocks may give rise to underground drainage and the characteristic suite of landforms which together constitute karst, resulting from corrosion of the rock by slightly acid rainwater, which may be further charged with carbonic acid during infiltration through the soil. A wide range of environments frequently results results. The resource value of such areas may be scant or else rich and diverse. The possibilities of a multiple purpose approach to their management are often inadvertently foreclosed by inadequate knowledge and consideration of the susceptibility of such landscape to damage.

Cavers in some areas have long been aware of threats to caves. Government has sometimes responded by the establishment of cave reserves, but never have Tasmanian reserves been defined on ecological criteria (Kiernan, 1974a), and serious problems have arisen, such as deterioration of cave streams originating outside reserves. While many new, better defined reserves are needed, caves are not the only resource of karst, and speleologists and tourists are not the only interests with a call on karst resources. Nor can karst be adequately managed in isolated, arbitrary, myopic units.

Rather, there seems a need for more broadly based managements of total karst landscapes and their resources. Caves could gain a substantial measure of protection as a consequence, whether they be inside or outside reserves. Such a proposal was raised in Tasmania (Kiernan and Harris, 1973a) in a submission to the National Estate Enquiry on behalf of the Southern Caving Society, noting that Mole Creek area posed a number of conservation problems of high priority, and and would be a useful pilot area for a general karst management plan. The need for such was also raised by the author in 1974 in a discussion paper prepared for a Tasmanian conservation group (Kiernan, 1974b). Response was understandably tempered by other pressures and a short lived sub-committee was formed which failed to attract any long-term interest or membership beyond that of its convenor, although a list of potential cave reserves was a little more enthusiastically received (Kiernan, 1975). Probably because it was a simpler and more expected solution.

However, Legrand (1973) strongly emphasises the need to view and manage karst as a complex system created by the interplay between carbonate rock and climatic, topographic, hydrologic and biologic factors, while Harris and Williams (1975) have stressed the importance of safeguarding evolutionary processes, and more recently Hamilton-Smith (1977) has discussed the necessity to consider the surface environment in cave conservation. Since the bulk of the present compilation was prepared, Davey (1977) has raised the issue of Karst resource planning in fairly broad terms in a paper published in the *11 th ASF Conference Proceedings*, which ought to be read by anyone with an interest in this field.

In various parts of the world, karst features are valuable for water supply, minerals, electricity generation, fish breeding and agriculture. Some springs allegedly possess curative properties. Caves have, and are, being used for storage, air-raid shelters, tourism, cheese production, mushroom growing or air-conditioning of surface buildings. In Hungary and Turkey, the allegedly therapeutic value of cave air has led to underground treatment for respiratory ailments.[1] Karst is also a valuable recreational and educational resource (Maximovich 1977, Jennings 1971).

Some 4.5% of the surface of Australia and adjacent Pacific Islands is karst terrain (Balazs 1977). By world standards, that means Australia is deficient in karst (forty percent of France is karst), although perhaps Tasmania approaches the world average (Com.Enquiry Nat. Estate, 1974). In Tasmania, karst has been primarily developed in Ordovician limestone and Precambrian dolomite outcrops, some of which are in hitherto unroaded terrain. Others have been developed for agriculture, forestry and other purposes, often with disastrous results. Improvement in karst management is complicated by inadequate knowledge, motivation and government control and the extent to which land alienation has progressed. Problems are likely to increase.

They result from a failure to appreciate that virtually all karst features are continuously interacting with water (Hamilton-Smith, 1977). The extraordinary richness of cave speleothem development which characterises Tasmanian caves in particular (and is the contact with karst for many Tasmanians) owes its existence to a soil cover which, in many cases, has been removed totally by inappropriate surface development. Difficulties of water supply have been compounded by pollution of groundwater. The community has had to pay for ill-considered development.

Apart from engineering geology publications overseas, and publications in the area of underground water supplies, much of the literature on karst and man suffers from four main shortcomings : it is predictably preoccupied with caves per se ; or, if more broad ranging, tends to be anecdotal, or negative or superficial. [2] This is particularly true of Australia, where interest is almost entirely academic and the paucity of karst has limited involvement in the problems entailed in developing it. We have the paradox that some karst resources are being lost simply because we have so little to lose we can ill afford to lose them (Jennings, 1975).

The purpose of this paper is to examine the interactions between man and karst with respect to agriculture and forestry, the two dominant uses of developed surface karst in Tasmania, and in the likely spread in the future of

MAN AND KARST IN TASMANIA (Cont)

settlement and industry, and in so doing, hopefully provide some thoughts for more effectively protecting caves by other means than localised arbitary reserves.

LAND USES AND ITS EFFECTS

(1) Agriculture

In Tasmania, limestone derived soils frequently consist of yellow clay, present in pockets and representing the insoluble residue of solution. Where continuous soli is present, it often consists simply of organic matter overlying the clay, which in turn overlies the limestone with a fairly sharp interface. Where it is thicker, a bleached upper layer has formed to produce a yellow podzolic. There are a number of hydrological and geomorphic implications in the conversion of forested karst environment to cleared land for agriculture or exotic pasture. Normal soil erosion process may be accentuated. The critical factors are land use and management associated with steepness and length of slope, a particularly erodable soil type, and prolonged rainfall at certain times of the year, particularly when the ground is bare. The problems are accentuated by the intensive use of small holdings, which characterises Tasmanian farming as well as the short-term economic pressure on farmers.

In sketch outline , here are several normal soil erosion processes. The splash action of raindrops may cause sheet erosion and remove an almost uniform layer insidiously, reducing infiltration, and increasing the liklihood of flash run-off. Particularly where uphill-downhill orientated cultivation is practised owing to the practical problems of using tractors on frequently steep limestone terrain, concentration of run-off energy may lead to rill erosion. The effects of this may be masked by subsequent cultivation. In deeper bodies of soil, slumping may follow saturation of steep slopes by prolonged rains. Steep farm tracks may initiate gully erosion. Over-grazing may strip all ground cover. All this may be reflected in slope-foot deposits. Where a surface watercourse exists, the increased sediment load may promote aggradation further downstream, increasing the incidence of over-bank flow such that erosion can be initiated on often more valuable flood plain lower in the catchment. Damaged soils may be colonised by hardy weeds, the seeds of which may wash downstream and infect pastures. The efficiency of karstic conduits may be inhibited by sedimentation. Sedimentation problems may, of course, be equally consequent upon mismanagement of the upper catchment of allogenic streams. The real problem on the karst surface itself, lies not in sedimentation ao much as in the susceptibility of the soil to destruction by total removal from the limestone.

Accelerated soil erosion in limestone areas is often evidenced by the exposure of rundkarren, a form of rounded solutional fluting of the rock developed beneath a soil cover. These runnels tend to be rapidly sharpened when exposed, and their presence is indicative of recent accelerated erosion. It is very widespread in Tasmania where farming and limestone coincide.

Just as agriculture may detract from the value of karst resources, so may karst pose problems for farmers in other ways. At Mole Creek, one farmer lost 12 animals down holes in 10 months (Anon. 1978). Subsidence may be a serious problem, and has amounted to a gradual drop of nearly ten metres in one Mole Creek pasture in the past five years. Such depressions may then fill with water during winter and leave large areas of pasture inaccessible. Free drainage appears to operate a positive feedback on the solution process. As with any weathering process, if the weathering products are not removed the process will cease, but when soil is removed the limestone may be open to renewed vigorous attack. Only where poor drainage operates a negative feedback and acts to keep calcium in the system will soils be stable in the long term and joints not subject to opening. (Trudgill, 1976).

Run-off from stock pens and barnyards have been established as a major pollutant of groundwater in some karst areas. Inorganic nutrients derived from agricultural sprays, dissolved materials and toxic substances, may readily gain rapid access to groundwater through large voids in the limestone. The faeces output of one pig per day may be equivalent to that of three human beings, hence areas of large scale animal husbandry basically constitute unsewered communities. Where the Mole Creek itself emerges briefly on the surface, it is often heavily fouled owing to stock watering direct from the stream. At Redpa, all the water occuring in a system of caves in a small hill has been polluted by direct access of cattle to a pool just inside one entrance. In South Australia, 40,000 sheep carcases were dumped down one cave following a bushfire. (Gartrell, 1979). At Mole Creek, one very popular cave is littered throughout with household debris from from nearby farms, due to dumping down a creek bank just upstream. Other natural shafts and entrances have been used for domestic dumping and trees and rocks have been dumped during pasture clearance.

Thus the recreational amentity of caves may be lost. At Mole Creek, one cave was ruled 'out of bounds' by a caving club owing to increased instability following clearing and tree felling above it (Anon. 1967). There may be implications for cave biota; the glow-worms,which once attracted visitors to the old Flowery Gully tourist caves near Beaconsfield, have vanished. Perhaps this is because the stream which flows into the cave, and upon which they (the glow-worms) appear

(Continues on page 13)

NOTICES & NEWS

KOSCUISKO NATIONAL PARK

The Koscuisko National Park has recently called for submission on its widely circulated draft Plan of Management. Although 13 Federation member societies have visited the Cooleman, Yarrangobilly and Indi karst areas, it appears that only two societies and a small number of individual Canberra cavers have made submissions. The time for submissions is now closed and the process of reviewing them is well underway. Consequent on the preparation, and acceptance by the Minister, of the Plan of Management, will be subordinate plans for the above cave areas. These plans will be discussed as widely as possible in the interested and (contactable) community and will naturally have to address the subject of caver access and other cave management issues.

Accordingly, Andy Spate invites member societies and/or individuals to the above address so that further material can be circulated. He would still appreciate comment on the issues raised in the draft Plan and the submissions received during the three month period the draft was open for public debate.

WACCON PROCEEDINGS

WACCON Proceedings are available from Rauleigh Webb at 60 Cobden St., Bayswater, W.A., 6053. The cost is $10 (including postage). Please make cheques payable to WACCON.

ITALIAN SYMPOSIUM

A Symposium is to be held by the University of Genoa at Imperia. The topic is "Morphology and the Karstic Hydrology of the Maritime and Ligurian Alps". Cathy Rothery, Secretary, ASF has the forms , but the due date appears to be 31 October, 1981. The Symposium will be held from 30 April to 4 May, 1982. Please note Cathy's address:

78A Balaclava Road
Eastwood, N.S.W., 2122.

NIBICON PROCEEDINGS

Those participants at NIBICON, who have paid for their copies of the proceedings, should contact Andrew Pavey, and send their current address to him. Andrew's address is 45 Arcadia St., Glebe, N.S.W., 2037.

FOURTEENTH BIENNIAL CONFERENCE

The Fourteenth Biennial Conference of the Australian Speleological Federation will be held on 3-7 January, 1983 at Flinders University, Adelaide. The Conference proposes two aims as basis of discussion. These will be

1. Visual aspects of cave recording
   - (i) This theme will cover all aspects of cave recording. Topics will be inclusive of photography, both in two and three dimensional, and their application in mapping, scientific and navigational activities in caves.
   - (ii) Trends in cave mapping with the advent of computer plotting, alternative methods of depicting caves and holograms.
   - (iii) Use of information retrieval systems, namely microfiche, aperture cards and word processors.

2. Forecasting the future of Australian Speleology
   - (i) How advances in technology affect speleology.
   - (ii) Cave access and management in the coming decade. How past trends may affect the future.
   - (iii) Population pressures on the natural cave resource.

RESCUE 1982

This weekend of workshops and practice sessions will be held at Bungonia Caves on 13 and 14 March, 1982. Contact Larry Zanker, P.O.Box 122, Bankstown, NSW, 2200 for further details.

MAN AND KARST IN TASMANIA (Cont.)

dependent for maintenance of adequately humid conditions having become intermittent in apparent response to forest clearing and conversion to pasture. (Kiernan 1977).

(2) Forestry

Undoubtedly, the greatest threat arising from forestry activity as presently practised on some limestone areas, and in others planned for the future, lies in soil erosion. As previously noted, such soil tends to be thin and delicate, in places almost totally absent and elsewhere present in pockets. It takes many thousands of years to develop. In contrast it may be totally removed by erosion in a matter of months.

In the Florentine Valley, sheet erosion on very low angle slopes has led to deposition of nearly a metre of sediment blocking a cave within one year of clear-felling.

As with agriculture, the problem is one of promoting increased surface run-off on slopes which were not as strongly influenced by that process during their development. Again, there is a danger of total removal from the limestone owing to sheet erosion and erosion associated with roads and tracks. As Richards and Ollier (1976) have noted:

> Forestry on limestone slopes can be a suicide path
> of irreversible processes.

Harwood and Jackson (1975) examined losses of soil nutrients to the atmosphere in the Florentine Valley, following the slash burning of clear-felled mixed forest (typical of present forest management in Tasmania). By studying marked plots, they determined a phosphorous loss amounting to 10kg/ha, calcium 100kg/ha and magnesium 37kg/ha. As a percentage of nutrients contained in the fuel actually consumed, this amounted to 18%, 17%, 12% and 29% respectively and as a percentage of nutrients in the total fuel 10%, 9%, 7% and 17% respectively. Moreover, they determined that the ash fraction contained about half of the above ground nutrients remaining. This of course, could be readily washed down the slope. Their study considered an atypically cold regeneration burn, and considerably greater loss through volatilisation may be anticipated from the greater heat and stronger updraughts of a fiercer fire. In addition to volatilisation, large losses occur in the log harvest and in the downslope washing and deep leaching of nutrients mineralised in the ash.

In addition to the loss of the recreational amenity in one cave (to which allusion has already been made) others have been rendered dangerous by the dumping of debris into shafts. There is one incidence of broken speleothems, which may be due to the passage of heavily laden jinkers overhead. At Gunns Plains, the situation with a tourist cave theoretically protected by a state reserve, but fed by a catchment extending beyond its boundaries into an area recently clear-felled, has compelled its operator to complain of a serious siltation and even speleothems being broken by debris during times of high flow. (Wing, pers. comm.)

The implications for cave biota are open to speculation. A large bat colony departed a cave in Victoria following forest clearing, which left the ceiling from which they hung, constantly damp. (Hamilton-Smith, 1977). Cave-dwelling bats do not occur in Tasmania of course, but the incident just mentioned, illustrates how prone to damage cave eco-systems are, even by above ground activity. Williams (1975) outlines problems in the Waitomo glow-worm cave owing to forestry and roading in the catchment. Hawke (1977) outlines research aimed at ameliorating the problem.

(3) Settlement, Communications and Industrial Development

Clearly, the presence of karst terrain poses a number of problems to human settlement. Apart from possible water supply problems, construction activities may also be complicated. A brief glance at some of the engineering geology literature on karst areas raises some interesting problems.

The siting of roads may be complicated by the need to fill or bypass dolines. Collapse of roads has occured, but the main problems are associated with high foundation loadings, such as are involved in bridge construction. Common sense in siting will avoid many problems, but in the Liena area a minor resurgence was simply plugged and built over by the Hydro Electric Commission (Young, pers.comm.). A major landslide, which swept over this area in 1972 causing considerable damage to a nearby farm, may have been related to this blockage. Following repairs, which didn't consider re-siting the road, a major doline five metres deep formed in its surface overnight after heavy rain in 1974. The hole was simply plugged and the road quickly handed over to the jurisdiction of the Public Works Department. The latest 'repair' has promoted s uration of nearby paddocks by numerous small springs, while heavily silted water resurges through the bed of the Mersey River nearby. At Yarrangobilly in New South Wales, a siltation threat to caves following re-routing of the Snowy Mts. Highway, was countered by the construction of silt traps which were not particularly successful.

Impermeable road surfaces, through restricting infiltration and promoting rapid runoff into adjacent areas, may expedite soil erosion and lead to more rapid sinkhole development. In Pennsylvania, such a situation developed when the sealing of part of the bottom of a karst depression for a factory and a car park, increased run-off, carrying overburden into bed-rock cavities and promoted accelerated doline development. In that case, a one million dollar proposal to pipe run-off some distance to a surface stream seemed the only satisfacotry answer (Knight, 1971).

The stage of evolution reached by a karst area will determine the best water sources. In the early stages,

MAN AND KARST IN TASMANIA (Cont.)

diversion underground has not progressed far, but later, a greater proportion runs underground and karst springs may be a useful source. This is reflected in the siting of the Mole Creek township. The extent of turbidity after heavy rain can be a guide to the degree of filtration of water since it passed underground. It emphasises the ease with which karst water may be contaminated, and the need for elucidation and protection of the relevant catchment if water quality is to be maintained (Thornbury, 1957).

Where the limestone is dense and of low permeability, satisfactory wells may be contingent upon chance intersection of soluble conduits. In the United States, a buried karst is also important for water supply, and the presence of a suitable filter, such as sandstone above it, is of great utility. Water may also be intercepted upstream of swallets and piped elsewhere e.g. Westmoreland Cave, Mole Creek.

Although cases of successful damming schemes on limestone (despite the threat of gross leakage) are recorded (e.g. Pavlin, 1970), numerous engineering misadventures are also recorded involving both leakage problems and dam instability. In Tasmania, Roberts and Andric (1974) have considered such factors with respect to the proposed Lower Gordon Hydro-electric scheme. On the Tennesee River (USA), the Hales Bar Dam was built by private interests during the years 1905-1913, at a site selected on primarily the basis of the narrowing of the valley. Failure to recognise the likely problems of limestone at the site increased the costs-a two year/three million dollar project to an eight year/11½ million dollar project. In south-east New Mexico, the Hondo reservoir had to be abandoned owing to rapid leakage. The costly May River dam in central Turkey is unlikely ever to serve its function. In Indiana (USA), city officials twice ignored advice and built water supply dams on the limestone, precipitating a series of water crises. The list is a very long one and continues to grow. Grouting is an expensive partial solution (Thornbury, 1957; Jennings, 1971).

While underground water may be of considerable significance in karst areas, there are numerous ways in which karst waters may become polluted. Knight (1971) records that

> it was common practice in some areas, before the enforcement of modern sanitary laws, to find a sinkhole for waste disposal.

In Tasmania, something very similar is still perpetrated at government level. In the Mayberry area, a series of dolines on the apparent drainage divide between Sassafras Creek and Overflow Creek, serve as the Municipal disposal area. However, Overflow Creek itself has been diverted underground; its surface course northwards through Sensation Gorge is dry, except during times of heavy winter flow, and underground drainage in that direction is cut off by impermeable rocks. The chain of dolines in which dumping occurs, extends from the mouth of Sensation Gorge towards resurgences, which account for a major proportion of the flow of Sassafras Creek. Although it has not to date been tested, the reported occurrence of sawdust at the resurgence during heavy rain, lends support to these hypotheses (see Jennings, 1967) that underground drainage passes under the tip.

Undoubtedly, a major karstic water supply , will, in due course, be found to be very severely polluted. A somewhat similar situation has been reported concerning pollution of a cave at Buchan, in Victoria (White and Davey, 1977). Sewage represents a serious potential source of pollution, threatening despoiling of groundwater with pathogenic micro-organisms, faecal coli etc. Septic tanks and stormwater disposal down a sinkhole near the main street of Katherine, Northern Territory, has possibily polluted a potential water supply from the limestone at the locality. In northern Tasmania, workmen at a limestone quarry at Flowery Gully, have for some years utilised a natural shaft as a toilet. The relationship of this to local hydrology is not known in detail, owing to a remarkable reluctance of Tasmanian cavers to explore this shaft.

Serious pollution of karst groundwater by industrial effluent has become a major problem in some areas. Radioactive wastes may pose particular problems. At Mount Gambier, South Australia, a cheese factory has polluted its own water supply, and 300,00 litres of milk were poured into a cave in Western Victoria (White, 1976). In Tasmania, there is some evidence of the pollution of a cave stream by disposal of refuse down a sinkhole at a limestone quarry (Kiernan, 1973), while sediment in underground streams may also result from quarrying.

There are numerous cases of subsidence owing to interference with karst hydrologic systems. Near Hershey, Pennsylvania (USA), a chocolate factory was established in 1903, adjacent to a plentiful water supply from karst springs. Owing to pumping of water from a limestone quarry, amounting to over four million litres per day, and the subsequent lowering of the water table by 60 metres at one point, a cone of depression developed nine by two kilometres in extent. Not only did the jeopardise the springs, but the removal of water from clay in solution cavities caused shrinkage, leading to the development of numerous sinkholes in the cone of depression. This threatened the very structure of the factory. Following litigation by the chocolate company, recharging operations were commenced.

A similar process (Martini et al, 1977) caused by pumping of water from goldmines in Far West Rand in Transvaal,

MAN AND KARST IN TASMANIA (Cont.)

South Africa, led to disaster in 1962, when sudden subsidence engulfed a crusher plant at West Dreifonten (Jennings,1971) killing 29 people.

In the Transdanubian Range, pumping has lowered the water table an average of 15 metres, and presently totals 20% in excess of natural infiltration (Bocker,1977). Adverse consequences may follow excessively large diversions from swallets, and, as a consequence, one such proposal in southern Tasmania was initially halted following pressure from conservationists. It has since gone ahead on a smaller scale.

Proctor (1948) describes cave-ins at a rayon plant in Elizabethton, Tennesse, owing to collapse of cavities not formed in underlying limestone but in overburden, after soil was flushed into limestone voids by the plant's excessive water. Clark (1961) describes collapse not only in overburden, but with the overburden cavity not directly over the entrance to the limestone void.

Thick overburden may make location and utilisation of suitable bedrock difficult and costly. Leggett (1939) cites a case in which failure to recognise how irregular a limestone bedrock surface may be, increased the cost of one contractor's site preparation from $82,992 to $209,018, with massive increases in rock excavation required. There was an increase from a planned 1100 metres of drill holes to 3500 metres and 6368 bags of cement were used instead of 4200 bags.

In Pennsylvania, a few hundred square metres of car park at a two storey motel fell victim to an overnight doline. It was subsequently found that one wing of the hotel spanned a large void (Knight, 1971). Television coverage of such problems in the United States is becoming rather commonplace in Australia. Allen (1969) suggests that if subsidence commences, the theoretical options are threefold: induce rapid subsidence, fill the hole or control the process. Preferable to that of course, is identification of potential problems and adjustment or avoidance in the planning stage.

Inadequately considered tourism amy also pose problems. In the United States, sealing of a car park led to speleothem dehydration in a sub-adjacent tourist cave (Skinner, 1972). The cave environment may suffer from artificial lighting, encouraging the growth of algae. Lint from visitors clothing may settle on speleothems. At Hastings, in Tasmania, a tourist cave stream has been littered with logs from old stairways and broken glass from spent light globes. In Victoria, Moon Cave has been polluted by campground sewage and other aspects of planning are of concern (White and Davey, 1977). At Jenolan, New South Wales, dehydration problems were considered in installation of airtight doors. The famed glow-worm display of Waitomo, New Zealand is threatened by a number of factors, including misguided tampering with cave water levels.

The foregoing has raised but a few of the many problems and complications man has encountered in seeking to more densely settle and utilise karst terrain, using techniques satisfactory on other non-karstic terrains. The lessons should be clear and the solutions for failing to heed them are often expensive. Planning needs to be more than writing down what one did yesterday, or one sectional interest trying to make a belated input to the decision making process after costly planning and purchase has given way to construction. Davey (1977) contrasts the failure of the government to action many recommendations of the National Estate enquiry report and the readiness of the Victorian governemnt to accept recommendations of its Land Conservation Council and suggests they relate to the degree to which each is incorporated into the machinery of government. Most likely, it is not that simple - the more deeply imbedded in government an agency lies probably influences also the extent to which it makes recommendations of a type not discomforting to that government Specialists may define the options, but value judgments are involved in the act of choice.

SOME THOUGHTS TOWARDS THE FUTURE

> Caves and karst landscape are one example of natural features whose beauty must be adversely affected if they are to be useful to man.
>
> -from "Heavy Hand of Modern Man", *Aust. Nat. History* ,18(6), 1975.

There has never been any great pressure on Tasmania's soils to date. Extensive use without the need for a particularly great yield has been the norm. There has been no real spur to inventory or study. Low population pressures and equable climate have meant karst water supplies have seldom been called upon, and then virtually only for limited agricultural use. There has been ample scenery for tourism purposes without protecting every cave with potential for development and ample alternative caves for cavers, should one be damaged by over use. Similarly, there has been no real need to maximize the efficiency of out utilisation of the state's forest resources. Tasmania has approached nearly all its natural resource development programs as mining ventures: tree mining for woodchips; soil mining for agriculture and so forth.

That is not to say that the present situation will always exist. The option should not be closed now, in this time of milk, honey and negligence.

MAN AND KARST IN TASMANIA (Cont.)

The apparently formidable set of charges laid against forestry operations and agriculture, and the complications envisaged for settlement, communications and industry, do not mean such activities can never occur on karst, for they are occurring at present. Indeed, with considerable success when viewed within present criteria. Any change to our approach must take into account that extant cultural landscape. However, if future land use options are to be kept open, it is necessary to identify problem areas and work towards appropriate management practices.

In countries where karst is extensive and population pressures are higher, there is considerable government input to karst research. In quantative terms, Australia is comparatively deficient in caves, although Tasmania approaches the world norm (Jennings, 1975). Here, only limited scientific curiousity and sport fills the research role. How limited that is, is evidenced by the number of question marks which still exist over such basic matters as the extent of karstic drainage basins even in areas settled and accessible for decades. Yet, there is a need to direct development of Crown Land and have some measure of control over freehold.

Reserves to protect caves have been established under numerous Acts in Tasmania, firstly under the Crown Land Act 1890, which provided for exemption from sale and reservation to the Crown of "places for the recreation and amusement of the inhabitants of any town or village". The Scenery Preservation Act 1915 provided greater security and appears to have operated in parallel with Crown Lands legislation but covering more "important" areas. It was superceded by the National Parks & Wildlife Act 1970, which incorporated reserves under the former Act through transitory provisions contained in the second schedule to S.53 (part 1c). It provided, under S.14(1) for private land to be gazetted as Conservation Areas with the concurrence of the owner, protecting fauna only (though there are current attempts to extend this) with the possibility of habitat protection through the additional declaration of State Reserve status over selected state-owned Conservation areas.

Other forms of reserve have been created under the exemption clauses in the Acts governing Forestry and Mining, but serve to protect the subject areas only from alienation for the purposes relative to the particular administration. Some apparent reserves have not been officially gazetted but appear to exist only by virtue of the concurrence of the relevant department head, and thus seem rather insecure. The general picture has been one of widespread public confusion It is significant that no parcel of land so secured has ever been defined dominantly on ecological criteria such as drianage basin, but only by arbitrary linear boundaries. Problems have arisen which exemplify the need for broader based karst management and the shortcomings of usual land parcel delineation.

These then are the only cases of legislation specifically protecting karstic features, and none could be practically extended to overall management of total karst landscapes of any substantial size. However, there are several pieces of legislation relevant to karst management on a broader basis, together with one stagnant Bill.

Environment Protection Act: The general theme is to protect the totality of the Tasmanian environment, but in reality it is mainly concerned with pollutant emission, plus research towards restoration and improvement: conceivably that might include efforts (if the issue were pushed sufficiently) towards re-afforestation of severely damaged limestone slopes, misused through ignorance.

Local Government Act: Local Governemnt potentially has the power to greatly influence development of karst landscapes through council regulations. Moreover, on environmental matters, regulations can be framed under the Environment Protection Act to increase punitive powers.

Underground Waters Act 1966 : This Act provides in S.11(1) that no person shall cause or allow any potential contaminant to enter "any hole, cavity or excavation" and under S.6 for the establishment of protected areas to effect any or all of the purposes of the Act, namely the prevention of the depletion, waste or contamination of underground water, and its equitable distribution. It provides for an advisory committee consisting only of representatives of the Department of Mines, Health Services, Agriculture, Rivers & Water Supply and a representative of primary producers. It certainly would not suffer for the presence of a speleologist.

Crown Lands Act: Under S.3, the Minister is given power to manage and dispose of all crown land, and S.69(a) provides for regulations under the Act to prescribe the care, management and protection of Crown Lands, under which terms a management plan has already been produced for the Central Plateau high country. The terms Regional Park or Protected Area have been bandied about also, as a multiple use alternative to contentious state reserves. However, they have no proper basis in legislation and seem little more than a method for inter-departmental landgrabbing. In those few cases where a karst area is hitherto unalienated land, the Act provides considerable power to guide development, but in an area area such as Mole Creek, crown land accounts for only a tiny fraction in comparison to freehold, ever increasing State Forest, and some small areas of State Reserve. The Act does provide, however, for the voluntary assignment of land (S.46(6)) which has the advantage over similar provisions in the National Parks and Wildlife Act of allowing actual land management. The likelihood of its ever occurring on a sufficient scale to be of utility for karst management is

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neglible.

Land Resumption Act: Karst management should certainly qualify as a "public purpose" for which land may be resumed under this Act, and theoretically it could then be passed onto another authority, such as National Parks and Wildlife Service. The political implications of sufficiently large scale application to allow this or permit rationalisation of holdings, make it an unrealistic approach.

National Parks & Wildlife Act: The basic categories of land for management under the Act have already been briefly mentioned. The Act provides for management plans to be prepared, although this aspect lags in reality, owing to shortage of funds and staff. A number of cave areas are already protected in reserves. Theoretically, broader karst protection could be provided through management plans allowing wider development than generally possible in State Reserves. However, there is negligible chance of sufficiently large areas of karst ever being protected under this Act. At any rate, such an approach would probably be inappropriate: both outside the spirit of the Act and posing threatening implications for public attitudes to the sanctity of State Reserves. With the agreement of the owner, the Service can now institute management plans for Conservation Areas which are binding on the owner and subsequent purchasers, but it is complex to get into operation. It can also exempt areas from the operation of other Acts.

State Planning Bill: This Bill provides for the preparation of local development plans, but has been held up by resistance in the Legislative Council. Under its terms, planning permission would be required for any development of land subject to a local development plan or interim order requiring planning permission. Section 54 however, provides that "permission is not required for any development of land for the purposes of agriculture or forestry" except with respect to certain stock matters. This completely emasculates the Bill as a mechanism for karst management planning. As well, an assumption of co-operative colleagiallity among government agencies is implicit in the Bill, whereas past experience has shown a tendency more towards more interdepartmental competition. Bowman (1979) has used the term "Icarus style" to describe Tasmania's approaches and attempts at planning. Tasmania's farmer-dominated Legislative Council seems unlikely to pass legislation offering such significant restrictions on allowing farmers to do what they like on their land.

Thus, the only really viable approach, given the advanced stage of land alienation on Tasmanian karst, lies through a modified State Planning Act, together with local council ordinances, solution of a large part of the problem through rigorous application of the Underground Waters Act, or the passage of either new legislation aimed specifically at karst, or integration of relevant clauses in the Acts pertaining to forestry, agriculture and other land uses. The former appears the most logical, but logic does not always prevail in the realm of political and administrative realities. Which ever route(s) is taken requires accurate knowledge of karst areas and processes, farsightedness and a degree of political courage. All three appear to be in short supply in Tasmania.

In the Mole Creek area for instance, the advent of woodchipping was appreciated not only as a boost for local employment, but also as a means of maintaining the viability of the branch railway line. Any perceived threat to the industry may also face the ire and consequences involved in increasing unemployment and the further short-term disadvantaging of the rural community,should the line close.

The preparation of an inventory of karst and karst resources is fundamental. (It is not envisaged as necessary or desirable in wilderness areas.) This would require geomorphological mapping of karst landscapes, oriend towards land use planning, hydrological engineering, civil engineering, soil surveying and conservation. Drainage basins form a natural unit for environmental management, but in view of the potential for wide discrepancies between actual karst drainage basins and apparent surface divides, this would often entail preliminary photogrammetric surveys, followed by detailed field research. This would include groundwater stream tracing by flourescein, *Lycopodium* or similar techniques.

The aim would be to produce a map delineating hydrological layout, and critical areas such as swallet catchments, slope stability, soil development and similar factors, as well as the study of the intrinsic suitability of areas for agriculture, forestry, recreation and other purposes. This would be aimed at producing an integrated plan for optimising for a multiple use rather than a single use, perhaps similar to the matrix form used by McHarg (1971) to relate degrees of land use compatibility, natural determinants and consequences.

In particular, prospective land uses should be examined against the degree to which they threaten soil stability or imperil the aquifer: those which do, should be prohibited. Allogenic catchments also need to be considered. One submission to the 1973 National Estate Enquiry hopefully suggested the Mole Creek area would be a good area for a pilot karst management program, and that even the opportunity for speleologists to be advised of and inspect land clearing operations would be of value (Kiernan and Harris, 1973a). Proposals for reserve status for the Mole Creek system have always envisaged a multiple use approach (e.g. Kiernan and Harris, 1973b). Reafforestation programs should alos be attempted where appropriate.

Even so, there is no simple solution for many of the problems which may be anticipated as karst areas become more desirable and heavily utilised by an increasing population. Construction activities require careful planning, with

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adequate contingency funds and close design-construction contact. Standard foundation techniques may be inadequate, and open test pit excavation may be desirable to expose the rock. Costly close spaced drilling may be necessary. Komarova and Shtengelov (1977) cite research in the USSR into surface radiometric surveys for hydrological and construction engineering purposes. Adequately constructed sewers are far more preferable to septic tanks. Consideration should perhaps be given to permeable road and car park surfaces in sensitive areas to minimize concentration of run-off, and tank storage of roof run-off for domestic use.

Some form of evaluation is necessary to identify desirable landscape for purposes of amenity and priorities regarding cave conservation. To some extent, though, protection would flow naturally from management oriented towards maintenance of the natural hydrological system.

As Legrand (1973) suggests: "the question is whether man will continue to compund the problems of the karst environment or whether he will adjust to and improve it.

A hydrological approach to management seems likely to facilitate the broadest possible range of concurrent land uses uses, and maximization of the benefit from many of these options appears dependent upon such an approach. Under such conditions, a truly remarkable land-use range from underground wilderness to surface agriculture or urban development seems possible. For the caver, there still remains the massive job of managing what is frequently the single most de destructive agent to the cave environment - himself.

FOOTNOTES

1. Although Gurnee (1977) notes the possibility of some danger owing to radioactive decay of gases found in some caves and of ecological damage in drastically modifying cave climates.
2. A number of papers published since this article was prepared have changed this situation somewhat.

Lest this article appear somewhat schizophrenic, a word on its origins may be in order. Much of it dates from a discussion paper prepared in early 1974, for a conservation group with virtually no knowledge of karst. It assumed something closer to its present form in 1976, with minor additions the following year. Some further additions were made in early 1978 with expansion of the section dealing with Tasmanian legislation. Already overlarge, it has not benefitted from some relevant material which has appeared on the Australian scene since that time, and suffers from that limitation. Nonetheless, in the hope that some of it may be still of interest to the more general speleo audience, it is published here, without the drastic revision which it really needs were I able to find the time.

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KSS Philip Holberton reports that KSS activity has concentrated on Sebastopol, which is now owned by KSS members Lyn and David Collett. The most significant find for the year on the Macleay was made in March, when a littl little digging opened a new cave with 100 metres of passage, plently of formation, and a promise of further extensions. John Taylor and Dorothy Niecterlein were with us when we made the discovery, and he was excited enough to spend Easter surveying it. The club has also had a working bee at Taits Creek, and a large party successfully climbed Fifes Knob, which overlooks Sebastopol below the junction of the east and west branches.

WASG Rauleigh Webb reports on the period February to July, 1981. This period has been extremely busy for WASG members. Several trips have been made to Weelawadji Cave to begin a program of bat banding. The most significant discovery so far is that the bats in Weelawadji are not only *Chalinolobus morio* but also *Chalinolobus gouldii*! (This is the first time that *C. gouldii* have been recorded in a cave.) In the south-west, the surveying continues with surveys of Kudjal Yolgah (again) and Bottomless Pit almost complete. While surveying in an overhang, onto his area map, Barry Loveday found that it was in fact a cave which is so far 50 metres long and still going. This cave was near Bobs Hollow, which was recently the site of a massive clean-up. It is a credit to the members, considering the numbers that turned up for this work and spent most of the day loading up the Ranger's Land Rover with thousands of cans, Bottles and other rubbish, including an old kero 'fridge. Many thanks to National Parks for the refreshments supplied. At Augusta, the lakes of Easter, Jewel and Labyrinth continue to fall. The records of water levels kept by WASG and SRG indicate that this trend is likely to continue, as rains in the area have not been substantial. Already the water is at an all time low - how much further will it go? Water table caves without water? Several Scout Venturer and Rover crews have recently been taken caving with WASG and it is hoped that this liason can continue. The last WASG meeting was the annual slide competition and the standard was very high.

MUSIG The attempt to get into B68 has come to an end. There was a massive assault during the dry summer months, when the water levels were the lowest we have seen. The parties pumped and siphoned as far as equipment and conditions would allow. There were still miles of water. David Rothery ducked under through an awkward keyhole squeeze to a little airspace. The passage is still heading down with no end in sight. The Forestry compass has returned from servicing, so the mapping of Naked Lady Chamber in Mammoth Cave at Jenolan will be completed. Work has also been carried out in the Bendethra area, and attention will now be focussed there

UQSS Trips were taken on most long weekends,which in Queensland are all in the first half of the year. These were to Kempsey, Mt. Etna and Ashford. A combined Easter trip was held at Kempsey with MUSIG almost outnumbering UQSS. At Carrai, a dead calf in the sinkhole has made the water at the efflux at Windy Gap suspect. Trips have also been made to the caves at Turtle Rock at Binna Burra (in tuff). This was a memorable trip which made an early start. It wasn't until the next week that Steve Henzell found they were a week early. The semester system of loading students with work and fear has curtailed the starters on any trip. Greg and Jan and Kimberley Williamson have moved to Canberra in search of greyer limestone pastures.

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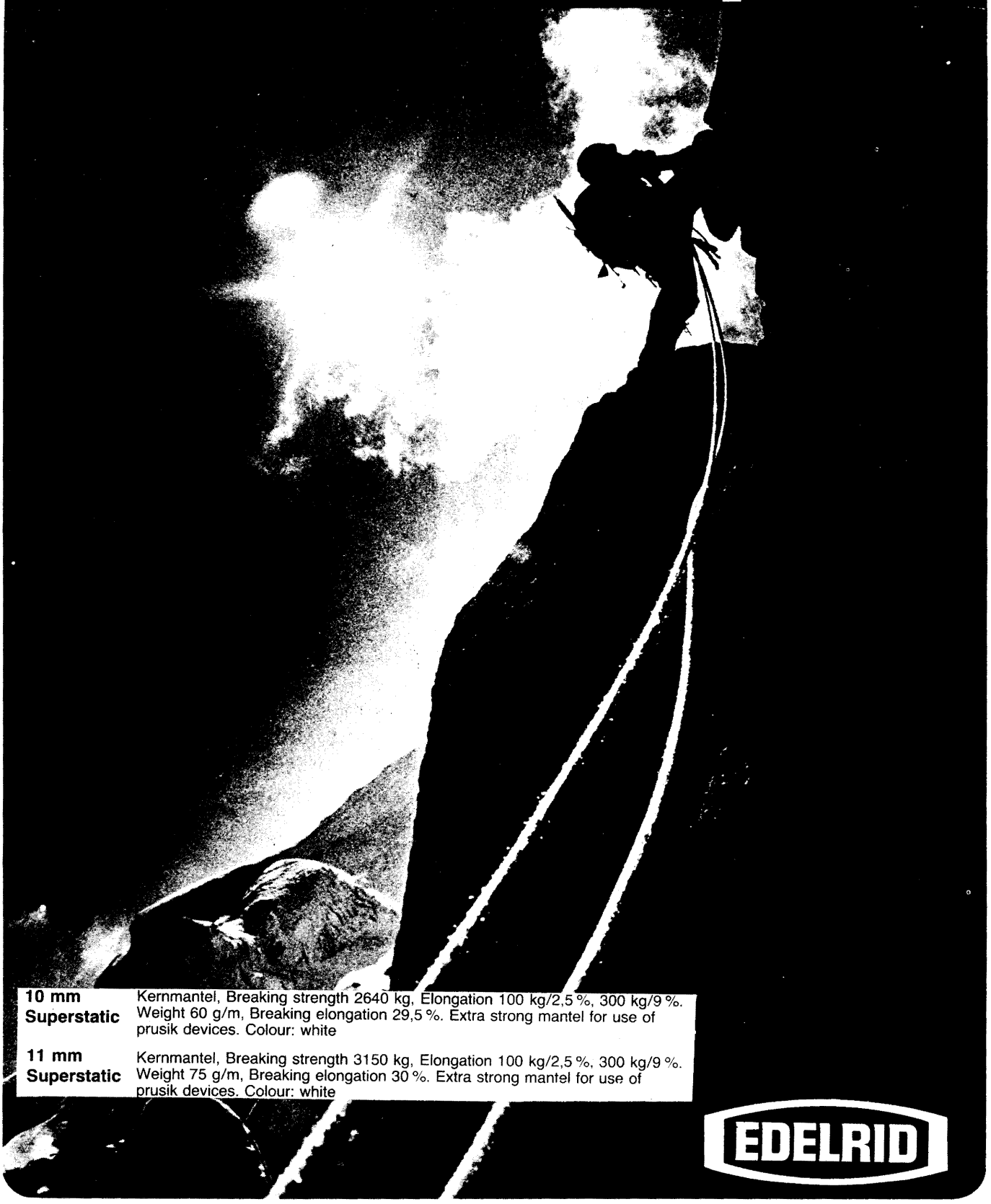

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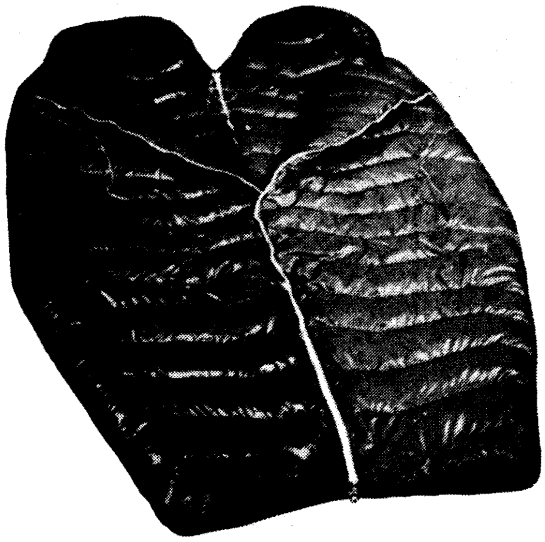

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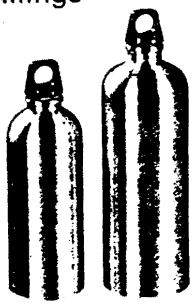

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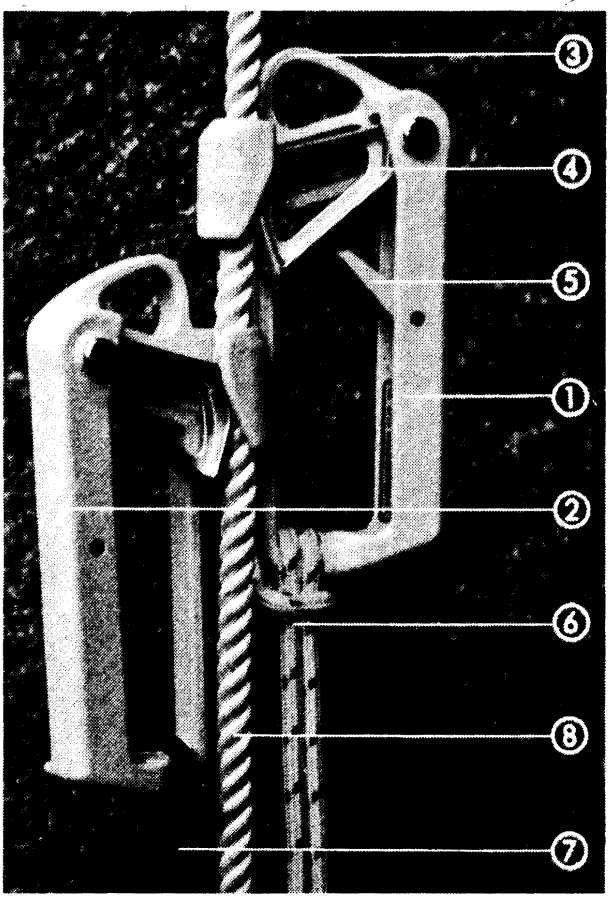

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