AUSTRALIAN SPELEOLOGICAL FEDERATION

TRANSCRIPT

OF PROCEEDINGS

7th BIENNIAL CONFERENCE

AUSTRALIAN SPELEOLOGICAL FEDERATION

TRANSCRIPT OF PROCEEDINGS OF THE 7TH BIENNAL CONFERENCE OF THE AUSTRALIAN SPELEOLOGICAL FEDERATION

Graham's Castle

Goolwa, South Australia

27th to 30th December, 1968.

Published by : The Australian Speleological Federation,
P.O., 388,
BROADWAY, N.S.W. 2007

Produced by : P. and M. Matthews of
The Victorian Speleological Association and
A.L. Hill of
The Cave Exploration Group of South Australia.

TABLE OF CONTENTS

INTRODUCTION

This is the first occasion on which a full transcript of the proceedings of an ASF Conference has been published. Unfortunately, in the past, much of the valuable and interesting material presented at the Conferences has been lost to posterity and therefore the efforts involved in its preparation were largely in vain. Some of the more scientific papers have been or will be published in appropriate journals and magazines but many were never published.

Perceiving the need for a full transcription, Margot and Peter Matthews took upon themselves the very considerable task of preparing a permanent record of the Seventh Biennial Conference. Following, as it does, so closely upon the production of the ASF Handbook, this is an example of energy and drive which we might all envy. The Cave Exploration Group (S.A.) then volunteered their assistance and have provided the plates, cover and duplicating and binding facilities.

It is proposed that in future the host Society appoint a secretary to produce the transcript, hire a professional if necessary, and charge the fees to the Conference. This should ensure that we will not be so dependent upon the goodwill of the energetic few. On behalf of ASF I should like to record sincere appreciation of a job well done.

R.P. WEBB
PRESIDENT

THE OPENING

Roly Webb, President:

Welcome to Graham's Castle for the opening of the 1968 Conference of the Australian Speleological Federation.

We have here this morning the South Australian Minister for Lands, Mr. Brookman, who has honoured us with his presence to open the Conference. Without further ado I would like to introduce him Mr. Brookman.

Mr. Brookman:

Major Webb, ladies and gentlemen. Thank you for the invitation to this rather unorthodox, informal and obviously very cheerful gathering. I have opened a good many conferences and sometimes the formality is of such a heavyweight nature that you spend almost to lunchtime before anybody starts talking business. I have noticed this happens with Ministerial conferences probably more than any others, but here we have a group that I can see are obviously interested in their own subject and want to get straight on to it.

I do first of all want to congratulate you upon your interest and, as one of the State Ministers whose responsibility is conservation (not the only one, but as one of them) express my appreciation of the interest in conservation and the contribution that you make to this object. I notice that speleology is one of those subjects in which, I think, there are probably very few full-time professionals. You, as I understand it would all have some other major occupation and this is a private interest of yours so to speak.

This seems to me a very worthwhile way of approaching any sort of scientific research, and in fact probably all scientific research has its origins in some private endeavour. Talking amongst you I have gathered that there must be people with quite a lot of skills from a wide range of disciplines, and I can see how important it would be to have zoologists, botanists, geologists, and not forgetting surveyors, because afterall, you do like to know where you're going and/or where you've been.

A point I would like to stress also with you is that as a Minister of conservation I am particularly gratified that you are doing this type of exploration work. You are doing

it in such a way that it will be recorded and that everything you find will be used in the way that it should be used. You will, I believe, by recording this information help the protection of caves from vandalism and general bad behaviour by tourists and other, well we'll say, odds and ends. You are inspired by the desire to be first in these places and I consider that that must be one of the most thrilling aspects of speleology.

You will appreciate that in conservation we have been thinking very largely of land conservation. We are a State which I think has a long way to go in proper conservation, or full development of conservation anyway. Other States may have their problems too, I believe they have, but we as a State do somewhat suffer by the easy access to most of our areas and we have suffered, I think, probably by over-developing settlement in past years. We are remedying this as fast as is possible to do within the limits of finance and other considerations but I do note that it's almost impossible to set down in figures just how much land should be set aside for conservation purposes. For instance, an area with a chain of mountains, we'll say the Rocky Mountains, which is not normally possible to develop for any other purpose, can be preserved for conservation with ease, and it adds very much to the general total of areas that are under conservation legislation. They now have in the United States an enormous area of conserved parks and other kinds of protected areas.

We are extending our areas very much - for instance, it might sound rather grand but we made the Simpson Desert National Park some few years ago and in doing so added many square miles to our total conserved areas. While nobody would pretend that there was perhaps as great a result as it would be adding conserved areas in places of high value land, nevertheless it is worth doing. We are adding to both our arid and to our wetter areas as much as we reasonably can.

I understand that one of your groups is going to Kangaroo Island; I believe you have three parties going to various parts of South Australia. As a member of the Board which controls the Flinders Chase I can say that you are very welcome there - we would like to see any authorised cave exploration, and the type of exploration that you do will add to the knowledge that we may have of Flinders Chase. You will find there a totally protected area and one which we feel is quite unique in some ways - it hasn't got rabbits and it hasn't got foxes, and apart from some few other pests like feral cats, you would find Flinders Chase would be relatively unspoiled.

Now I want to just say one more word about this cave exploration which seems to me apposite. That is that in a world where - well it is easy to be comfortable, it is pleasing to see people who are willing to go in for physical exertion and put up with discomfort and hardship because they have an interest in doing some exploration. You, I can see, do put up with quite a lot of hardship. Mr. Gartrell sent me the brochures, firstly I think, the report on Mullamullang Cave and the other report upon the other caves on the Nullarbor Plains, and I can see just how difficult and exhausting cave exploration must be. After all its possible to do a lot of undersea exploration in a submarine, or go by air somewhere, but in this case, having got to the mouth of the cave there seems to be no known way of carrying gear, food and looking after yourselves except entirely by your own efforts, and I can just imagine that it would be very exhausting indeed. In fact I find it hard work getting up and down the wooden steps of the tourist cave at Kelly Hill on Kangaroo Island. If you've got to crawl down there and carry your own lights and gear it must be a good deal more difficult, but nevertheless very rewarding when you get there. And in that respect I suppose you feel just as triumphant when you get to the bottom of the cave as the mountaineer is when he gets to the top of the mountain. It's rather remarkable what a short distance man can go underground and it is only it seems in these limestone areas, of which we have plenty in Australia, it is only in these places where man can go underground any distance at all.

Now Mr. Chairman, I was talking to Mr. Gartrell and he told me that you would like to collect zoological specimens or fossils or any other specimens in the caves on Kangaroo Island and take them to the Museum for proper study. Now that is exactly what we would like you to do - there is absolutely no difficulty about that at all. We have had a policy which might be described as a little bit sticky in this matter, but that was a policy which applies to the general public and not to authorized expeditions, because obviously in many cases people don't know what they are picking up. If you are collecting specimens and they are being taken for proper study, well, that is the way that they ought to be used. The other thing is that as a result of your work you will increase the knowledge, for all time, of the caves which you are exploring, and because of that, you are making a serious contribution to scientific research in Australia.

I do hope that you are going to have a good holiday here and that you will find a rewarding expedition at the end of it.

I understand that there are some hard-done-by members of your group who can't go anywhere after these holidays but have to go back to work. But anyway I wish you luck and although I can't stay for the whole morning I would be appreciative if I could stay, (I've been invited) , for some of the proceedings for a little longer. I wish you luck, Happy New Year, and plenty of interest in the following out of speleology.

I now have much pleasure in declaring the 7th Biennial Conference of the Australian Speleological Federation open.

****

CONSERVATION

CONSERVATION AND SOUTH AUSTRALIA - UNDERGROUND

G. Gartrell *

Say the word "Underground" to a caver and a chill will race up his spine. But say it to the bloke in the street and he may show a vague glimmer of interest, or just think you are unhinged. This is about the best reaction you can hope for. There are much worse responses. He could think you are being insulting and hit you. On average, however, a blank stare will be forthcoming, and from that you may deduce that the word "underground" is synonymous with the phrase - "OUT OF SIGHT - OUT OF MIND".

You have not got a hope of conserving caves while this state of general knowledge about them persists. It is necessary to educate people on the one hand, a hard job at any time, whatever the subject, and at the same time try to convince them that something which is out of sight - out of mind, and just a hole they might fall into, is to their advantage.

Conservation is in practice a fight by a few against man's expedience and lack of foresight. Most people will probably find this definition of it objectionable or feel that it is true but applies to the other bloke. Rather like traffic laws in a way - we all know that we can drive faster than the speed limit safely, but we need laws to protect us from all the mug drivers around these days. I'm alright - it's the other bloke again. However even if not always appreciated, it can be understood by most when applied to the problems of extinction of species, effects of insecticides, scenery scarring, water catchment areas, pollution, and so forth. The Lock Progress Association, like many similar bodies, is all in favour of Conservation. They just think it should be done somewhere else though, and don't give a damn about an existing National Park that they think should squeeze up to half its size to let in a few farmers. Progress of that sort is often something we are better off without. Even the professional kangaroo shooters look up between shots, with tears in their eyes, and shake their heads sadly at the way these mugs from the cities, these weekenders, are coming up and driving the poor old reds to extinction - that other bloke is a real terror.

But human nature has always been so, and despite all our outward signs of technical cleverness these days, human nature has not changed all that much since the dark ages. We cannot hope to get the majority of people on side by saying that conservation is directly to protect or assist species other than man. To most of us, self is number one

* President, Cave Exploration Group (S.A.)

chap. Man won't generally realize that such things as natural balance between species occur, and that even the little bacteria in his cheese are contributing to his welfare. It is not practical to consider conservation in its most pure sense. Of course, that means changing nothing. Strictly speaking one should stop breathing lest one blow a fly off course. Not even I would agree to that proposal.

The best and most generally acceptable definition (or maxim) for Conservation is that it should imply - "The widest possible use, over a long term (emphasise long, most people have short memories) of all our natural resources, applied to the benefit of man."

The practical application of this is another story. Too often man with his cleverness at creating fertile land out of barren wastes, and his enthusiasm to make Nature more efficient, does not weigh all factors before bursting out with one of his schemes. Even when he is consciously trying to do his best for all in some development project, what is actually best, in the long range is not always clear. It is human to make mistakes. In the old days when the human population was in balance with the rest these mistakes were not too serious. One could move on to greener pastures. We cannot afford the same mistakes today. The World is shrinking at an alarming rate. Do you realise it was only less than twelve years ago that the first satellite was launched. Today men have been around the back of the moon. One hundred years from now, at present rates, it will be standing room only, and that includes the middle of the Nullarbor. Conservation is not a luxury. It is a necessity, and it is up to this present generation of people to save what they can, now, and to plan our future development so that we do have a future.

Well, this does apply to caves. I think that all of us here today realise this. Really, all that we can do to promote the conservation of caves is to try and sweep away the ignorance and cobwebs of superstition which are uppermost in most peoples' ideas of caves. Oh dear - we are back again to that repulsive idea of trying to educate people. The answer is - just keep trying. A little bit sinks in each time.

I will now review a few facets of knowledge about caves and try to give you a bit of perspective.

DEFINITION

First of all - what is a cave? Uh-oh. Trouble already. They are all different. I can best say that caves are part of the geography of the countryside surrounding them, and will influence it and be influenced by it to some degree. They are both regional and individual in character. In

essence the term "Cave" refers to a natural feature, usually accessible to man, and usually with a dark zone inside it, commonly formed by solution or erosion of rock. The rock is most commonly limestone, although significant cavities may be produced in other materials.

Caves are a comparatively rare part of our surroundings. Even the biggest of them are small when compared with major scenic features on the surface, and the total volume of all limestone caves in the world has been estimated to be of the order of only ten cubic miles, or less than one ten-millionth of the total volume of the oceans. Some town-planning authorities have come up with a figure of 4½% as the minimum area which should be set aside for reserves. Averaging this over the world, or worse still, averaging it over Australia, which does not over-abound with caves, we find that the proportion of this 4½% which would be taken up by caves, if every cave in Australia was protected, at least by a small plot of land around the entrance, would still be very small. In regard to land use, we could comfortably protect all caves this way. Like trees, caves may be destroyed in a much shorter time than it takes them to grow, so that any threats to cave conservation are an immediate and urgent problem. Unlike trees, however, once a cave is destroyed we cannot plant a seedling in its place and repair the damage.

At present Australian caves are little worse off than those of most other comparable parts of the world in this respect, although a few countries have very strong laws for the protection of caves - but, as our population grows, so do those agencies which tend to destroy caves, or have a conflicting interest.

These agencies fall into a number of broad categories. Here are a few:-

a. Commercial interests and civil authorities, concerned with quarrying, road building and so forth.

b. Certain farmers and land-owners.

c. Casual vandals and souvenir hunters.

d. Entrance dynamiters.

I shall dismiss the last two groups first, and not talk too much about the first, as other speakers will be dealing with this.

Casual Vandals

Among the casual or organised vandals of recent history none perhaps would surpass the illustrious English poet, Alexander Pope. In his day it was the height of fashion to

have a concrete grotto in the bottom of the garden, and if it was desired to outdo the Jones's next door, natural stalactites stuck in the roof were a must. So expeditions with soldiers to various caves were arranged, and while some would point their blunderbusses to the ceiling, others would hold a net underneath and catch the bits, a procedure which must have been jolly fine sport. Modern-day vandals are still with us, but less imaginative perhaps, and less likely to make the pages of history.

Entrance Dynamiters

The fourth group I mentioned, the entrance dynamiters, do just what the name says, first of all crying out - "This cave is too dangerous". They are usually well intentioned but misguided. In some ways they are like film censors. They close a cave to all to protect some who are inexperienced or ill-equipped. Too bad about the cave's natural inhabitants. A better solution in our eyes would be the installation of a gate, capable of withstanding onslaughts by modern safebreaking apparatus, preferably with a key which could be wielded by a responsible person.

Imagine somebody bulldozing Wilpena Pound to protect people from falling off St. Mary's Peak or getting lost there. Ridiculous it may be, but if Wilpena was a cave, public pressure or something similar would have cooked its goose for just the same reason.

Some land-owners in this category have a more understandable if less public spirited reason. If a caver were to injure himself in their cave they might be legally liable. Solution: get rid of the cave. No case has been tested in court as far as I know, and it is doubtful if one would succeed, but the bad publicity created and bad public relations generally would close caves like tidal oysters all over the countryside. Official organizations representing cavers should discourage members from ever thinking or even speaking light-heartedly along these lines, and get their members to sign indemnity forms, which may not always be strictly legal documents, but are certainly better than nothing.

- - - - -

We should conserve caves just because I like them, that is a good enough reason, but you may want better reasons, so here are a few.

REASONS FOR THE CONSERVATION OF CAVES

1. They are natural wonders of limited occurrence which must be saved so that future generations may enjoy the same pleasures that we get from caves today.

   a. In this class lie present Tourist Caves and others of outstanding scenic potential, which might become show caves in the future. Population growth, ease of access, and available finance are governing factors in the development of these caves, but the time to protect them is now. I should just say in passing here, that while it is generally recognised even among cavers, that one of the most effective ways of protecting a cave is to make it into a Tourist Cave with a lock, experience shows that there is more to the protection of a cave than just a gate. A great tunnel, known as the Binoomea Cut, has in recent times been driven through the hillside at Jenolan, N.S.W. to provide a new entrance into a couple of caves, including the Orient Cave. The doors on this tunnel are like great refrigerator doors, and hermetically seal the opening when people are not actually passing through. Otherwise, the tunnel would have created new airflow patterns in the caves, and temperature differences, and most probably dried the decoration out and deadened it in a big way. The construction of pathways through caves, and the installation of lights are also fields which have just as many hidden pitfalls, but that is another story.

   b. Besides Tourist Caves, we should preserve others in their natural state as "Underground Wilderness Areas", to cater for those with a deeper interest in caves than just the viewing of pretty stalactites and so forth. Speleology as a hobby or relaxation, and even the sport of underground mountaineering are pursuits equally as valid as their surface counterparts. The majority of organised cavers are <u>not</u> dare-devil nitwits despite the fact that most newspaper accounts of caving incidents seem to convey a different impression. This is understandable, and generally not the fault of the reporter. Serious cavers are not publicity seekers. Publicity can be dangerous, and even publicity "as a public service" does not always have the desired effect. Say that a cave is dangerous, and you may not keep those away that would not have gone there anyway so much as attract the attention of the dare-devils who decide to try it for themselves. Joe Brown and his cousins cross the road every day without getting into trouble. One day one gets run over and gets his name in the paper. We all cross

the road, and know the risks involved, so when we read his name in the paper we don't write letters to the paper demanding that the motor-car be banned or roads abolished. It is the same in caving. There are safety practices and rules. It is safe - we have very few accidents indeed. But people don't know much about caving, and when they read accounts of these accidents, they have no personal experience to go by and so can only believe what they read and get their impressions that way. Quite a diversion I must say, but I cannot emphasize too strongly that publicity is the most powerful lever in the World today, and the most often misused or wrongly directed lever at that. It is our vehicle for that education that I was talking about, and at the same time it can be our bane.

Back to "Underground Wilderness Areas" -

You may be familiar with that relatively recent idea of the declaration of "Wilderness Areas" as distinct from "National Pleasure Resorts", a need which has become a bit more widely recognised lately, both in the United States and in Australia. A wilderness area is a place where no permanent structures or roads are permitted and where man is "only transient" where he must take to his feet and come to terms with his surroundings rather than regiment them. Psychologists recognise that our need for these areas even as an escape from urban living is becoming greater as the pressures of big-city civilisation increase.

Amongst the few areas in Australia at present which fall into this category and would be familiar to most of us are portions of Kosciusko State Park in southern New South Wales, and the Cradle Mt.-Lake St. Clair National Park in Tasmania. Closer to home we have Flinders Chase and Hambidge, and I suppose we could put Wilpena Pound into this category too. You know what a job it is trying to hang on to these let alone getting any more dedicated.

The idea of Underground Wilderness is just as fundamental as that of surface wilderness and equally important, and probably ten times as hard to convince disinterested persons about.

Problems can arise, of course, when a cave which should be protected in this way turns up under land which cannot similarly be declared a wilderness area - a town perhaps - where uncontrolled drainage from the surface may cause pollution of the cave below.

2. The second main reason for protecting caves is that they are a distinct and different part of our environment, with their own populations of insects, micro-organisms, fish, crustaceans and so on.

We can divide these up into three distinct categories.

a. Trogloxenes: Partly surface dependent.

b. Troglophiles: These are cave lovers - they prefer caves totally but could exist without them.

c. Troglobites: These are creatures adapted completely to life in the cave and not equipped for life outside. The most common differences found for these compared with surface relatives is a loss of pigmentation, and a loss of eyesight, eventually even loss of eyes altogether.

There are well over a thousand species to date discovered in caves alone, and a number of these have only ever been observed in one cave. They have probably evolved in their own cave and never been able to move outside it. Of that estimated total volume of caves in the World of about ten cubic miles probably eight cubic miles still have yet to be examined for evidence of troglobitic population.

Studies of these creatures are still in their infancy but have already yielded some interesting results and have raised many more questions than they have answered.

Recorded occurrences of Australia's only known true troglobite, so far, an eyeless cockroach, are in caves widely separated on the Nullabor Plain. Cockroaches are thought to be slow in comparison with many creatures to undergo evolutionary changes, and the lack of eyes indicates that they have been co: .ed underground for a considerable period. They have lost their eyes, or at least only vestigial eyes remain, but have not lost their pigmentation, whereas the reverse is the usual order. In view of their adaptation, have several isolated occurrences of a species undergone parallel changes with no contact between the groups, or are the cockroaches widespread under the Plain throughout a hypothetical system of small tunnels linking all caves in the region? This may be extremely far-fetched or it may not. There do exist considerable complexes of anastomoses in some areas, as evidenced by the occurences of blow-holes. Further studies of this are either going to tell us surprising things about the Nullarbor, or give us a

new look at the processes of evolution, or else throw light on the biggest coincidence of all time. A parallel situation may be found in the United States, where two isolated and only occurrences of the same species of shrimp, I believe, are in widely separated caves, conceivably linked by waterfilled passages running several hundred miles through the particular band of limestone in which they occur.

At what stage does a creature with eyesight which has elected to spend its life in darkness begin the process of losing its eyesight and eyes altogether? Is evolution a selective accident, or is it reasonable to expect that colonies of cockroaches widely separated but under similar conditions might keep neck and neck in their evolutionary transformations? How fast do these evolutionary changes proceed? Troglobites, whose specific adaptations are similar for a wide range of species, could very well hold the key to our understanding of evolutionary processes.

Trogloxenes

Perhaps the most famous of trogloxenes would be the bats, studies of which are interesting from many points of view. Nocturnal in habit, the bats of the South-east sleep in caves by day and catch about half their weight of insects each night. Farmers have come to welcome the ibis as a friend. Few of them also realise how much the bat is on their side.

The numbers of bats in the huge colony of the Bat cave at Naracoorte, S.A. has recently been estimated at about one quarter of its former strength, although I cannot say how reliable that census was. It is possible the depletion was due to a disease, possibly the drought was responsible, possibly insecticides - no one knows for certain.

Recently a bat banded during a C.S.I.R.O. bat-banding programme in a railway tunnel at North Sydney was caught in a cave at Glencoe in the South-east of South Australia, nearly seven hundred miles away.

Bats employ a sonar system (a sort of sound-wave radar) and some species emit squeaks as high as 108 kilo-cycles per second. In comparison the limit of audibility of human hearing is generally not much better than around 17 kilo-cycles per second.

Bats have other remarkable attributes, but I hope that I have already made my point. The relatively dry South Australian caves have a particularly sparse fauna, but make up for this in other directions.

I refer to the fields of paleontology and archaeology - or anthropology.

Caves with vertical entrances have often in the past acted as animal traps, and cave micro-climatic conditions, which are so consistent, with yearly variations in temperature commonly of the order of only 1°F and which have been responsible or essential for the maintenance of the highly specialised forms of life found therein, are also favourable for the preservation of fossil material. In humid caves, fleshy remains are likely to be attacked by micro-organisms, but in dry ones even these may be preserved. Bones will be preserved in any case, and usually in well stratified layers of in-fill material. Within the caves these deposits will usually be free from weathering effects and disturbances normally encountered above ground. Often they are rich in material, and may be read by a trained person almost like a book about our past, with all pages intact in some cases. Recent finds of Thylacine (Tasmanian wolf) remains on the Nullarbor and in the Flinders Ranges are examples of this.

In many parts of the World caves have been inhabited by pre-historic man, who has left paintings on the walls which have been amazingly preserved to the present day. Implements made or used by them have often been found by excavating the floors of such caves. In Australia the aborigines have kept fairly clear of the deeper recesses of caves, with perhaps one notable exception. Koonalda Cave in the South Australian section of the Nullarbor Plain has been the site of an aboriginal workshop. In the limestone walls of the cave, numerous nodules of flint have been exposed, particularly in one section, and these were valued for toolmaking.

Anthropologists have now excavated this site to a depth of around twenty feet, passing through distinct strata all the way, and evidence from this dig dates aboriginal occupation as far back as 18,000 years ago, which is I believe, the most ancient evidence of this so far discovered. Mr. Bob. Edwards of the South Australian Museum has recently completed production of a film on this work which should appear on television and elsewhere soon.

It is important that I should emphasize most strongly that some of the most significant caves in this respect have the least imposing appearance, and much may be lost when the fate of a cave is left to an untrained or disinterested land-owner or civil authority to decide.

A local surface parallel to this situation is the different views of the Geological Society of South Australia, who see the area to the rear and North of Hallet Cove Beach, south of Adelaide known as the Hallet Cove Badlands as a unique area and an invaluable Geological show-piece, and on the other hand the real-estate developers who got their hooks into it and proposed to beautify this scar on the face of the earth by the action of

bulldozers, paving the way for an American-style shopping centre and the works.

I should add that caves are one of the few frontiers left on earth above the ocean surface where the probability of unexpected discoveries from systematic exploration is very high. Again some of the least imposing caves will not always be so. A relatively small cave in Tasmania, although never just a rabbit hole, which required a 2 hour hike through almost impenetrable bush just to reach the entrance, became the focus of attention last year, when a couple of cavers were able to find a way past a rock-pile choking one passage. The cave now has more than 7 miles of passage surveyed, more discoveries likely, and the Australian record of a 720 foot deep shaft, which includes one free ladder drop of 360 feet. There is, most fortunately, a reasonable chance of this cave becoming the nucleus of a new National Park.

Although relatively little sophisticated scientific work has been carried out in Australian caves to date, the potential is definitely there, and all that is required is the people and time to do it. Systematic exploration is, of course, the first stage of scientific study, and a necessary basis for all further work.

Certain Farmers and Land-owners

Earlier I mentioned that one agency in conflict with caves was a group I called "Certain Farmers and Land-owners". I should perhaps extend this to include some civic authorities as well.

As I have already said: Caves are part of the geography of their surrounding country, and are generally formed by water action. Commonly they trap surface streams and divert them underground, and occasionally, as in the South-east (and the Nullarbor) they are so comprehensive and efficient (and the country rock is so porous) that little or no evidence of normal surface drainage patterns exists.

The Nullarbor is virtually unpopulated, and its water-table varies between 250 and 400 feet below the Plain. On the other hand - the South-east is populated and has a water-table between zero feet and 100 feet below the surface, on average probably around 30 feet. It is the South-east I will refer to in particular now.

Recently there was an emergency at Keith, on the main Adelaide to Melbourne road, when the town water supply (which consists of bores) was found to be polluted. The solution in this case was to forget about those bores and drill some deeper ones into another layer, but where has the

pollution come from? The answer is not all that hard to see. Man is the answer. He has himself to blame but will look at everything else first before believing it.

Over the past decade or so, due to the great South-eastern Drainage Scheme, average South-eastern water-tables have dropped by amounts near ten feet. This represents an enormous volume of water through the highly porous rock. The population has increased during this time and will no doubt continue to do so. Practically all water supplies are from bores or else the Blue Lake at Mount Gambier. The source of the water in the Blue Lake is shrouded in mystery, but the rock near water level is ordinary Gambier limestone, and whether or not the deep down indefatigable source of crystal clear water is all that it is hoped to be, increased pumping of the Blue Lake will increase the flow of ground-water into the Lake from the surrounding rock.

Significantly, it was recently reported in the Border Watch, a South-eastern paper, that the Blue Lake water has been found to have an alarming increase in its bacterial count, and to be good stuff to drink if you'd like a bit of gastro-enteritis. Public health measures have been implemented and kept very hush hush, but nobody will really get up and go to the source of the problem. They would be too unpopular. They still won't believe that prevention is better than cure. Even in Mount Gambier itself the storm and town street drains run conveniently into the Town Hall Cave. I suppose it could be worse.

Many farmers and others, not having an Engineering and Water Supply sewer passing the house, just drill down until they find a cavity. Some don't even have to drill. When sheep or cattle die, it isn't necessary to bury them - there are plenty of holes to throw them down, along with your old fence wire, household rubbish and anything else you've got, perhaps the old car even.

Earl's Cave, one of a system of largely interconnected and water-filled sinkholes, with water to a depth of about 200 feet, south of Mount Gambier, was useful after the great bushfires some years back. Reports vary, but somewhere between several hundred and 40,000 burnt sheep carcasses were thrown into that unfortunate hole. I don't know which figure is the closer but it certainly was still putrid several years ago, with a sea of legs sticking up out of green slime. It is probably this lot that is now finding its way into the Blue Lake germ by germ. The District Council has since erected a "RUBBISH DUMPING PROHIBITED" sign but on our last reconnaissance that too had been heaved in and in its turn was becoming buried by fresh offerings. The Council has since, at our request, erected a further sign and re-fenced the area.

Five Corners Cave - a most extensive system on the outskirts of Mount Gambier itself, probably with several miles of passage, and large calcite-flake covered lakes in flatteners at the water-table connecting large domes, now has a dairy built over one entrance hole, which is a convenient drain. This must be seen to be appreciated, but anyone contemplating doing so is likely to contract some disease to remember the occasion by.

I was going to say that pollution of this magnitude of surface streams would be unbelievable, but that's not so. I've dragged everything else in and now I will drag in the new Victoria Square Fountain in the centre of Adelaide. No, it isn't polluted, well, no more than usual, but it is one of the greatest travesties of our time. South-Australia is the driest State in the driest continent in the World. You think we would value our creeks and rivers. The fountain has three corners, each representing a S.A. river and one of these has a statue representing the Murray. Another represents the Onkaparinga River, south of Adelaide. It lacks something. It doesn't smell quite right. If you can walk along the banks of the Onkaparinga River below the Noarlunga Abattoirs where the blood and guts drain down from above and where the river actually gives off bubbles of green gas you have a stronger stomach than I, but you won't wonder anymore why the fish float up dead further downstream.

While this state lasts above ground, what hope have we got for a better deal for Underground South Australia.

Perhaps it is not generally realised in the South-east that the degree of joint enlargement through water action is as great as it is. Where water in other areas might be filtered by gravel beds and passage through a reasonable quantity of rock, the cavernous and porous nature of the South-eastern limestone is such that water may pass for any conceivable distance through it with almost no purification at all.

Household drains situated right alongside water bores - too bad about the neighbours, any old hole a convenient rubbish tip, pollution that may travel for miles. What a time bomb the whole thing is. The signs are plainly there to anyone interested enough to look for them, but Public Health Authorities can usually only act on positive evidence, and a comprehensive study to get this on a large and general scale would be difficult -if possible- most time consuming and expensive. Water underground does not flow in straight lines any more than surface streams do. It meanders along the path

of least resistance, a path which still will not generally be anything like a straight line even in the porous stone, and which may change with time, depending on hydraulic heads driving the water and so forth.

I must in fairness add that there are a number of farmers and others who are aware of these problems, and some who do take an active interest in their caves. Most of the others, fairly naturally, regard the holes as just another nuisance, or a convenience, or a magical bottomless pit, and have not given the matter more thought.

The right type of publicity and education might reach a lot of these people, and our surveys might eventually provide sufficient evidence to convince the Department of Public Health. Might is a funny word. If there were no traffic laws people might drive safely anyway, but if that were not the case and everyone got killed on the roads, there would not be any need for the laws in the end anyway, so why worry in the first place. Perhaps if we pretend the pollution isn't there it will go away, like spooks in the dark.

As a final point, to win over any animal lovers present, I probably do not need to say, although I still will, that pollution of a cave system in this way is almost guaranteed to destroy any natural community that may have been able to survive there previously. The constancy of cave conditions lends itself to the support of delicately balanced ecosystems to a degree probably unmatched above ground, and any change in those conditions will usually have a disastrous effect upon all members of those communities, whether directly or indirectly.

A simple example of this would be when extraneous bacteria are introduced and attack a member of a food chain, or say perhaps, an acidity, or pH, change in a cave stream could affect the ability of some species to breed, and again the chain could be broken. Pollution of one single cave by one thoughtless person could conceivably result in the extinction of one or more entire species with the greatest of ease.

I would be prepared to bet that the situation will not improve until pollution becomes sufficiently acute to be a major and widespread health problem, by which time it will be too late for whatever cave life might remain at the moment. I must add that as far as I know, few of these caves have been examined at all for troglobitic populations, and the only cave with a reasonable stream known until recently was named after the dead cow stuck down one entrance.

I will not pursue this line of discussion further at present. I think I should have got the point across by now. Nor will I discuss the other major predators of caves - the quarrying and public works interests. South Australia hasn't been too badly off in this direction so far, although a quarry for limestone on behalf of the Highways Department on Eyre Peninsula near Lake Hamilton was last heard to be within twenty yards of a nice and well decorated cave, and likely to eat it all up. This branch of the subject is best left to our friends in New South Wales and Queensland, who have plenty of good first hand experience to draw upon.

I hope that I have given some of you some new ideas, and re-awakened old ideas in others. If you haven't enjoyed listening to me at least you will be pleased to know that I have enjoyed talking to you.

I will finish off by telling you a secret about human nature. Tell enough people often enough how good you are and they will, despite themselves, start to believe you. Cavers are on the whole a quiet bunch, who generally only make loud noises late at night when they are not appreciated.

Even though we are only amateurs with limited time and money to follow our interests, there are no professionals, and if we don't do it - no one else does. Many of us do become experts in our own particular fields. Don't try to play it down, it's true. We should all strive towards some degree of expertise in some branch of speleology or caving practice. We should at all times conduct ourselves as experts especially when in the public gaze, and when we realise that we are experts, or assume the status of experts, like it or not we also assume a moral duty as experts to take up the case on behalf of caves when they are seen to be getting a raw deal from any source whatever.

We cannot hope to interest many people directly in caves themselves through education, although we will score a few converts, and it will never hurt anyone. Our greatest hope is to sell to people the idea that <u>we</u> are experts, and that caves <u>are</u> interesting to <u>some</u>, and have value for <u>all</u>, even if they themselves are not particularly interested in them.

I believe that we can get this message across much better. It isn't too much effort for people to absorb the idea, whereas they might undergo all sorts of traumatic experiences trying to develop a love for caves through the written and spoken word. Many are only too pleased to leave decisions to others, if only they know that the others are there to be approached.

We should be prepared to accept the responsibility - and should be given this - of deciding the fate of a cave which is in somebody's sights for quarrying say. If it has unique features, or is an outstanding example, we should say so and fight for its protection with all we have got. If it does not fit this description we should admit it, but still try to see if alternatives can be found which will save the cave and still keep the other party happy. One thing we must never do is accept someone else's half-baked word in the matter. If we have not had a chance to investigate a cave thoroughly before it is threatened, we must ask for time to do this, and then prepare a comprehensive report on it. This is fair enough. Here we are at a disadvantage, being amateurs with limited means and time, but we should not be shy about that. Let people know, and perhaps even some financial assistance might be found in some cases. It certainly won't if you don't. Even if we are at a disadvantage we must keep trying to do our best for caves. Never give up. Your efforts will not be entirely wasted. As the President of the National Speleological Society of America said in regard to conservation recently: "If you are not part of the solution, you are part of the problem." I'll leave you with that thought. Thank you.

DISCUSSION

Bill Wallis, N.U.C.C.: You mentioned the gating of caves rather than the complete blocking of entrances: does this also apply to caves which are say, in danger of collapse, rather than just dangerous because, say, someone may fall down the shaft?

Grant Gartrell: This is a point. It's very difficult to decide. On the one hand you have the cave in Claremont where a young chap was rescued recently after having his legs trapped by falling rock for many hours. This is generally considered "a crummy little cave" and no one would be particularly worried if it was completely filled in. But on the other hand I have heard of a cave in New South Wales, Grille Cave I think its called, where there has been raging torment, with various parties practically coming to blows. Some have been measuring the subsidence of the roof and claiming that the cave is in imminent danger of collapse and must be blocked at all costs. Others say that there is nothing happening and the cave should be left alone. Here you have the two opinions. Anything which is done to close that entrance off completely, to my way of thinking, is bad. Fair enough, put on a thundering great grille, throw away the key if necessary,

or just stick it in a big block of wax and keep it in your Quartermaster's store until the year 1999. But don't change the cave permanently - it's only one person's opinion, and natural processes do go on in caves - they are naturally eroding, things are falling out of the roof. Our personal experience is that things don't usually fall out of the roof very frequently, and you usually hear a rumbling noise and a creaking and step aside. I think that we should follow some policy of looking after all these caves even if they are intrinsically dangerous. We should rather warn people about them, make access to them restricted, and make sure people know what they are up for when they go in there. They are nevertheless interesting places and we shouln't try and censor them completely and ban them from the country.

Fred Sanders, C.E.G.S.A.: Mr. Speaker, in the South-East there are considerable problems in the land development, and one of the chief offenders in some sections has been the indiscriminate clearing by contractors for the Woods and Forests Department for the planting of pines. In many cases these holes have just been ruthlessly bulldozed over as just purely an inconvenience. I think this is something to be deplored.

Another question I think very adequately brought out in your speech is the matter of pollution, and few people outside of the cave groups realise and appreciate how much contamination has taken place. I would like to congratulate you on that point.

Grant Gartrell: Thank you Fred. There is one point I must emphasise, and that is a cave isn't just a complete room, with a door, and that's all there is to it. A cave is also composed of all sorts of little nooks and crannies and no-one would have any hope of finding out where these could lead pollution to.

Roly Webb: Another point is the pollution of camping areas in cave locations. This is in fact a hobby-horse of mine, and seems to be getting notably worse of late. I don't think speleologists are entirely to blame for this, but I am sure we do add to the rubbish either inadvertently or through negligence, but I do feel, that it is our responsibility to try and do something to prevent it or cure it where we see it. At Bungonia for example near the Grille Cave my family and I did an emu-bob on one occasion and collected a mound of rubbish about from here to the wall and then burnt it (probably during a fire restriction period!).

I would make a plea here to everybody that when they see rubbish about to try and do something about it if the time is available, and so we will avoid creating this sort of problem

ourselves.

Grant Gartrell: I would just like to reinforce that, and say that if you're not going to burn, bash and bury your rubbish (which is the recommended boy scout and bush-walkers way of getting rid of it when there is no rubbish bin handy), or if you're not prepared to bung it back in your car and take it right home with you which is the best way, then dig a deep hole - don't just leave it on the surface where the local dog is going to come along and dig it up - he will! - by crikey he will - a rubbish heap buried like that to a dog is terrific. I have seen this, ten minutes after a pile of rubbish has been buried it's back out on the surface, and it's your fault.

Don't just bury your own rubbish and forget the bloke over there, go and grab him by the ear if you can catch him throwing his stuff away and run the risk of being punched but try and educate people actively; and also, if you can't catch him in time just look after his rubbish too - otherwise you will probably have to pitch your tent over it next time.

Fred Sanders: I think the base answer to a lot of the problems which have been brought up is education at a much earlier stage. In other words, it is a matter we should try and teach our children. It should be brought to the notice of the Education Department and the general public at large that conservation also begins with a good education on how to behave and how to live with one another and how to keep the place tidy. This idea is awakening in many other countries.

Grant Gartrell: South Australia has recently changed its "Arbor Day", which was the one day a year when we used to choof out to the back of the school and plant another tree, to a more general idea of a "Conservation Day". So that shows the idea is awakening slowly.

Elery Hamilton-Smith: If I can comment on the problem of teaching conservation to young children, abstractions such as conservation are pretty hard to teach and you just can't start teaching them to young children. You know it's been said and I think there is a lot of truth in it "Sunday Schools have done more to drive people away from church than anything else", because they try to drill into little kids ideas which will inevitably be rejected once those kids start thinking in abstractions, which is somewhere around fifteen-sixteen years of age.

Now the point of all this is that I think we need to do a bit of real thinking, and educationalists need to do this too, about how one does educate people about conservation. It's not just

a matter of telling them because if you do just tell them about it while they're children they are much more likely to rebel against it and go to the opposite extreme rather than build it into their own behaviour. It's not nearly as simple as just telling people.

John Dunkley, SUSS: I would like to make the observation that in New South Wales we now have a Conservation Advisor to the Education Department. He is at present going around the schools in N.S.W. to find out how he can develop a conservation programme for the next decade.

Roly Webb: The thing about teaching children is that children are great mimics and although we are very few, the best way that we can teach is by example. Wherever we go we must set the example conservation-wise.

Mr. Brookman: I said I wouldn't mind a second helping before you finish up this session so I would like to observe (I might also mention that I'm Minister of Tourism) that I'm very pleased to know that we have subsidised you a little bit. I have noticed that having had an interest in conservation for quite a number of years and been in public life, that it is easier for a camel to pass through the eye of a needle than it is to gain complete approval from conservationists.

It is impossible, and I think that what Mr. Gartrell raised this morning was of tremendous interest to me and I am sure that everybody here learnt something, but it only goes to show that whilst there are a great many things which should be done in the future to prevent any evils, and which can probably be done now to arrest some that are already in progress, there are some others which I think probably we'll never be able to solve, to be quite realistic. These are the problems particularly associated with close settlement. This Onkaparinga River for instance - we have already so upset it by putting a large reservoir on it that it doesn't run very frequently below the reservoir, and we are putting another reservoir there to catch extra water still; on the other hand the abbatoirs have gone in for evaporating ponds and they are doing something about the pollution that was undoubtedly most offensive.

The matter of the bulldozing over of holes (I presume that's not a disrespectful word, to just call it a hole, because it's a hole in the ground) the matter of bulldozing them over and clearing forests is the sort of thing that I think could easily be prevented, and I would be quite happy to take up this sort of thing with the Conservator of Forests; my colleague the Minister of Forests would be interested in that.

Now, one other comment, this question of National Parks. I want to draw your attention here to one point which works somewhat in favour of National Parks and that is that the dedication of National Parks can be done simply by proclamation by the Government. To then alienate a National Park which is dedicated you would have to run the gauntlet of quite a large legislative process and go through both Houses of Parliament and so on. And whilst we don't get much publicity for this, that National Parks are being added to all the time, I jotted down the proclamations which have been made within the last nine months : the Flinders Ranges, the Coorong (several thousand acres), a quarter of million acres out in the far west in the county Wey - that is in dry country, York Peninsula, additions to Mowbray Creek, and five hundred or so acres at Goolwa which we had to buy back from a private owner.

What all this is leading up to as far as I am concerned is that you here have all got ideas and you're all discussing problems from a conservation point of view so why not assemble them in the form of suggestions and come along, perhaps Mr. Gartrell or a committee with him, come along and discuss with me the various suggestions which have come out of the Conference. I'd be happy to do that. They could be categorised so that they could be divided up: bullets to the Highways Department, rockets to the Forests Department, and so on. If you'd like to assemble those after the Conference Mr. Gartrell you will be very welcome, and I personally would think that we might be able to get some very concrete benefit from the suggestions that you are making.

****

THE CASE FOR COLONG

OR

COLONG IN THE LIMELIGHT

G. J. Middleton *

A summary of, and some observations on, the major conservation issue in New South Wales in 1967-68.

INTRODUCTION

Colong is a classic example of the conflict between conservation and exploitation. Associated Portland Cement Manufacturers (Aust.) Ltd. plans to quarry limestone in the Colong Caves Reserve, initially at Church Creek, but conservationists see the area's proper future as part of the Kanangra-Boyd National Park.

The case for conservation in this area is not based solely on the caves - Colong would be worth retaining in its natural state even without them - but they do form an important, integral part of the region as well as having their own intrinsic value.

LOCATION

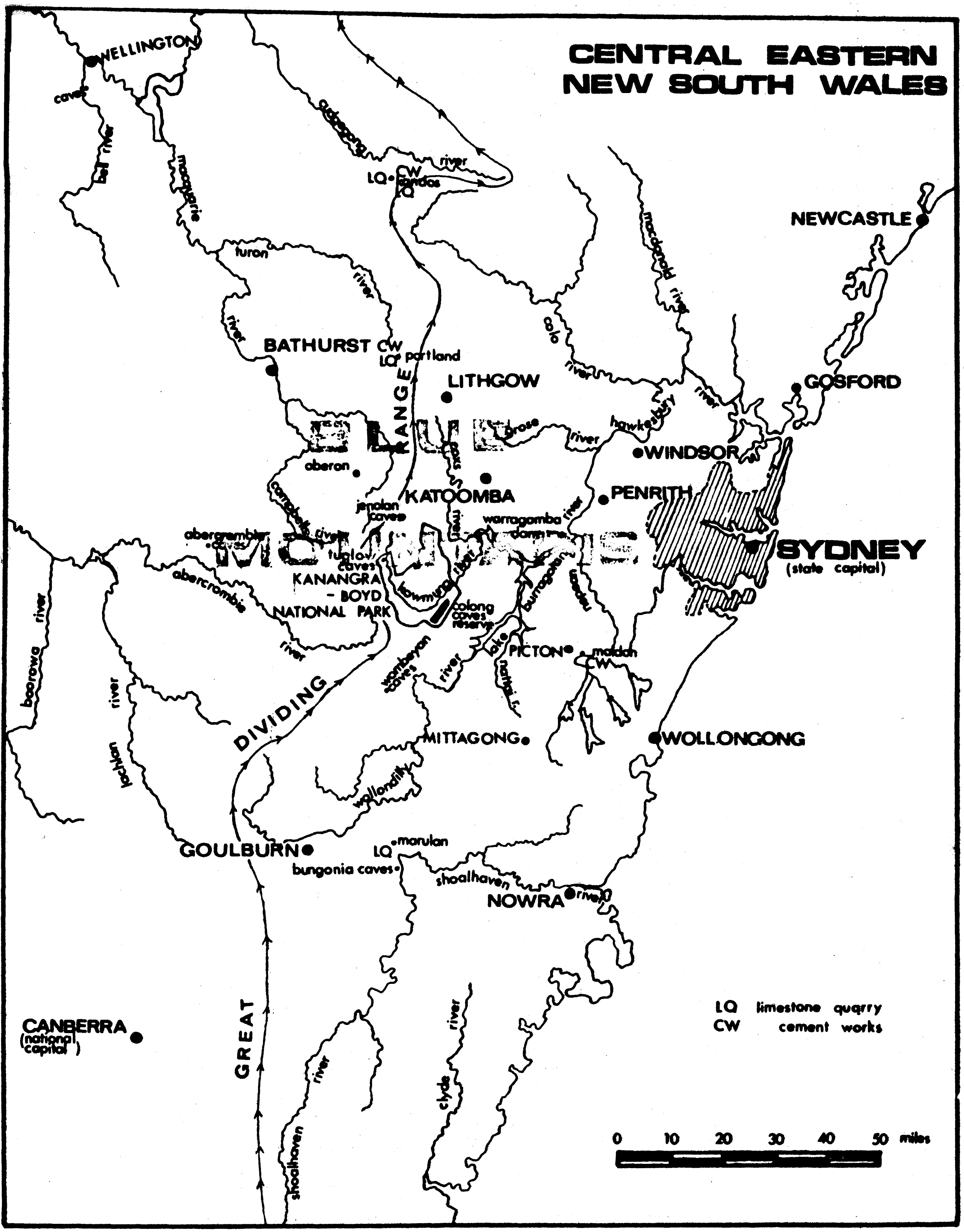
The Colong Caves Reserve is located in the Southern Blue Mountains, 62 miles west-south-west of Sydney (170 miles by road). It is 20 miles south-south-east of Jenolan and 15 miles north-north-east of Wombeyan Caves. It is well within the Proclaimed Catchment of Warragamba Dam, an area which is considered to be the finest potential national (wilderness) park in N.S.W.

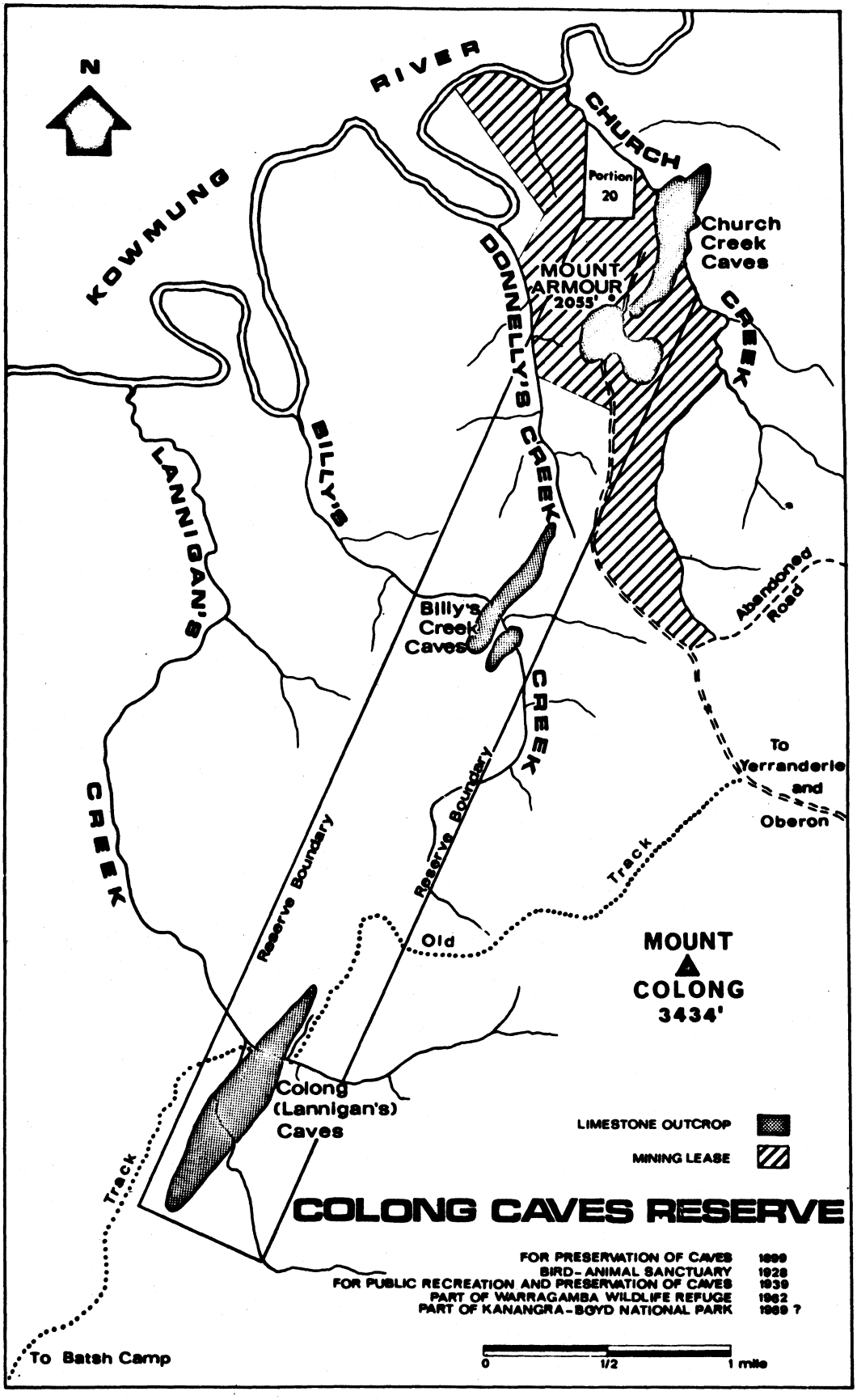
LIMESTONE OUTCROPS

Massive, high grade limestone occurs in the Reserve at three localities.

The largest outcrop is at the junction of Lannigans Creek and Caves Creek, at the southern end of the Reserve. It contains the main Colong Cave System, with over 4,000 feet of passage. The outcrop is a mile long but it is trisected by the steep-sided gullies of Lannigan's and Caves Creeks. Its maximum

* Sydney Speleological Society; Observer for A.S.F. N.S.W. Co-ordination Committee on The Colong Committee.


CENTRAL EASTERN
NEW SOUTH WALES
WELLINGTON
caves
bell river
macquarie
river
LQ
CW
kandos
turon
river
river
BATHURST
CW
LQ
portland
LITHGOW
RANGE
colo
river
macdonald river
NEWCASTLE
GOSFORD
hawkesbury
river
river
grose
WINDSOR
oberon
KATOOMBA
PENRITH
jenolan
caves
warragamba
dam
SYDNEY
(state capital)
abercrombie
caves
tuglo
caves
KANANGRA
- BOYD
NATIONAL PARK
abercrombie
river
colong
caves
reserve
burragorang
PICTON
maldon
CW
wombeyan
caves
river
boorowa river
river
lachlan
DIVIDING
MITTAGONG
WOLLONGONG
wollondilly
GOULBURN
LQ
marulan
bungonia caves
shoalhaven
NOWRA
river
CANBERRA
(national
capital)
GREAT
river
shoalhaven
river
clyde
LQ limestone quarry
CW cement works
0 10 20 30 40 50 miles


N
KOWMUNG
RIVER
CHURCH
Portion 20
Church Creek Caves
MOUNT ARMOUR 2055'
DONNELLY'S CREEK
CREEK
BILLY'S
LANNIGAN'S
Billy's Creek Caves
Abandoned Road
CREEK
To Yerranderie and Oberon
Reserve Boundary
Reserve Boundary
Track
Old
MOUNT COLONG 3434'
Colong (Lannigan's) Caves
Track
LIMESTONE OUTCROP
MINING LEASE
COLONG CAVES RESERVE
FOR PRESERVATION OF CAVES 1900
BIRD-ANIMAL SANCTUARY 1928
FOR PUBLIC RECREATION AND PRESERVATION OF CAVES 1939
PART OF WARRAGAMBA WILDLIFE REFUGE 1962
PART OF KANANGRA-BOYD NATIONAL PARK 1969 ?
To Batsh Camp
0
1/2
1 mile

width is about 2,000 feet and it reaches a height of 650 feet above the creek. Although, strangely enough, the mass of this deposit has not been assessed in any available official report, the exposed portion would be in excess of 100 million tons. Analysis by the Department of Mines in 1958 showed it to be the purest limestone in the area, with 99.1% calcium carbonate and only 0.1% gangue.

There are two small outcrops at Billys Creek, totalling about 6 million tons. Analysis: 98.1% $CaCO_3$, 0.7% gangue. Investigation has revealed only a few small caves.

In the Church Creek - Mount Armour locality, where the present controversy is centred, two outcrops can be superficially distinguished. The larger, more northerly one is cut by Church Creek, on the southern side of which the Cathedral Rocks rise sharply to about 200 feet. The limestone continues to outcrop almost to the top of Mt. Armour, a thousand feet above, and is exposed again just south of the summit. A sample yielded 96.4% $CaCO_3$ and 2.2% gangue. The latest estimate of reserves in this locality (excluding the small outcrop on the northern side of the creek) was given by the Minister for Mines on 2nd October, 1968 as 30 million tons.

HISTORICAL BACKGROUND

The Reserve, covering 1400 acres, was first dedicated in 1899 for preservation of caves. This was a direct result of a report by Department of Mines surveyor, Oliver Trickett, who was responsible for most of the caves reserves in N.S.W. He included in this Reserve, not only the well known Lannigans (Colong) Caves limestone but also the then little known outcrops at Billys Creek and Church Creek.

In 1928 the same area was made a Bird and Animal Sanctuary and after applications for mining leases were refused in 1939 as "inimical to public interest", it was re-dedicated "for Public Recreation and Preservation of Caves". It was also included in the Warragamba Wildlife Refuge, proclaimed in 1962.

Few areas of Australia probably enjoy as much apparent protection or have had their value to conservation as often recognised as the Reserve at Colong. However, none of these dedications exempts the Reserve from the provisions of the 1906 Mining Act, under which it is treated as Crown Land.

As far back as 1928 it was suggested that this area should be a national park. Definite plans were put forward in 1932 and again in 1962. In 1966 the present Government announced that it would establish a national park covering about 102,000 acres in the Kanangra Walls - Kowmung River - Colong

area. For an undisclosed reason (which can only have been that the mining leases were not finalised) it was not included among the twelve national parks established under the National Parks and Wildlife Act, 1967. Despite more recent statements indicating the Government's approval, it is still not a national park.

FORMER MINING PROPOSALS

Attempts had been made to obtain mining leases in the Reserve in 1939 but these were refused. (Apparently the Department of Mines was more aware of the need for conservation in those days than it is today). However, in 1955 and 1958, despite opposition from conservationists, other applicants were more successful and three leases were issued. However, the interests controlling these leases were unable to exploit them and they were subsequently taken over by A.P.C.M. In January, 1968 the Government granted a new lease to Commonwealth Portland Cement, a subsidiary of A.P.C.M. Almost immediately about 5,000 acres was excised from the proposed national park - apparently so that the Government could claim (as indeed they did) that the mining leases were not in the proposed park.

Local conservationists reacted to these two actions as never before and the Government, and particularly the Minister for Mines, was swamped with letters of protest. Objections came, not only from conservation societies, bushwalkers and speleos, but also from professional organisations such as the Institute of Architects, the Labour Opposition and the Government's own party.

Conservationists sought an opportunity to have the dispute heard before a Mining Warden (a Mines Department official with no power to enforce his decision on the Minister) but as no objection had been lodged within fourteen days of the application this poor substitute for a democratic process was denied them. (Note that the only places where notice of the application was given were, 1. A calico sign pinned to a post somewhere on the side of Mount Armour and 2. The notice board at the office of the Mining Warden's clerk at The Oaks, 50 miles from Sydney). Even after the statutory period has elapsed, the Minister may authorise the Warden to hold an enquiry - this he steadfastly refused to do.

THE PRESENT PROPOSAL

A.P.C.M.'s subsidiary, Metropolitan Portland Cement operates a cement manufacturing plant at Maldon, near Picton, at present supplied with limestone by rail from its quarries 60 miles away at Marulan, near Bungonia. It is A.P.C.M.'s intention to supplement this with limestone from Colong. The rugged nature

of the area precludes the use of road or rail transport so the company plans to construct a 39 mile pipeline (at a stated estimated cost of $13 million). The limestone would be transported through this as a slurry. The only source of water near Church Creek is the Kowmung River, one of the few unpolluted streams in the State and the major watercourse of the proposed national park. Despite official denials, it is believed that it would be necessary to build a dam on the Kowmung, if not initially, then within eleven years - by which time the rate of output is planned to be approaching 1 million tons annually.

THE COLONG COMMITTEE

On 21st May, 1968 the Minister for Mines wrote a letter to a Sydney daily newspaper setting out the Government's reasons for granting the lease. As a result of this letter, and a general desire for a better co-ordinated campaign, a meeting of representatives of 50 conservation and allied societies was held at Sydney University on 29th May. It unanimously passed a resolution strongly condemning the Government's action in granting the lease, and also set up The Colong Committee. It consists of representatives of the National Parks Association, The National Trust, the Wild Life Preservation Society, the Institute of Architects, the Federation of Bushwalking Clubs, the Nature Conservation Council, A.S.F. and others.

In its first six months the Committee has:-

1. Obtained the services of a Public Relations Consultant to help publicise the campaign and inform the public of the issues involved.
2. Obtained the services of two solicitors to investigate and advise on legal matters.
3. Commissioned a Consulting Engineer to investigate aspects of erosion, siltation and pollution of the Warragamba Catchment which might result from the proposed mining and associated works. His report is extremely critical of the weak conditions in the lease concerning erosion and the failure of the Department of Mines to consult the State Soil Conservation Service in this respect.
4. Commissioned a Geologist to investigate alternative deposits of limestone in the region which could be mined without seriously affecting the national park and are not known to contain large caves. His report contradicts the Minister for Mines' claim that these consist of only 600,000 tons, stating that in fact these deposits (in the Murruin and Little Wombeyan Creeks area) total in excess of 50 million tons. The Minister has, as a result,

amended his estimate to about 25 million tons but still denies that these deposits are economically exploitable.

The Committee is at present in the process of expanding its membership and increasing its activities.

CHURCH CREEK CAVES

Oliver Trickett, on his visit to Colong in 1899 was told that a cave at Church Creek was "not particularly interesting" so he did not visit it. A writer in the Sydney Morning Herald in May, 1910 mentioned caves at Church Creek: "The hill (Cathedral Rocks) is a limestone one, and no doubt honeycombed by caves. It has since been ascertained that you can walk right through the old subterranean river for a distance of two miles". Recent investigations have so far failed to reveal any caverns of such proportions.

The area was visited by speleos. in 1965 but results were not very encouraging. About seven sinkholes, the deepest reaching forty feet, were located. Difficulty of access discouraged further investigation until recently when a road built by the mining company was found to be trafficable.

In two trips, in July and September this year, thirteen separate caves were located. Their lengths range from about 15 to perhaps 1200 feet and the maximum depth reached is 90 feet.

CC4, the largest cave, is the most interesting. It is well decorated throughout much of its length, particularly in the larger chambers. There is a flowing stream in the main passage which is 25 feet below the dry bed of Church Creek. The presence of the stream augers well for cave life but so far little investigation into this aspect has been carried out.

A number of caves in the area are inhabited by bats of the Eastern Horseshoe and Bent-winged species. The extremely rare Brush-tailed Rock Wallaby (Petrogale penicillata) inhabits small caves in the limestone. It is proclaimed "rare fauna" in N.S.W. and is in danger of extinction. The wallabies formerly inhabited the limestone at Lannigans Creek but have apparently been frightened away by the large number of visitors. Their obvious preference for limestone indicates that Church Creek may be their last stronghold in the Blue Mountains where the only other known colony is in a captive state at Jenolan Caves.

NEW ENLARGED MINING LEASE

On 2nd October, 1968 the Minister for Mines issued a statement regarding "Colong Limestone", as a result of new negotiations with the cement company. The outcome is, that under the guise of "consolidation", the company is to get a new lease of 580 acres (covering nearly all the limestone at Church Creek) in place of four former leases totalling only 120 acres. The guarantee deposit on the new lease has been increased from $2,000 to $100,000, apparently in an attempt to satisfy conservationists; and the area surrounding the lease has been returned to the national park. The lease conditions are, however, still considered to be unsatisfactory particularly as they would be, for the most part, unenforceable.

One condition, in four parts, purports to protect caves: "14. (a) The leasee shall comply with any directions in connection with its blasting operations that may be issued from time to time by the Minister for Mines for the purpose of minimising damage to any limestone caves within or adjacent to the area demised," (b) and (c) relate to the erection of barricades to prevent public access to caves during blasting. "(d) The leasee shall comply with any directions which may from time to time be issued by the Minister for Mines to prevent or minimise spoil or other material from blocking off entrances or openings to caves within the area demised provided that the Minister for Mines shall not be obliged to issue any such directions if he is of the opinion that the blocking of any particular entrance or opening to a cave is necessary for the proper conduct of quarrying operations within the area demised." (My emphasis). All of which means that the conditions do not ensure preservation of caves - this depends entirely on the whim of the Minister for Mines at any particular time.

THE FUTURE

The Government's case is based purely on economic grounds and it is apparent that it believes these should override any aesthetic considerations and any moral obligations it may have to maintain public reserves established by its more far-sighted predecessors.

It is the Government's intention to make Colong limestone available to A.P.C.M. to supply the Maldon plant which, on a capitalisation per ton output basis is the least economic cement manufacturing plant in N.S.W. This plant has been subsidised by previous Governments to the extent of over $4 million which was written off from a $9.2 million Rural Bank loan after the company incurred losses exceeding $3 million. More recently the Premier threatened that Government building

contracts might not be let to companies using imported Tasmanian cement. This in fact amounts to indirect assistance to A.P.C.M. which thus has its competition reduced. Colong limestone for Maldon is another indirect form of Government subsidy to A.P.C.M.

The present Government has tried to infer that the Church Creek deposits (which the cement industry has done without for so long) are now essential for the survival of the industry and mining in the Colong Caves Reserve, formerly officially described as "inimical to public interest" is now declared "in the best interests of the State".

If mining is allowed to take place at Church Creek, it will not stop at the present lease. Once the area is worked out (in perhaps 20-30 years) the company would have a very strong argument (capital outlay on pipeline and plant together with a much larger workforce than is presently employed) for extending its operations to the rest of the limestone in the Reserve. Indeed, if caves are destroyed in this reserve - and it is inevitable that they will be if mining proceeds - a very dangerous precedent will have been set which could endanger almost every other cave system in N.S.W., since most are "protected" by the same type of reserve.

Increasing public awareness of the situation and the issues involved, reflected in growing support for the Colong Committee, will eventually result, it is hoped, in some form of public enquiry which could consider the case independently of political pressures. In the meantime the dispute has unfortunately, but of necessity, become a political one. Perhaps only if it sees some threat to its own future arising from this issue will the Government take action to terminate the vandalism of the Colong leases.

SOME OBSERVATIONS

Perhaps the first mistakes were made in 1955 and 1958 when conservationists were unable to prevent leases being granted in the Colong Reserve. More recently, there would have been opportunities to have the latest two lease applications contested before a Mining Warden if we had known about them in time. As a result of the realisation of the ludicrous method of notification of applications, some thought is being given to how the Mining Act could be amended to ensure that there would be adequate notification - perhaps by notice in the Government Gazette.

As a long term measure it would appear to be desirable to get as many caves reserves as possible incorporated into national parks. Even then protection would not be ensured but the process of granting mining leases would be made more

difficult. In the meantime, the adoption by State Governments of a general policy of protection of caves in caves reserves would be a step in the right direction, though an extremely unlikely one at the present time.

Colong is not the first instance of its type (cf. Mt. Etna in Queensland) and it is by no means the last. Our society is obviously going to require cement as a basic building material for some time and unless those most interested in caves and their conservation can find some way of directing mining into areas of minimal aesthetic and speleological value, it may not be many decades before we are left with only tourist areas from which Governments derive actual financial benefit.

DISCUSSION

Does the Colong committee intend to stop at Colong or do they intend to go beyond this case and try to force the Government to introduce better safeguards against this kind of thing?

Greg Middleton: It's amazing how many people have asked us this question. Apparently they have concluded that this business is going to finish soon - we envisage that this fight for Colong itself could go on for at least another four, perhaps ten, years, and this is the expected life of the present committee.

Regarding other things, this is a pretty big fight as it is, and, as I say, we have spent about $2500 as it is on this particular issue and I don't know how much we will spend in the next ten years. We certainly haven't got the capacity for expanding our interests to include other particular things. Regarding these amendments which we would like to have brought in, the National Parks Authority, the National Trust and other such bodies also want these and they will be working for them irrespective of any action taken by the Colong Committee. The Colong Committee itself is having to restrict its activities to this particular case, it's big enough in itself. For example the other thing we don't like in the area is the Yerandery silver mining which is likely to start up again in the next few years but although it has been suggested that we take this up too we are going to completely ignore it. That's another fight again.

Fred Sanders, C.E.G.S.A.: One interesting point which was brought up was the restriction on importing cement from Tasmania. I think that would be rather a sticky one under the Constitution, wouldn't it?

Greg Middleton: This has been questioned, but the Attorney-General had denied that the Federal Constitution does restrict this strictly as it was stated by the New South Wales Premier. He indicated that there was a possibility that contracts would not be issued to companies which were using Tasmanian cement, so that it's not a direct embargo which the Federal Constitution disallows. It's a very indirect sort of thing in which preference just wouldn't be given to such companies - only for Government contracts of course. However there was a column in the Sydney Morning Herald which made a very biting attack on this on the grounds of infringing Section 92 of the Constitution. We feel in fact that New South Wales would be better off if it could import this cheaper cement from Tasmania.

****

THE CONSERVATION ISSUE OF THE TEXAS CAVES

M. Bourke *

Queensland, as a State, holds few records, but it appears that it may be establishing a new one - that of cave destruction.

Limestone caving areas in Queensland are few and far between. Two areas occur in the far North, one at Mt. Etna, Central Queensland and one in Southern Queensland, between Stanthorpe and Texas. Conservation problems exist for the latter two. The construction of the proposed Pike Creek Dam in 1972 will inundate the Texas Caves and eventually destroy them as the dam silts up, and a large area in Northern N.S.W. and Southern Queensland will be caveless.

The caves are not numerous nor extensive. Ten major caves exist, the largest two of these have 1500 feet passage length each. Total passage length of the ten caves is 4500 feet. Russenden Cave and Crystal Cave are particularly well decorated while Glen Lyon Cave boasts the only permanent underground river in Queensland.

If the caves are of no great extent why are they worth saving? Any reason why caves are of value is applicable in this situation because they represent the only significant caves in such a large area.

The caves have value from an educational viewpoint. Three Officers from the National Parks Section of the Forestry Department and the Irrigation and Water Supply Commission made a three day inspection of the caves. The I.W.S. officer referred to the educational value of the caves in his report. A by-product of the conservation campaign and the associated publicity is that several groups of school children have toured the caves. The area represents the only area of limestone scenery in South Queensland.

The caves present an opportunity for scientific research. Fossil collection has been performed by U.Q.S.S. members for the Queensland Museum. "Russenden Cave" presents the possibility of integrating a vertebrate fossil zone with spore bearing stratified succession.

Detailed cave surveys have been performed and investigation of factors responsible for cave formation can contribute to the study of geomorphology of the area.

* University of Queensland Speleological Society

People in the district visit and explore the better known caves and many more people are now visiting the caves following publicity of "Russenden Cave". In the report referred to previously, Russenden Cave is stated to possess potential for commercial tourist development. However, distance from centres of population probably precludes its present development. Hence the caves do possess recreational value. The proposed dam would also offer recreational facilities but the area is already served by a dam and the recreational facilities of the caves exceed any comparable recreational benefits of the dam.

The most potent reason for attempting to save the Texas Caves is because they represent an example of our irreplaceable natural heritage which is unique in a large area.

Conservation activity commenced in July, 1968 after U.Q.S.S. had heard of plans for the dam's construction. Henry Shannon, at the time a hydrologist with the Irrigation and Water Supply Commission, prepared a report to the Commissioner on groundwater as an alternative to Pike Creek Dam. We immediately contacted the Ministers for Conservation and Tourism in New South Wales and Queensland. This was the first they had heard of the caves. A petition was presented to the Queensland Government and one to the N.S.W. Government asking that the decision be delayed until a detailed economic analysis had been performed and that if other alternatives could be found, the area declared a National Park.

We were able to obtain good television, radio and press coverage including an article in the Women's Weekly. Several U.Q.S.S. members spoke at Conservation symposia and we produced Conservation Bulletins No. 4 and 5. The former was distributed to most Australian Speleological Societies and Queensland Bushwalking Clubs, all Queensland and N.S.W. tate parliamentarians and conservation bodies and community leaders.

Bulletin No. 4 is a general outline stressing the application of the conservation concept to the caves, a brief look at the economics of the project and suggesting alternatives to the dam at its present site or the utilization of underground water. Bulletin No. 5 presented a more detailed economic survey. The conclusions of No. 5 were that "the project should not proceed unless a rigorous benefit/cost analysis showed it would be profitable and that if the irrigation project proceeded despite the adverse findings of such an analysis, the scheme would be heavily subsidised by the community in general for the benefit of particular interests at the expense of the nation as a whole". We feel that the project is not economically viable and combines poor economics with vandalism.

Our preoccupation with economics may appear a strange approach to a conservation problem. However, the reasons favouring retaining the caves aren't very powerful. The more abstract concepts of conservation are understood by few people not actively concerned with conservation problems. The reaction to economic arguments has been poor and in the future we will probably place more emphasis on the conservation concepts.

REACTION TO THE CAMPAIGN

Several parliamentarians, mostly of non-government parties, reacted with enthusiasm to the Bulletins. The Australian Conservation Foundation refused to support us in any way. My personal opinion is that the few people we dealt with are more concerned with biological conservation than an issue with social emphasis. We received little support from the Duke of Edinburgh who we had contacted.

After initial good publicity the newspapers commenced quoting the Border Rivers Committee as the authority on the matter. This group consists of local politicians, graziers etc. whose interests are well defined. They are waging a campaign to discredit U.Q.S.S., and to ensure that the dam is built on its present site. Our pleas for an investigation into alternative sites for the dam appear to be ignored. A newspaper situated in the irrigation area presented a vicious, emotional attack on us while the Stanthorpe paper situated close to the caves appeared to support the conservation of the caves.

We received moral support from several speleological societies. However, generally speleologists have not materially supported the campaign.

Public reaction has existed - the 4000 signatures on the Queensland petition testify to this. The campaign has not caught public imagination despite the fact that "Save the Texas Caves" is a familiar catch-cry.

The Government has had inspections made of the caves and is investigating the underground water situation. It is also seeking advice on "the present interest in and use of the caves as a tourist and recreational facility". The alternatives presented have been of water or a few caves and no investigation of alternative dam sites has been initiated. The Minister for Conservation (i.e. conservation of water and hence irrigation projects) will recommend action to the Government.

U.Q.S.S. intends to continue with the campaign, although the outlook for the caves is pessimistic. Further distribution of the two bulletins and more publicity is envisaged. A film of the caves has been commenced.

We are seeking pressure on the Government from the public and groups. How can the A.S.F. member societies and individuals assist the campaign? We feel that letters to the Ministers for Conservation and newspapers in both states involved would help. Note that the project is jointly sponsored by the Queensland, N.S.W. and Federal Governments and hence the campaign is relevant to the New South Welsh speleos. A petition to the N.S.W. government has been prepared and signatures are required for this petition. Although the effect of the petition on parliament is probably of no significance, it is a good talking point, and newspapers take to it readily. Being a University Society money is a problem and two conservation campaigns have used most of our 1968 funds.

Out of the campaign has come a realization of the lack of government concern for conservation of natural phenomena which are not particularly spectacular and the absence of conservation concepts on the part of much of the public.

Applied to caves, if these individual conservation problems re-occur for different areas, finally the few remaining areas will be forced to bear a pressure of people that they will be unable to withstand. The solution lies in public education and the responsibility rests upon people with an awareness in these matters - the speleologists of today.

****

SOME IMPROMTU THOUGHTS ON THE TEXAS CAVES

H. Shannon *

With regard to the Texas Caves, Mr. Bourke has left out the very important economic arguments against irrigation projects. You will find that if you have got an economist in a corner and talk to him about irrigation that he will be pretty scathing about any Australian irrigation project, the first reason being that these things cannot cover the actual cost of construction of the dams and headworks, and therefore are costing more than they are worth, and next, that they are generally growing unprofitable crops to boot.

* University of Queensland Speleological Society

We are in the position of having to win a cave conservation battle in a State where people do not understand what a cave is, and to try at least to correct the impression that we are standing in the way of the nation's prosperity. The economic case against the project is so strong that this project should be rejected regardless of whether there are caves or a beautiful valley there or not. It has got no real merit of its own.

Now, even assuming there was any use for irrigation to provide water for the valley, which is doubtful, water can be provided on my figures for 1/135 of the cost of the dam, which is $400,000 as opposed to $40,000,000. We are able to offer this one to them as an alternative. It so happens that there has been comparatively little development of underground water for irrigation in this valley. There are two reasons for this - one is that people in this area have less initiative than is usual in the country, another is that most blocks being grazing holdings it is simply not worth their time to irrigate. But very few people in Australia are able to resist the temptation of getting a large wad of government money spent in their area, and they will push for the project, regardless of whether it is a sound investment or otherwise, and this dam is a very, very bad project. It is even uneconomic by comparison with many Australian irrigation projects, and that is really saying something. However, assuming that they did really have an economic use for irrigation and even if the water from underground was not sufficient for their requirements(and it is) the underground water can provide 60 thousand acre feet of annual assured supply. The dam would provide 45 thousand acre feet plus another 25 thousand from the other streams in the area which could be operated in conjunction with the dam, bringing it up to 60 thousand.

However, they are proposing to build another dam on the Mole River which would provide twice as much storage capacity as the Pike Creek dam. So they are planning to produce this one, which would be more expensive granted, but it would be possible to build this dam and provide even more water than they require. So you would have this situation where the underground water, plus the Mole River dam would provide more water than they originally thought available in the area, and for less money. Also Pike Creek is not without other dam sites on the creek. There is another one about five miles upstream of the caves and several more above that. They would not provide the regulated supply of 45 thousand acre feet but they would provide a fairly substantial portion of this.

So in effect we are rejecting this dam site and also putting a limit on the Dumaresq dam site which is considered impracticable at the moment. This would result in sacrificing

something like 10% of the ultimate water supply capacity of the Border Rivers catchment. This could not be called an unreasonable sacrifice for preserving any feature of natural beauty let alone a place which is, for southern Queensland, and in effect most of northern New South Wales as well, actually unique.

Imagine that Church Creek was the only cave system you had, and its destruction was imminent. Just let that sink in a bit. The Texas Caves are the only caves that we can get to reasonably easily on an ordinary weekend that are in a reasonable state of preservation. The only ones. It is a superlatively beautiful area in its own right and would probably be worth preserving even if there weren't caves there. Yet the government of Queensland and New South Wales look like destroying them for a project which is economically unjustified.

Now the record which is established here is not so much the worst bit of vandalism perpetrated by any government, but the most pointless. Never has there been less justification for vandalising a beautiful valley.

Not being economists ourselves we have assembled the economic criticisms we got from published works of economic specialists. We were assisted in the work by an Agricultural Economist who is thoroughly familiar with the economics of irrigation.

The following quotation summarises the situation pretty well once you can penetrate the jargon. "We will at times assert that certain policies are mistaken, that is that they incorrectly represent what we believe the correct social preferences are. In such cases the political process will be regarded by us as having failed though it remains possibly amenable to correction. The subsidy to irrigation, for example, will be regarded in this light because it ultimately can be justified only on the basis of a preference to particular interests which we cannot believe others would generally concede once the fallacies and obfuscations surrounding the policy were stripped away".

This is applicable to Australian irrigation projects. On the 1963 Queensland report on this particular thing, it is proposed that the maximum charge for the water would be $3.00 per acre foot. The actual cost of the water is $12.00 per acre foot - thus the subsidy would be $9.00 per acre foot. Cost increases since 1961 may by now have brought the cost of the water to $14.00 per acre foot. You have about 200 farmers down this valley; these farmers would be receiving a pension of something like $1,500 each per year. These people are not

even prepared to pay for the water but they are prepared to drive us out of our one decent caving area. They will not even think of shifting the dam site. They sat there not using the underground water which has been there all the time.

It is rather difficult for us to keep our heads screwed on in these circumstances - we have succeeded in doing it, as all the volatile materials have been steamed off and only a crude oil residue is left. We do hope that we can get a little bit more than just sympathy. Particularly some suggestions. We are rather busy and think that the Colong people might have some suggestions as to how we can get other people involved in the campaign. We think we have done reasonably well considering the immense mental block we have to get over.

****

CONSERVATION OF MT. ETNA AND DISTRICT CENTRAL QUEENSLAND

R.K. Headland, B.Sc. *
Presented by: L. Johnson **

Ladies and Gentlemen,

I have prepared this lecture with **the aim in mind of completely** examining the issue of the conservation of Mt. Etna in Central Queensland as known to me at this time. It will necessarily duplicate some of what other persons and myself have previously written; I believe this is justified in order to 'get it all under one roof'. Thus this treatise will be complete on its own but will make frequent references to publications listed in its addendum. I therefore request the indulgence of those of you already familiar with the case.

The treatise shall for convenience be divided into sections very much along the lines of the University of Queensland Speleological Society's Bulletin No. 3 which I prepared in September 1967 and is now almost out of print.

INTRODUCTION

My knowledge of and interest in the Mt. Etna conservation campaign dates from mid 1962 when the University of Queensland Speleological Society commenced activities which it has continued to date to secure this end. The mountain remained untouched until late 1965 when machinery was installed and later quarrying commenced. Subsequently very large amounts of limestone have been removed and quarrying continues. Already much damage has been done to the area, however, it still remains recoverable. I am strongly of the opinion that the total economic and social effects, both immediate and long term, of the destruction of the mountain will be very grave and impossible to rectify. This could easily become, dependent on official and other action, one of the worst examples of gross exploitation of natural resources, totally without regard of future development, natural beauty, rare Australian animals and plants, indeed regardless of the country and community in general - or an example of conservation in its widest and best aspect. The justification and elaboration of this opinion constitute the remainder of this treatise.

* P.O. Box 10, University of Queensland, St. Lucia, Q.
** University of Queensland Speleological Society

LOCATION AND PHYSIOGRAPHY

Maps of the area indicating its location with respect to Fauna Sanctuaries and its position in Australia are included in the appendix. The mountain is situated about a mile north-east of Cammoo railway station on the main line seventeen miles north of Rockhampton. The cavernicolous area is determined principally by Recreation Reserve R444 and Portion 120 Parish of Fitzroy. Other important areas are 'Limestone Ridge' one mile south of Mt. Etna - Recreation Reserve R272 and Olsen's Caves Portion 2371 also in Fitzroy Parish. Other than the main railway communications are provided by Highway One, with Rockhampton, a major city eighteen miles south with a population of 46,052 at the 1966 census. The highway is the major longitudinal road connection between North and South Queensland and carries very heavy traffic. Locally, roads connect the area with 'The Caves' township and the local countryside.

The mountain is a substantially isolated peak which has highly cavernicolous limestone outcropping over its northern aspect. It rises about 800 feet from the surrounding plain to an altitude of 988 feet. The opposite 'Limestone Ridge' is about 300 feet above the plain. It is visible for many miles in any direction and provides a view of Rockhampton from its summit where a Trigonometrical station is established.

Mining leases number ML 281, 307, 326 and 340 have been let over the mountain and numbers ML 236, 243 and 306 over 'Limestone Ridge'. With one exception of ML 306 of Mt. Morgan Mines the leases are held by Central Queensland Cement Proprietary Limited.

HISTORICAL

The caves on Mt. Etna and in surrounding districts have been known since almost a century ago. The original owner of what are now Olsen's Caves recognised their great beauty and has since the last century had these caves open for public inspection. Publications describing early history and discovery of the caves have been prepared by the present owners.

The first commercial exploitation of the caves was the extraction of bat guano by early German settlers for use as a fertiliser from a small number of caves . Relics of this are provided by tramways, rusted buckets, navigation markers and in some cases names (Johansen's Cave, Flogged Horse Cave, an allusion to the method of powering the tramway, etc.). During the second world war the area was used for munitions storage and Commando training for activities 'behind enemy lines' under the guidance of Captain, now Professor S.W. Carey.

In 1920 the two recreation reserves were proclaimed to protect the cave areas and provide access for the people for purposes the name indicates. It is only during the last ten years that this action has been reversed by the present government and the mineral leases granted.

In late 1966 Cammoo Park Caves were opened to the public by Councillor J. B. Hinz of the Livingstone Shire Council. In his opening speech the manager mentioned the caves were found in 1886 by a young girl, Miss Charlotte Kohn, but were never opened to the public. Councillor Hinz in his address stated 'As time passes this area of Queensland will be host to a growing number of tourists...' and the success of the new caves venture has amply demonstrated this to be the case.

Prior to the closure of public access to the Recreation Reserves quite large numbers of persons regularly visited the caves on them, frequently during week-end days, and have continued to do so where possible.

CONSERVATION ACTIVITIES TO DATE

The first records available indicate that members of the University of Queensland Speleological Society, during exploratory investigation of the area in early 1962 about a year after the Society's foundation, heard locally about the threat to the mountain. I can recollect that apart from trying to obtain general information on the area, little specific conservation activity took place, as the possible exploitation was then fairly remote. Perhaps the most significant work in early 1963 involved discovery, mapping and biological collection. At the Australian Speleological Federation's 1964 Conference the first comprehensive report was prepared, and distributed. This provided a general case for the conservation of the still undamaged Mt. Etna, mainly on the basis of preservation of Macroderma gigas, a rare bat, to be described later, & initiated action which resulted in Mount Morgan Mines voluntarily ceasing its quarrying near Johansen's Cave in the interests of conservation. Early in 1965 the Rockhampton Naturalists Society and Central Queensland Research and Development Bureau became associated with the campaign.

The first contact with the cement company was in May 1965 with a reply to a letter to the Editor of the Courier Mail. The original letter by Mr. B. Kay stated that the cement company intended to quarry the mountain and thus cause irreparable damage to the caves. It went on to justify the opposition to this action. The reply is very important in this case. Mr. D. Woodcroft, Manager of the company, denied that 'quarry operations would destroy natural caves at Mt. Etna near Rockhampton' and further stated that 'areas in which there were

caves did not lend themselves to mining operations'. It is very interesting to compare this with what actually happened less than six months after these statements were made and in the light of an 'Application for Exemption' for a period of six months dated 19th May, 1965, in which it is stated that 'on 25th March, 1965 the company entered into a major contract with Noyes Bros. Pty. Ltd. for the erection of quarry equipment and installations on the leases.... Mining operations will commence after the installation of the equipment'.

The University of Queensland Speleological Society investigated legal proceedings about mid 1965 but found this avenue to be futile. On 12th May, 1965 the Morning Bulletin, Rockhampton, published a letter from the President of the Rockhampton Field Naturalists Club which ended 'This mountain should never be destroyed for its limestone'.

The first of a series of conservation bulletins published by the University of Queensland Speleological Society appeared in May 1965. It included a general description of the area and problem and stated in part 'why must the quarries be sited where they will do the maximum of damage?' On behalf of the society the following recommendations were made:

1. Mt. Etna be left undisturbed and preserved as a National Park.

2. The northern section of the ridge containing Johansen's Cave be preserved.

3. That quarrying be carried on in the site of Pilkington's Quarry (now unworked and leased to Central Queensland Cement Pty. Ltd.) where the existing caves have already been destroyed.

Pilkington's Quarry is situated in the southern end of Limestone Ridge and was purchased by Central Queensland Cement for $120,000.00. This circular received several letters expressing support and assistance.

On 5th August, 1965, Mr. P. Bridge of the Western Australian Speleological Group wrote a letter giving an excellent statement of the case to the two Companies, four relevant Queensland State Government Departments and the University of Queensland Speleological Society. It emphasised the precedents for such destruction of natural resources for ephemeral development and the betrayal of trust involved in selling parts of the people's heritage to business interests. I am unfortunately unaware of the results of this letter.

Mt. Etna

The University of Queensland Speleological Society Newsletter of August, 1966 contained a comprehensive article by Mr. M.J. Graham, one of the founders of the Society, and this together with the completion of the cement factory and commencement of quarrying marked the beginning of the most recent concerted conservation efforts. The University of Queensland Speleological Society commenced active enlistment of support by letter, with disappointing results. Two further bulletins were prepared, No. 2 on the bat population by Dr. P.D. Dwyer and No. 3 by myself.

On Thursday, 27th July, 1967 at 7.45 p.m. the Central Queensland Speleological Society was founded as a result of a public meeting called by the Mayor of Rockhampton. This society has been quite active as regards conservation and has very great advantage in its location.

During July and August, 1967 two major newspaper items about the problem were published while Dr. Dwyer and myself broadcast over the A.B.C. in the matter. This resulted in several more organisations including the Queensland Trades and Labor Council becoming interested and actively pursuing the aim, all somewhat independently. Dr. McMichael of the Australian Conservation Foundation later contacted the Cement company requesting them to refrain from mining certain sections of limestone which are considered to be important for the preservation of caves and the substantial bat populations inhabiting them, they are proceeding with the matter. On 4th October, 1967 I received a telegram from Dr. Everingham, the newly elected A.L.P. Member for Capricornia expressing support and requesting further information, and he has subsequently been of great assistance in the matter at Federal level.

The Australian Conservation Foundation held a Symposium at the University of Queensland on 14th and 15th October, 1967. The registrar gave permission for Dr. Dwyer, Mr. Shannon and myself to give an hour long lecture and slide show on the problem. This was very well received and gave more impetus to the programme. Similarly, the Humanist Society of Queensland received a lecture and expressed support in December, 1967 and various branches of the Australian Labor Party have done likewise.

One result of this increase in activity was the establishment by the Queensland State Government of a Departmental Committee consisting of Officers of the Lands, Forestry and Mines Departments to investigate 'the future of Mt. Etna Caves system and the question of mining thereon' and the first meeting took place towards the end of December, 1967. The University of Queensland Speleological Society was able to submit a report, photographs and maps to the Committee which also made an

inspection of the area. The Committee continued to examine the problems and discuss it with the Cement Company with a view to obtaining surrender of parts of the leases immediately surrounding the caves. Several days ago the Society was advised by the State Government that the Company was not prepared to surrender any of the lease. Despite this unfortunate result the Committee obtained several important undertakings from the Company, notably that it would 'leave a barrier of not less than 66 feet between their workings and known caves'. Also 'workings are being directed to keep clear of possible cave structures'. Regular inspections by the local Inspector of Mines were instituted and as at 16th October will continue to be made.

In October of this year the U.Q.S.S. was advised that quarrying had been extended around the mountain to the north in dangerous proximity to Bat Cleft. As a result of this intelligence the Society wrote again to the State Government Departments and contacted Mr. Sherrington, the State Minister for Salisbury, who has taken a great interest in the matter. I also telegraphed Dr. Everingham in Canberra who was able to speak during adjournment in the House of Representatives at 2 minutes past midnight, 10th October, 1968. He referred to a six week old unanswered question and made many allusions to the value of pure science, he referred further to the actions of the Cement Company as being 'high-handed, contemptuous and specious in their arguments' and that the matter was very urgent if worse consequences are to be avoided. Dr. Everingham's excellent statement was reported over the A.B.C. National News and in National, Queensland and local newspapers. Following this, Mr. Shannon of the University of Queensland Speleological Society, Mr. Young of Central Queensland Speleological Society and myself commenced writing to various editors of newspapers.

To date, this virtually sums up the matter although each day is bringing more developments. The Queensland Government Mining Journal No. 805 gives some interesting data about the quarry:

'Limestone mined during quarter (to Nov. 1968) 38,456 tons
Value $133,500;
Production and development concurrently on 3,4 and 5 levels;
No. 6 has been prepared for initial drilling;
Average number of employees - 15.'

This issue is, I believe, one of sufficient importance to transcend any political boundaries; however great assistance has been lent by Mr. Sherrington the State Member for Salisbury and Dr. Everingham, the Commonwealth Member for Capricornia, both of the Australian Labor Party. Because of

this I think that it is of interest to quote two sections from the A.L.P.'s 'Platform' VII Science and Technology; Natural Resources 'Australia's future, and the wellbeing of its people, depends on the scientific development of its natural resources. Development is not mere exploitation; it means wise use of natural resources'. 'Enough of both kinds of resources, (renewable and non-renewable) and particularly of our natural landscapes, must be reserved for social, cultural, educational and scientific purposes.'

CONSERVATION - REASONS AND JUSTIFICATION

The reasons why I deem conservation of the mountain to be of very great importance have for convenience been divided previously into five categories and I shall again follow this division. This is to be regarded as purely arbitrary and by no means are the compartments 'watertight'. It is very important to remember throughout the very great importance of cement to the economy, about which I will say more later. I have designated the categories i. Aesthetic, ii. Geological, iii. Biological, iv. Economic, v. Tourism and Recreation, and will discuss them in order of those headings.

AESTHETIC

Caves are very rare in Queensland. The two major areas other than Mt. Etna, Chillagoe and Camooweal, are separated from major centres of population by large distances and roads of doubtful quality. The third area near Texas in the south east, is of a far smaller nature, fairly inaccessable and may be innundated by a new dam in the near future. Apart from smaller outcrops the nearest interstate caves of note are at Kempsey, 300 miles south of the border in New South Wales. Thus the only example of significant cave development over two thousand miles of Australian coast and about seven hundred miles inland (limited by Kempsey, Kathrine and Cape York). The caves on the mountain provide the best examples and most highly developed formations of all the caves in the area.

Apart from the intrinsic fascination of these subterranean recesses themselves, they contain most beautiful examples of decorations of crystalline carbonate of lime. These take the form of stalactites, stalagmites, helictites (stalactites going sideways, etc.), straws (stalactites hollow, 3/16 inch thick and up to six feet long), flowstones, columns, terraced gour pots and many unclassifiable varieties, many glistening in a perpetual film of water and still growing. Owing to the very slow rate of formation and changed climatic conditions these decorations are for all practical purposes totally irreplaceable in common with all similar cave structure. They have already been seriously damaged and are continuing to be

damaged by blasting. They have been compared favourably with the best of the formations of the Southern wetter caves although on a much reduced scale and are, as far as is known, the only example of this phenomena in Queensland.

To pursue the description of formations and their claim for protection is, I believe, not justified in an address to this body whose members will commonly be far more familiar than myself with the matter.

GEOLOGICAL

These caves are formed in a vertical pattern rather than the more frequent horizontal one and as such they warrant special study as to the general origin of caves. Their nature and formation has been suggested as being due to reactions occurring during leaching from organic detritis from a rain forest equivalent through a pluvial period of a glacial cycle. I regret that as I am not a geologist I cannot amplify this rather interesting theory.

BIOLOGICAL

The most numerous species inhabiting these caves is the bat Miniopteris schreibersii which I shall discuss under the heading 'Economic'. Other bats do occur which are dependent on these caves both for breeding purposes and normal activities. Australia has among its placental (non-marsupial) mammals very few which are indigenous. One of these is the bat Macroderma gigas. The genus Macroderma is not found outside Australia and is one of only two genera of bats that are uniquely Australian in their origins. Macroderma gigas is peculiar amongst bats in its carnivorous habits. At one time it was widely distributed over the Australian continent; today it is only known as small colonies from a few scattered localities in Northern Australia. Observations at the Rockhampton caves have shown that a breeding colony of about 100 Macroderma gigas recurs annually in spring and summer in Johansen's Cave. During the rest of the year these bats are dispersed in small numbers through the larger caves of Mt. Etna, being found most commonly in caves that have several large entrances and hence relatively well lit interiors. No populations of Macroderma gigas are known south of Rockhampton and none of the recorded colonies appear to be as large as that found in Johansen's Cave. The rarity of this species within Australia generally, combined with its being a uniquely Australian mammal of a class very rare in Australian indigenous mammals merits its conservation at all times. The presence of a relatively large and apparently well-established colony of Macroderma gigas based on Mt. Etna caves and adjacent systems calls for the conservation of these caves. Evidence,

to date, suggests that populations of Macroderma gigas may be highly localised and dependent upon particular areas that are appropriately cavernicolous. In contrast to Miniopteris - to be described later - conservation of Macroderma gigas is not dependent soley upon conservation of specific caves; rather it depends upon conservation of entire cavernicolous areas.

Numerous anthropods - notably insects - occur in the caves. Most tend to be anomolous and consequently interesting. A cave which, except near the entrance, is perpetually dark, has a high humidity, constant temperature, little air movement, differs very greatly from the environment outside it. Consequently cave inhabiting animals are very differently adapted to those on the adjacent surface. Often they are unable to live outside caves. The food chain series of cave animals is notable, in the closed community that exists in caves there is little interchange of material with the outside. What there is, however, is utilised many times by different animals and plants (fungi) before being reduced virtually to gasses. Their ecology (environmental study) ethology (behaviour) and morphology (form) is usually very specialised; its study gives information about the actual adaptions which all animals, including man, make changing environments.

Cave adapted animals can rarely live outside their caves in the very different environment; thus destruction of the caves will render many of them extinct. Little study of the Mt. Etna caves fauna has yet taken place; enough however to show it is very important. It is hoped it will be preserved long enough for suitable investigations to take place. Much similar work has been done in Southern cave faunae and has proven very significant.

To what extent other species in the region (i.e. bats such as the eastern horse-shoe - Rinolophus megaphyllus, and the sheath tailed bat - Taphozous, the dense population of brush-tailed rock wallabies, the marsupial native cats, the scrub turkeys, etc.) are dependent upon this particular area cannot at present be ascertained. It is of significance, however, that the Mt. Etna area represents a moderately rugged coastal upthrust of cavernicolous limestone that has no equivalent elsewhere in Central Queensland. This topology has permitted development of an unusual rain-forest habitat (semi-evergreen vine thicket) in a latitudinal range where rain-forests of any type are poorly represented. It is possible that this habitat is the underlying factor permitting continued co-existance of several of the local animal species.

ECONOMIC

To many persons, notably those involved in primary industries, this will be the most important reason for conservation of the area and involves the bent-winged bat Miniopteris schreibersii.

Previous studies on bent-winged bats in Australia have been carried out in south-eastern Australia (in New South Wales, Victoria, and South Australia). These studies have revealed that the survival of Miniopteris schreibersii in south-eastern Australia is dependent upon a few caves that are re-visited year after year by huge colonies of bats (10,000 to 200,000) for purposes of rearing young. These breeding caves are of special structure, with enclosed chambers or domed ceilings, such that they retain air that has been warmed by the constant activity of the bats themselves and in this way can be converted into giant incubators within which the young of each year can be reared through to independence. Any damage to these caves which prevented them from retaining warm air would prevent survival of the young and would ultimately lead to extinction of large populations of bent-winged bats. Banding studies have shown that the bent-winged bats of many different caves and mines, scattered over a relatively large area (typically a major watershed area) rely upon a single traditional breeding cave. Destruction of any given breeding cave would therefore mean ultimate extinction of all the bent-winged bats in a much larger area than that of the immediate environs of the cave itself.

In New South Wales the Willi Willi Caves (near Kempsey) serve as a breeding cave for populations of Miniopteris schreibersii and Miniopteris australis inhabiting the Macleay River watershed area. Knowledge of the significance of breeding caves for these bats, and of the implications of destroying or damaging such caves, was sufficient to prevent a mining lease being granted for phosphates in 1963.

Work to date at Mt. Etna has revealed that a cave known as 'The Bat Cleft' serves as a major breeding cave for both Miniopteris schreibersii and Miniopteris australis. Estimates of colony size indicate that about 100,000 adult females of these two species move to the Bat Cleft each year to give birth to, and rear, their single young. This means that in late December, after the young are born, nearly 200,000 bent-winged bats occupy the one cave. The structure of the cave is, as in southern latitudes, such that it may be warmed by the activity of the bats and thus reach temperatures appropriate to the rearing of young. No other caves are known upon Mt. Etna, or in the general area, that provide a

similar structure and nor are other major cave systems known anywhere within 400 miles of Rockhampton. Even if suitable caves did exist elsewhere, however, it is unlikely that they would be used as breeding sites in the event of the Bat Cleft being desroyed. Experience with a variety of animal species (e.g. seals, penguins, egrets, passenger pigeons) has shown that species relying upon traditional breeding grounds may be inherently unable to abandon them for another place no matter how intensely they are exploited by man. Conservation of species such as these can only be achieved by rigid protection of their breeding places. Mining activities currently under way at Mt. Etna are about ¼ mile from the Bat Cleft. If mining continues then destruction of this cave is inevitable. Even at the present distance it is possible that blasting may lead to collapse, or partial collapse, of the cave. One rock-fall is known to have occurred since mining began. Destruction of or excessive damage to the Bat Cleft will mean extinction of the breeding colonies of bent-winged bats. This in turn will mean extinction of the entire populations of these two species which are dependent on the Bat Cleft for reproduction. These populations probably number between 400,000 and 500,000 bats.

Much of the area surrounding the mountain, indeed most of Central Queensland is dependent on agriculture and grazing industries and is thus engaged in constant battle with insect pests destroying crops, grasslands and forests. Many varieties of insects are involved, the most important being the moths (Noctuidae, etc.) owing to their larvae caterpillars. The moths, the reproductive phase of the pest, fly principally at night and generally remain concealed during the daylight periods avoiding birds and numerous other predators. Control of many of these pests is maintained in cultivated areas by insecticides, however in large rural areas this is uneconomic and frequently impossible. Thus natural predator-prey relationships become the most important population control. The bent-winged bat is exclusively insectivorous, it catches insects in flight, and furthermore it is active only at night. Thus it is seen to be the major predator of moths. It has been reliably estimated that over one ton of moths amounting to perhaps six million individual moths are eaten by the bats each night.

The extinction of the bat would very rapidly remove this very powerful control on moth populations and could very probably lead to a cataclysmic increase in their numbers. It is to be expected that this would severely affect all primary production and could well make the difference between success and failure in some of the borderline primary industries. These industries are of much greater importance to the State and directly affect far more people than does the quarrying of limestone.

TOURISM AND RECREATION

The tourist potential of caves in the area is indicated by the success of present caves open to the public. These (Olsen's Caves and Cammoo Park Caves) have had access made easier, have been fitted with lighting and as a result prove very popular. The area is situated very close to the main northern road, the Bruce Highway and within convenient distance of the City of Rockhampton. As previously described, there is virtually no cavernicolous area so accessibly located in Queensland. The caves thus present a very unusual tourist attraction to the area. In beauty and form parts of them are easily comparable to the Great Barrier Reef. It has been mentioned above that the caves on Mt. Etna are far superior to those at present open to public inspection. Numbers of them are however of slightly difficult accessibility, although as in the tourist caves this may be eased. It would be an important and irreparable loss to the district if this notable tourist attraction were to be destroyed at a time when the very important tourist industry is undergoing rapid expansion. The permanent population of the statistical division of Capricornia is 96,030 (1967).

Caves as a source of recreation apart from tourism appeal mainly to a minority of the population, such as members of this Society (UQSS). In Rockhampton the newly established Central Queensland Speleological Society, the Rockhampton Naturalists Society, the Boy Scouts and numerous members of the general public have shown interest in the caves and their conservation. With more publicity as can probably be expected more persons will become involved and realise the asset these caves are to Rockhampton as well as their individual beauty.

PROBLEMS ARISING FROM CONTINUATION OF QUARRYING

The quarrying of cavernicolous limestone is in itself a dangerous occupation. Blasting into rock which is not known to be reasonably homogeneous has led to many serious and misdirected blasts. One may refer to an incident at Ashgrove, a Brisbane suburb, where houses were virtually shelled with rock from a quarry - some of the houses were up to half a mile away, and similar instances not unlike this involving 'shelling' of houses have been reported near Mt. Etna. Collapse of caves may, if in a quarry face, precipitate very large amounts of limestone from the mountain above on to the plant and workers below. Similarly it is possible, especially when higher levels are worked, for collapse of the quarry floor owing to blasting and weight of machinery. It is noted that Mt. Morgan Pty. Ltd. experienced great difficulties in its quarry near Johansen's Cave. Enough limestone 'leaked'

into caves to prove an economic problem, and explosions proved embarrassingly large. Fortunately the dangers of continued blasting were realised and operations ceased.

Quarrying of cavernicolous limestone often results in the separation of very large blocks of the rock - too big generally to handle. Further reduction of these - by blasting - on the quarry floor may be necessary. This is also a dangerous process and is quite uncontrollable, apart from its being of doubtful economic value.

It is considered that these factors may, especially when more cavernicolous areas are encountered, result in serious personal injury or perhaps death to the workers at the quarry. This may not necessarily coincide with an explosion but could occur after personnel return to the unstable quarry following blasting. The stimulus of machinery may initiate it.

Very good evidence for these hazards was provided by the Manager of the Cement Company in 1965, who previously quoted 'Areas in which there were caves did not lend themselves to mining operations'.

ALTERNATIVES

The development of a cement industry in Central Queensland has been a particularly important factor in the economic development of the area. The Company has expended large amounts of money in building its Parkhurst factory seven miles north of Rockhampton. It is very important for me to indicate that conservation of Mt. Etna will not stop the availability of limestone for cement production. There are many other sources of limestone available which are far less cavernicolous than Mt. Etna and even Limestone Ridge and hence far safer and more desirable to quarry.

The publication by the Queensland State Department of Mines - Limestone Resources of Queensland - lists several areas which could be considered as alternatives for limestone supply, some closer to the factory than Mt. Etna, which is ten miles distant. The only advantage to compensate for the dangers of quarrying is its superior bulk and physical shape. However, the bulk is far below the total of other limestone resources in the district.

Examples are provided by the Glenmore outcrop only four miles from the factory, which is classed as a major deposit of ready accessibility. It has a width of 450 feet and an exposed length of fifteen chains, the estimated tonnage available to a depth of 100 feet is of the order of five million tons. Quarry operations removing 2,000 tons have previously been

carried out at Glenmore. A larger area of limestone occurs beside the Fitzroy River at Limestone Creek Siding. It is twenty-seven chains in maximum width and is believed to contain immense quantities of limestone, reserves are however somewhat limited by the river level. Quarries in this deposit were worked many years ago. Numerous other areas more distant are recorded such as Ulam Marmor, Raglan and Ambrose. Other cement factories have found it possible to economically utilise limestone from fairly large distances (Calcium to Townsville - 29 miles rail, Mud Island to Darra - 24 miles boat, 2 miles continuous belt).

Much of the alternative supplies may not prove quite as easy and convenient as Mt. Etna to quarry and may seem less attractive to the Cement Company despite considerations of blasting cavernicolous areas. However, the disadvantages resulting from this will be, in my opinion, far outweighed by the advantages accruing to the people and industries, indeed country and community of Central Queensland and thus Australia, both present and future.

Some restricted parts of Mt. Etna have been found to be less cavernicolous than others; there appears to be increasing cavernicolousity as one moves north from the present quarry areas (The quarry is at present moving in that direction). It has been suggested that quarrying can continue on the extreme southern section of the outcrop yielding at least enough for the Company to recover expenditure for the existing installations and preserving the remainder of the mountain. This has not been well investigated but may form a possible ground of compromise bearing in mind the destruction already extant.

CONCLUSIONS

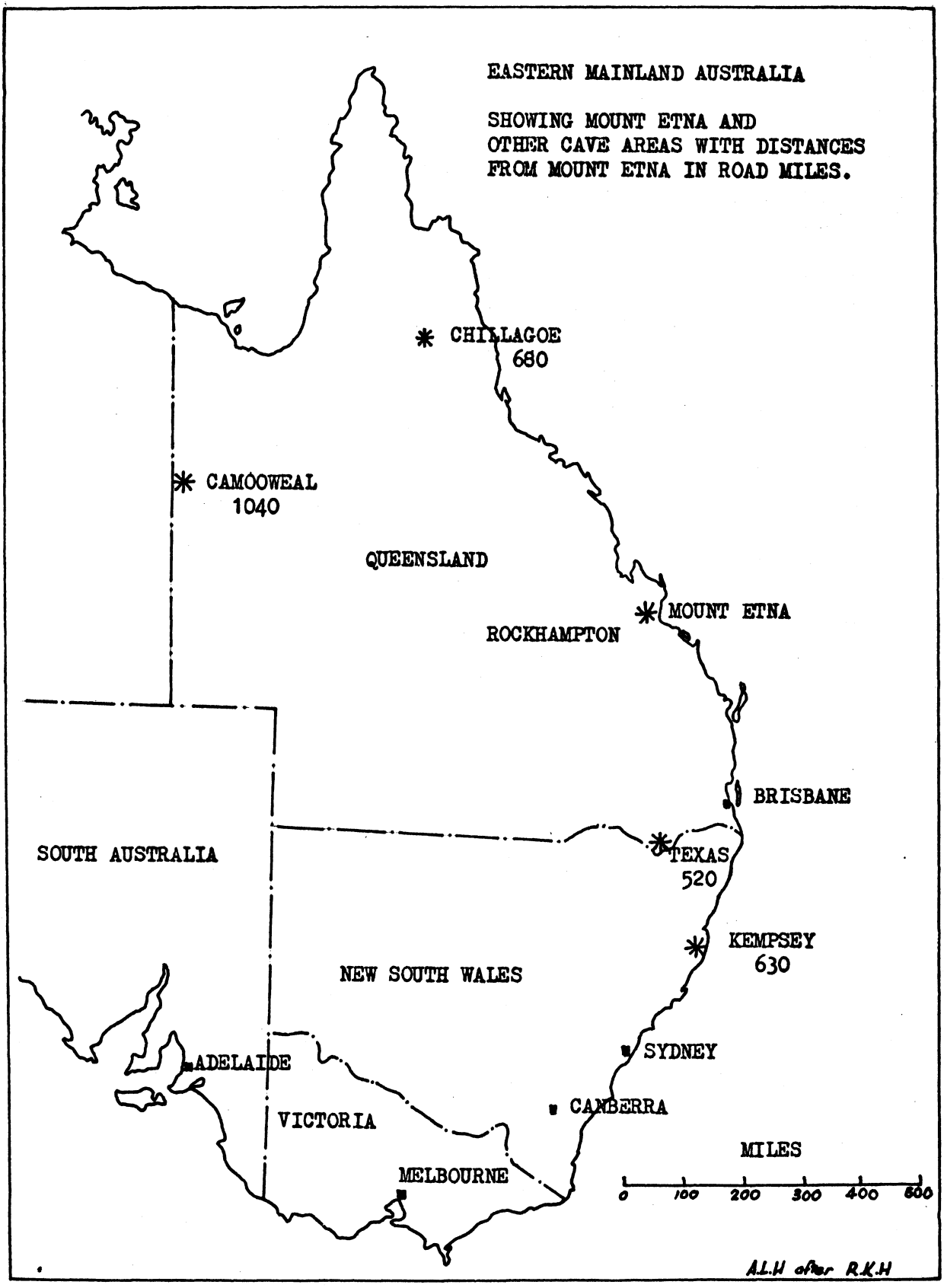
I have described what I know of the conservation of the mountain and surrounding area and endeavoured to justify my opinions on the matter. In summary, I believe conservation is justified by the economic and scientific/aesthetic considerations. I recognise that the production of cement is vital to the economic development. However, the necessity for utilisation of Mt. Etna for this purpose is mitigated by other limestone outcrops known to be available. Unfortunately large amounts of data and information are lacking hence the hypothetical aspect of many of my suggestions must be remembered. I remain convinced that the continued destruction of the mountain will lead to very grave and serious problems for the district. I am particularly mindful that now (December 1968) the female bats are congregated in Bat Cleft giving birth to their offspring and so doing whilst blasting, quarrying, etc. continues on the mountain.

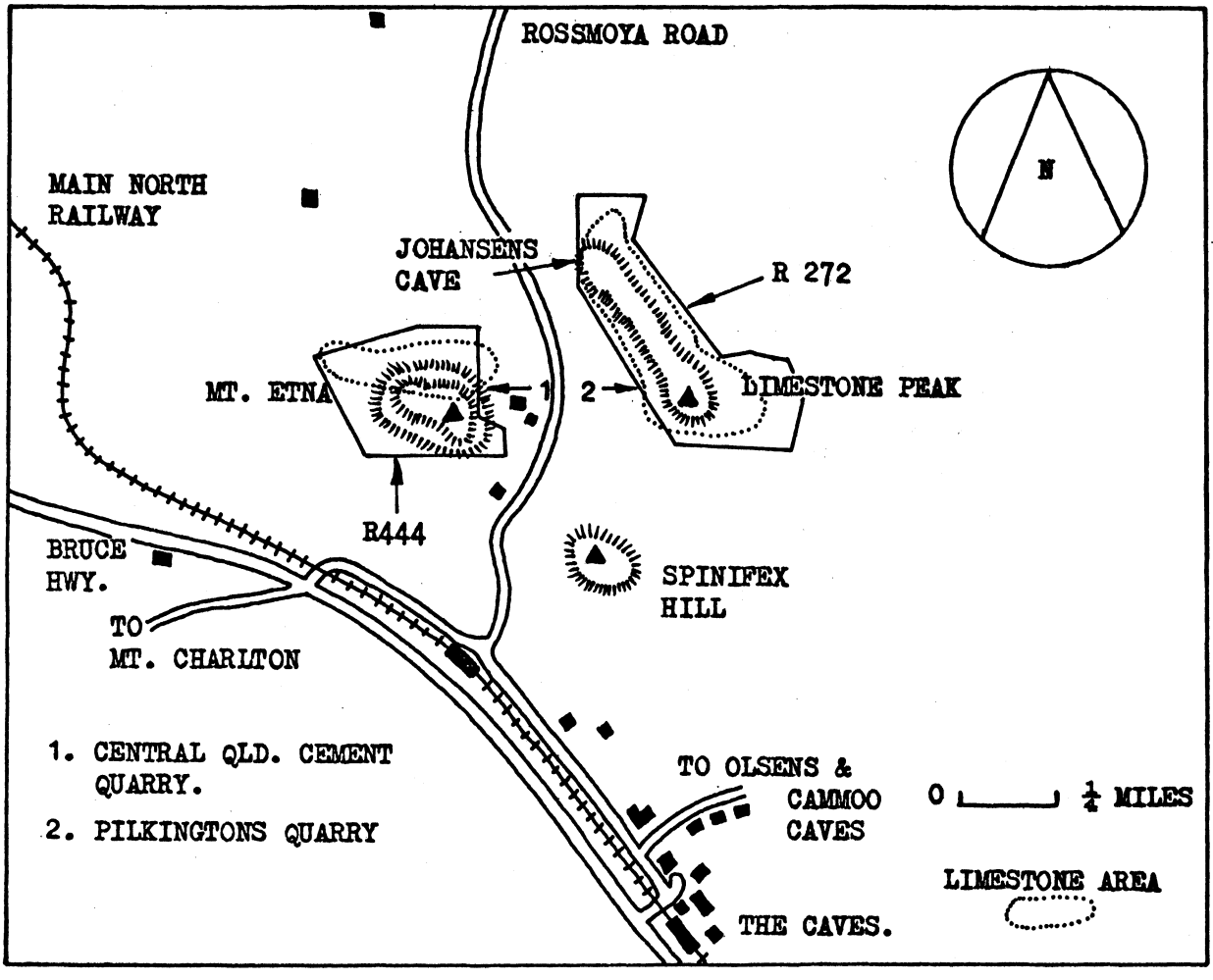
For the reasons stated above I believe in the public interest the quarrying of Mt. Etna should cease permanently and immediately, the area being declared a National Park.

I remain of the opinion that the matter is in a very late state.

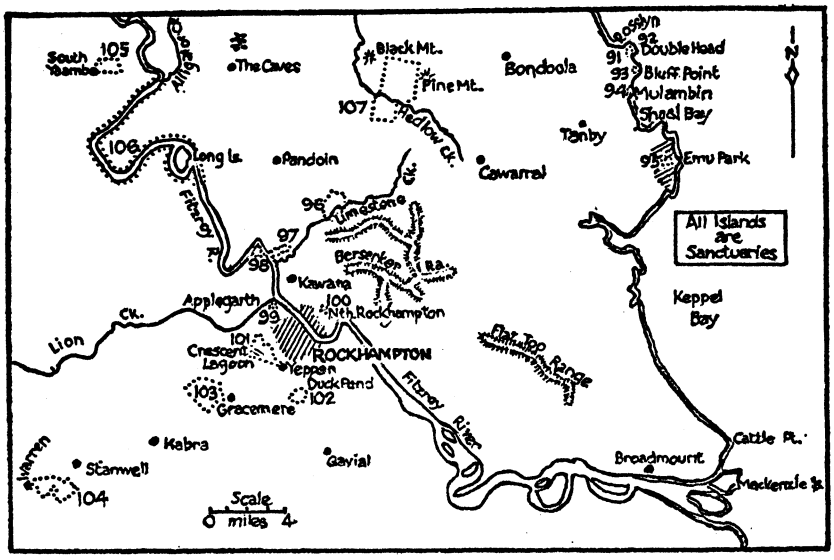
Ladies and Gentlemen, Thank you.

****


EASTERN MAINLAND AUSTRALIA
SHOWING MOUNT ETNA AND
OTHER CAVE AREAS WITH DISTANCES
FROM MOUNT ETNA IN ROAD MILES.
CHILLAGOE
680
CAMOOWEAL
1040
QUEENSLAND
MOUNT ETNA
ROCKHAMPTON
BRISBANE
SOUTH AUSTRALIA
TEXAS
520
KEMPSEY
630
NEW SOUTH WALES
SYDNEY
ADELAIDE
CANBERRA
VICTORIA
MILES
MELBOURNE
0 100 200 300 400 600
A.L.H after R.K.H



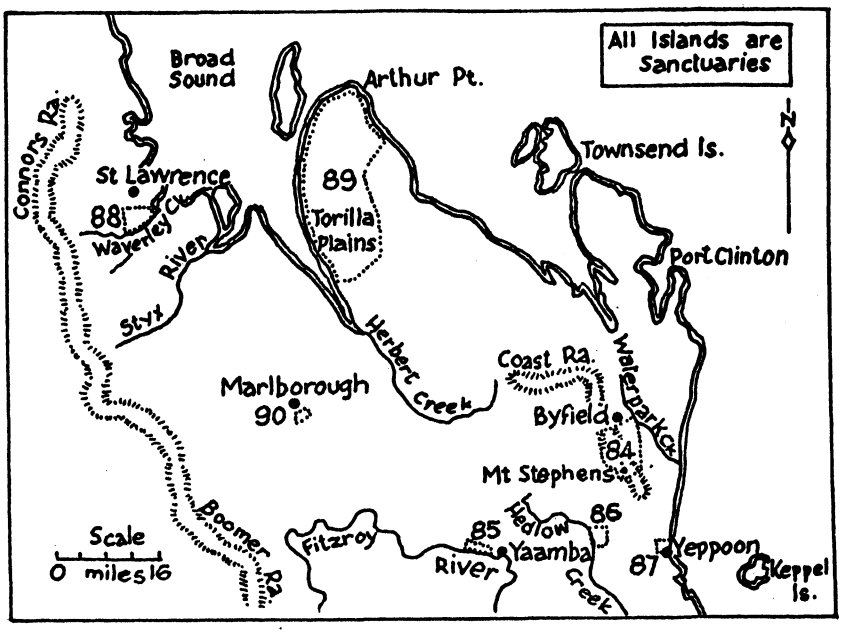
MOUNT ETNA AREA



The sanctuary boundaries (as at December 31, 1957) are delineated by dotted lines.

SANCTUARY INDEX

No.	Sanctuary	Area in Acres
91	National Park Reserve 642, Parish of Hewittville, Rosslyn Head	100
92	National Park Reserve 641, Parish of Hewittville, Double Head	28
93	National Park Reserve 643, Parish of Hewittville, Bluff Point	122
94	National Park Reserve 644, Parish of Hewittville, Mulambin	20
95	Sanctuary at Emu Park Water Reserve, Emu Park	68
96	Seeonee Park, Rockhampton	585
97	Hunter's Farm, Glenmore, via Rockhampton	349
98	Picnic Point Reserve, Rockhampton	145
99	The area previously known as Jardine's Lagoon, Rockhampton	20
100	Subdivision 11,Section 10,Parish of Archer, North Rockhampton	10
101	Diggers' Park, Rockhampton	96
	Murray's, Yeppen and Crescent Lagoons, Rockhampton	600
102	Duck Pond, Gavial, via Rockhampton	320
103	Native Birds Reserve, Gracemore	1,400
104	Property of S.F. Roberts, Warren, via Rockhampton	1,216
105	"Waterview," South Yaamba	570
106	Part of Fitzroy River, Belmont Creek to Alligator Creek, via Rockhampton	2,880
107	Mount Hedlow, via Rockhampton	2,137



The sanctuary boundaries (as at December 31, 1957) are delineated by dotted lines.

SANCTUARY INDEX

No.	Sanctuary	Area in Acres
84	State Forest Reserve 20, Parishes of Maryvale and Byfield, via Byfield	28,135
85	Yemeappo Station, Yaamba	3,020
86	Hedlow Creek, via Rockhampton	3,600
87	The Grounds of St. Faith's School, Yeppoon	54
88	Property of C.W. Wright, via St. Lawrence	10,752
89	Torilla Plains, via Marlborough	149,200
90	Police Reserve, Marlborough	48

SCIENCE AND TECHNOLOGY

POSSIBLE METHODS OF CAVE DETECTION

M.G. Webb *

CONTENTS

* National University Caving Club

Last year I published a rather journalistic article on this subject, but restricted to electrical methods. It is now my intention to extend the previous article, and to consider some different methods, with reference to the advantages and disadvantages of each.

All possible systems have one thing in common - they must be portable, since measurements must be made in the field. This condition immediately restricts the complexity of apparatus and its power requirements, since batteries tend to be heavy, and in general, the more complicated a piece of equipment, the larger and heavier it gets.

It is then required to construct some piece of equipment which will accurately delineate the interface between limestone and air. Across the interface there will be changes in conductivity, dielectric constant, magnetic susceptibility, elasticity, refractive index, and specific gravity i.e. density.

I shall below consider each of these changes for a feasible and practical method of cave detection.

MEASUREMENT OF CHANGES IN CONDUCTIVITY

The conductivity of any substance is a measure of the ease with which electricity flows through it. The first requirement for the use of this property then is some portable source of electric current and the means to apply it to the test area. Since there is no immediately obvious reason why direct current (d.c.) should not be used, we shall define our power source to be dry cell batteries. Dry cell because they are relatively small and light compared to accumulators, and because a check of conductivities shows that power requirements will be small, obviating the need for the extra energy of accumulators. To apply the current to the test zone, we shall drill small holes into the rock and affix contacts.

Having current passing through the rock (see Figure 1 for configuration), we must measure its magnitude. This will tell us the resistance of the test area, and hence its conductivity. Then the lower the conductivity, the larger the airspace. We therefore need electrical meters for measuring currents and voltages. Once a

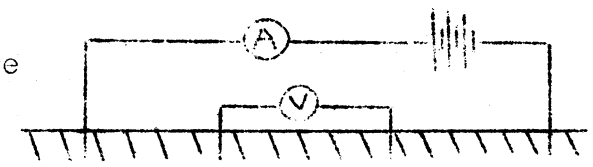


Figure 1
Four-electrode Method

measurement has been made, everything is moved to another spot and the process repeated.

Advantages of this system are that it is fairly simple and cheap to make, and that interpretation is relatively easy.

Disadvantages are that it is of low range in depth and that the area covered is very small.

We can increase the coverage area by extending the outer electrodes shown in Figure 1 on out of the page. Increasing the depth range can best be done by changing to the plotting of equipotential lines where deviation from parallel represents a change in conductivity. Lines converge into a cave, diverge from gold mines etc. This is the Equipotential Method of what is called Potentiometric Surveying.

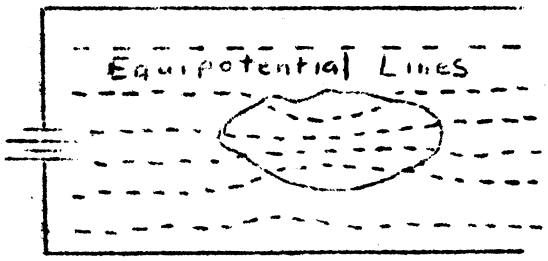


Figure 2 Equipotential or Parallel Wire Method.

Advantages of this system are that it is simple, coverage is good, with good depth range, and that it is accurate.

Disadvantages: Interpretation is harder than with the four-electrode method; it requires more equipment; power requirements are higher - it needs a minimum field strength of 0.25 volt/foot of wire separation (Experimental figure).

Comments on this section: Conductivity systems are simple and cheap, and reasonably accurate. However it is found that polarization of electrodes can occur, causing loss of efficiency. These can be annulled by the use of a.c., but apparatus then gets expensive and large. I have a power supply giving 200 volts peak to peak at 2 Kc/s, but its power requirements are enormous and its use is almost out of the question for field work, since packed for use it weighs almost 25 pounds.

MEASUREMENT OF CHANGES IN REFRACTIVE INDEX

The systems discussed below depend upon the fact that when electromagnetic radiation strikes a change of dielectric, part is transmitted and part reflected. This is best demonstrated by holding a sheet of plate glass to the light. Of course, rock is opaque to light waves. However it has been shown that limestone is virtually transparent to radiation at frequences of about 100 Kc/s.

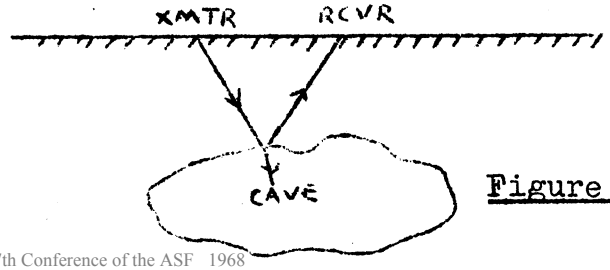


Figure 3

(At 100 Kc/s, the wavelength is 3 Kilometres). Therefore at any interface, there will be a certain amount of the signal reflected. Not much, but a sensitive receiver could detect it. We therefore need a 100 Kc/s transmitter and receiver, or, preferably many receivers. The next problem concerning us is the range between the transmitter and the interface. There are two feasible ways of doing this.

(i) By time lag between transmission and reception

(ii) By the phase relation between the transmitted and the received signals.

This first method requires clocks capable of measuring in the microsecond to nanosecond range (10^{-6} to 10^{-9} seconds). These are triggered on by the transmitter and off by the receiver. Such timers are expensive and hard to come by. In addition, over the ranges in which we are interested, the triggering pulses would probably take as long to reach the clock as to traverse to the interface and back, thus introducing inaccuracies.

The other possibility, phase shift, depends upon the fact that the wavelength (3Km) is a good deal longer than the range we are interested in (0.01 to 0.1 Km).

Since at each point between the transmitter and the interface, the phase of the transmitted signal is different, knowing the phase at the interface is equivalent to knowing its range. Remembering that when electromagnetic radiation is reflected, an instantaneous phase shift of 180° results, we measure the phase angle at the receiver. Subtracting 180° gives the distance of the receiver from the transmitter in terms of radians. Knowing the wavelength in limestone, calculating the distance between the transmitter and receiver via the interface is a matter of simple geometry. This then leads to the cave depth in metres. The easiest method of phase detection is of course with the oscilloscope, which is, unfortunately, not really portable. Alternatively, a 100 Kc/s signal generator with a variable inductance or capacitance

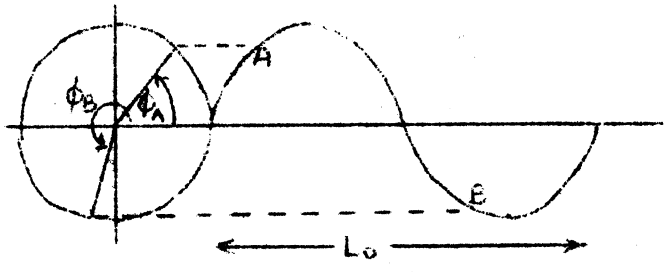


Figure 4

Phase Relationships

on the output calibrated in degrees of phase shift would do. After the detector and transmitter have been synchronised, the receiver and phase detector outputs are mixed, and the inductance tuned for maximum signal strength. The phase angle is then read off.

Example of Computation:

Suppose the phase detector reads 300° for maximum signal strength.
Subtracting 180° leads to a phase distance of 120° for XMTR - interface - RCVR.
120° is 0.667π radians.

Wavelength of 100 Kc/s in limestone is $\frac{L}{n}$ where n is given by the relationship $n = \frac{c}{v} = K^{\frac{1}{2}}$, so $L_1 = 1.03$ Km.

Whence 0.667π radians is equivalent to a distance of 0.343 Km.
i.e. XMTR - interface distance is 172 metres.
Suppose angle of incidence to the interface is 45°, then perpendicular depth of cave is 172. sin 45° or 121 metres.

Advantages:

(i) Range is only limited by depth of limestone, power output of transmitter, and sensitivity of receiver.

(ii) One-frequency transmitters and receivers are fairly easy to construct.

Disadvantages:

(i) Owing to the long wavelength, the phase relationship degrees per metre is very small. Accordingly, a very sensitive and accurate phase detector (or else an oscilloscope) is needed to give accurate ranging.

(ii) The low coefficient of reflection requires that a very sensivitive receiver be used. However, note that as the angle of incidence increases, the coefficient of reflection increases. For low incident angles it increases slowly, then more rapidly as the angle increases to larger values, until the limit of one, when the angle of incidence is 90°. Consequently it may be possible to reduce the power requirements by increasing the angle of incidence to, say, 45°.

(i) and (ii) above require the use of directional antennae, which at these frequencies could well be large and cumbersome.

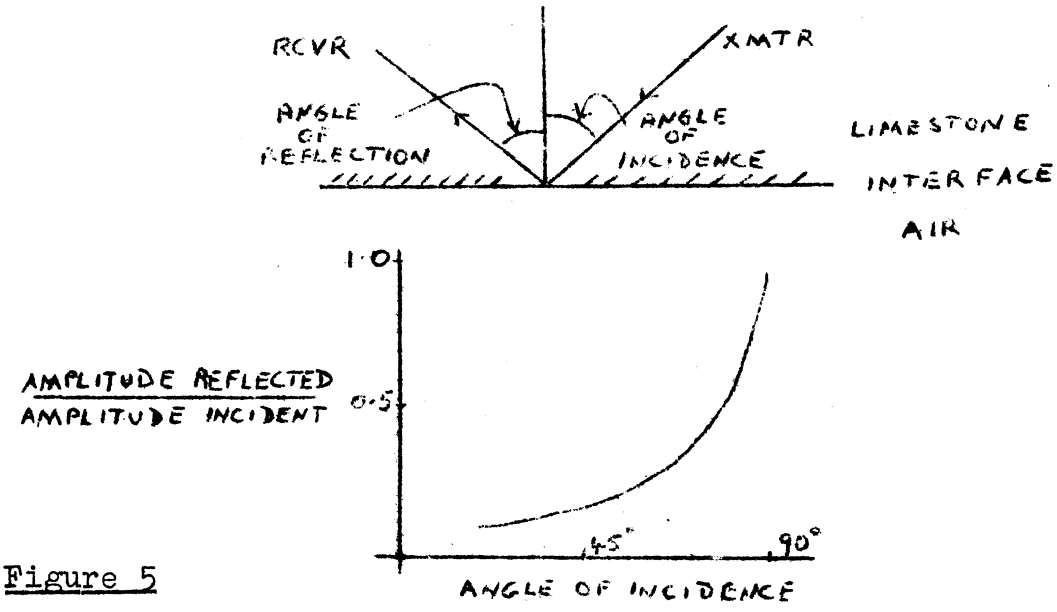


Figure 5

Comments on the above section: With the exception of the directional antennae, all the apparatus required could be made portable, although perhaps heavy. The greatest problem is the power supplies for the electronics. Valves would be preferable to transistors in the transmitter because of the larger signal voltage swing they can handle. This requires at least one 200v power sup, although the receivers could be transistorised. However, it is not strictly necessary that the transmitter be relocated once work has started. The receiver is portable, and can be moved instead, the shift of either being equivalent. So long as the transmitter - interface - receiver range does not exceed 0.5 Km ($\frac{1}{2}L_1$), no phase ambiguity can result.

MEASUREMENT OF CHANGES IN ELASTICITY

Under this section we shall consider such systems as use waves requiring a material medium for propagation. Of particular interest are sound and shock waves. These are bounced off the change of medium, or allowed through it and timed over a known distance.

In neither case, unfortunately, is it practicable to use phase detection for ranging, owing to the comparatively short wavelengths of sound waves (in limestone the audio range is approximately 0.2 metres to 50 metres; in air the wavelengths are approximately 0.1 of these).

Cave Detection

When a sound wave is bounced off an interface, the coefficient of reflection is considerably higher than for radio waves, as the velocity changes are higher. Consequently the returning signal is easier to detect. If therefore we can design a unidirectional transducer for applying sound waves to the ground, we can work as in the previous section. Some form of narrow beam microphone and an amplifier is required to increase the intensity to a usable value. However such microphones are available, although expensive, and the design of high gain, low noise amplifiers is relatively easy (see at end of article).

Whether we bounce the signal, or time it over a given distance to detect the cave, we still need to know the time lapse between transmission and reception to know how deep the cave is.

Constructing a clock which works in milliseconds up is fairly simple. Owing to the low velocities involved it can be coupled to the transmitter by coaxial cable with only slight loss in accuracy, (over 100 metres, electrical pulses take 0.3 uS while sound waves in limestone take 25 mS, a loss in accuracy of only 0.001%).

Timing the signal through the cave requires that equipment be set up on opposite sides of a hill that the apparatus is strong enough to penetrate. That imposes a severe limitation on that method.

Furthermore, attenuation of the signal at the air--limestone interfaces will be such as to render it highly improbably that part of the signal will reach the receiver. However this effect would result in a zone of silence corresponding to the cross-sectional area of the cave, which could be used to determine the location of the cave and its vertical cross-section.

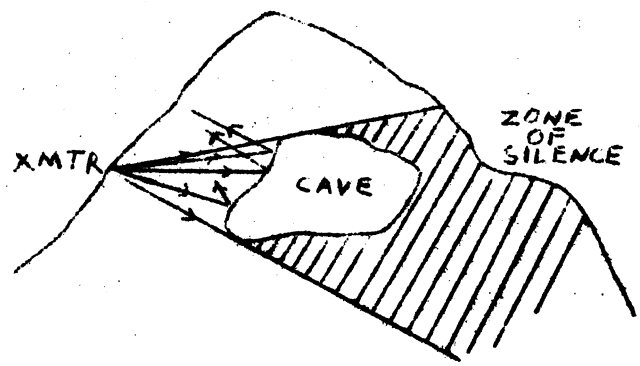


Figure 6
Zone of Silence

It would also be possible to carry out the above experiments using shock waves, detected by a seismograph. To increase the sensitivity of the seismograph, an interferometer system could be used. However, the use of shock waves would necessitate some form of shock pulse, such as that produced by explosives. Short pulse explosives (i.e. short rise and decay time of pulse) are essential to prevent masking of the shock front by the back of the pulse.

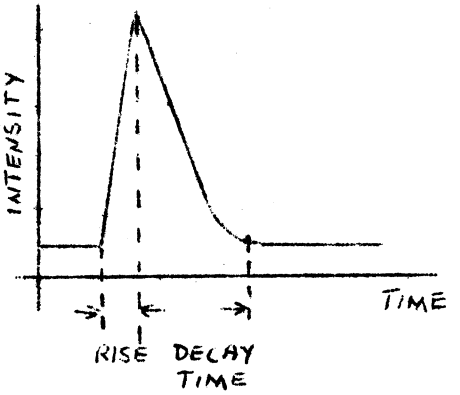


Figure 7

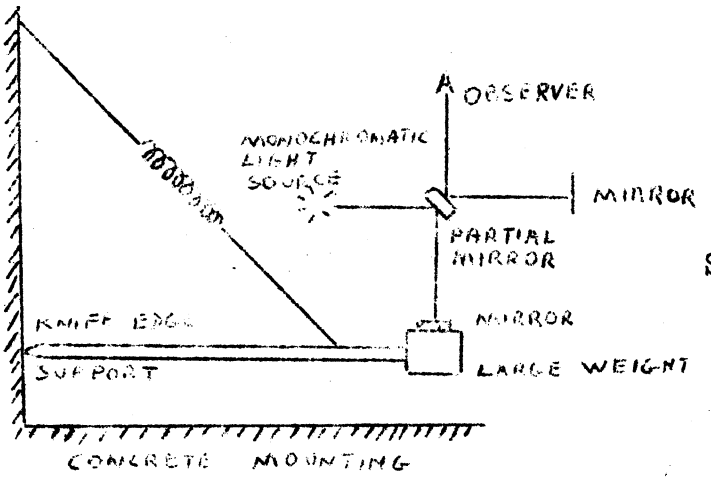


Figure 8
Simple Seismograph

Advantages:

(i) The clocks for these intervals are not too difficult to construct.

(ii) A good seismograph is relatively cheap and simple to make compared to a phase detector or a 100 Kc/s 1 watt transmitter. So too is the interferometer. The instant and magnitude of the shock front is determined by measuring the fringe shift as seen in the interferometer.

Disadvantages:

(i) Short pulse explosive have a very fast burning time. The fastest non-nuclear burning rate I know of is that of R.D.X. ($(CH_2N.NO_2)_3$) which is 8600 m/s. This is not available on the market and hence is expensive to obtain. The next is PETN with similar substances. Nitropril is both the cheapest and the easiest to make (in a concrete mixer is standard) but it has a long pulse compared with R.D.X. and PETN. Consequently the main disadvantage of seismic detection is that when explosives are available they are not satisfactory over short ranges, and those that are ideal are virtually impossible to obtain however the figures below

(Numerical Example:

Consider the use of shotgun cartridges. These have a charge approximately 1.5cm long, and a burning rate of about 500m/s. Consequently the burning time is 3×10^{-5} seconds. With a velocity of sound in limestone of 3500 m/s, the shock pulse would have a length of 10 cm. Assuming that the length of the pulse is negligible provided it is less than about 5% of the total distance, a minimum range of about 2 metres is available)

show that if the energy output of these cartridges is sufficient, and if a suitable means of discharging them is available, they may be usable. I would be interested to learn if anyone has satisfactorily used these cartridges for seismic work.

(ii) Farmer Brown and Co. may not like ounce charges of R.D.X. going off on his property every hour or so.

(iii) Seismographs are heavy, since the inertial mass may easily be 20 or 30 Kilogrammes.

(iv) A sound transducer capable of putting high output into rock may be difficult to make.

Comments on this Section: The size and weight of the seismograph precludes the use of shock waves in cave detection. However, with a suitable transducer, the reflection method is a fairly simple one for use in the field.

MEASUREMENT OF CHANGES IN SPECIFIC GRAVITY

Basically the mean specific gravity of an area determines the local acceleration due to gravity, g.

Neglecting local changes due to inhomogeneities in the crust, the acceleration at any latitude L, and height h in metres above sea level is given by:

$$g = 980.616 - 2.5928\cos 2L + 0.0069 \cos^2 2L - 0.0003h \text{ cm/s}^2$$

However slight alterations are induced by the presence of air spaces in the rock. An instrument to detect these small changes is called a gravitometer. One such, suitable for amateur construction, is the Cavendish Pendulum. In view of the size, weight and complexity, and hence price, of this and similar instruments, they are not really suitable for use in detection by speleological societies, and consequently I shall not cover them any more fully in this paper. Any person considering experimenting in this field is recommended to read the article on the Cavendish Pendulum in the "Scientific American" for September 1963, pages 267-280.

MEASUREMENT OF CHANGES IN MAGNETIC SUSCEPTIBILITY

In this section we shall consider the effects on the Earth's magnetic of a body of limestone and air. Now air is paramagnetic, limestone is diamagnetic, consequently there will be a slight bunching of the natural field lines about a cavity, a slight rarefaction about solid rock. Any caves will therefore show themselves by an intensification of the Earth's local magnetic field.

An instrument which will detect such changes in magnetic fields can be constructed about the Hall Effect. This is the name given to a phenomenon which occurs when a current flows through a thin strip of conductor in the presence of a perpendicular magnetic field: a potential drop is observed perpendicular to both the applied e.m.f. and the magnetic field. E.H. Hall carried out his original experiments in 1879 using copper strips, finding a perpendicular potential drop of less than 1 microvolt. It has recently been found, however, that this can be augmented by a factor of up to 10^5 by using semiconductors instead of copper.

Especially suitable are alloys of indium and arsenic.

The transverse current depends upon the normal current flow in the strip and on the field strength, while the transverse potential depends inversely

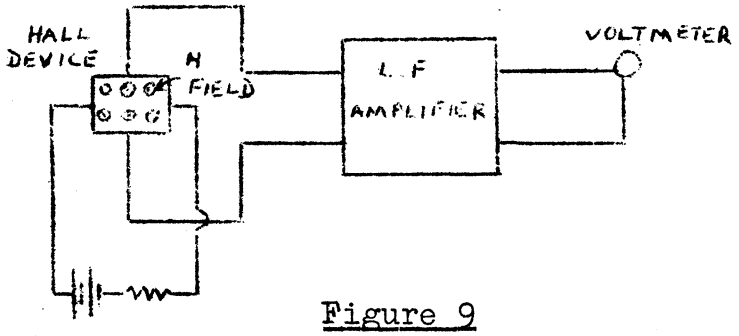


Figure 9
Hall Device as Fluxmeter

upon the thickness of the strip. It is common then to make Hall Devices only a few thousandths of an inch thick.

In Figure 10, a suitable amplifier for the fluxmeter is shown. The potentiometer R is used to adjust the output to zero in any given field. Changes in the field strength then show as positive or negative changes on the voltmeter of Figure 9 - positive for para changes, negative for dia changes.

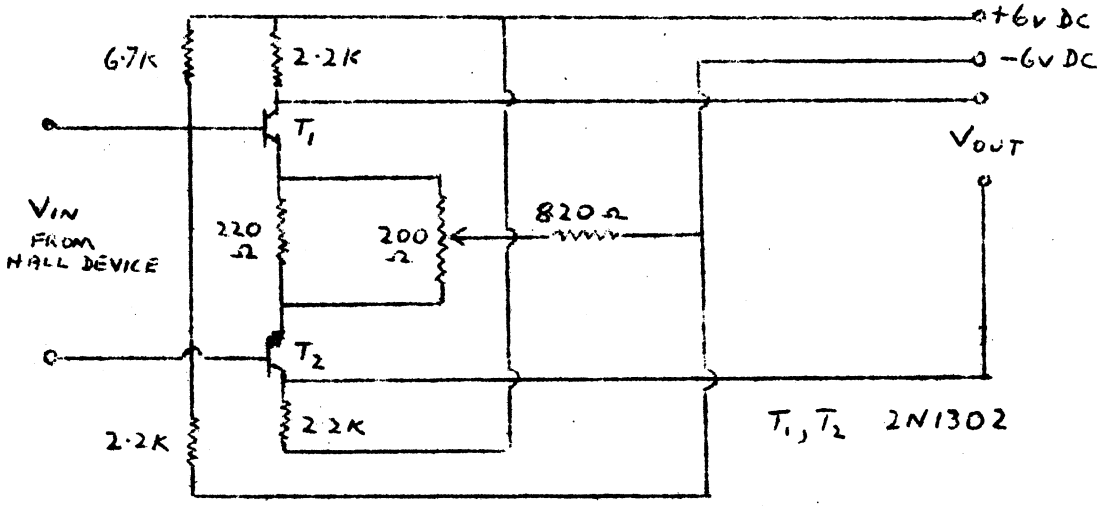


Figure 10
Amplifier for Hall Device as Fluxmeter

The magnetic field in the Hall Device may be intensified by using ferromagnetic strips overlapping over and under the semiconductor strip as in Figure 11.

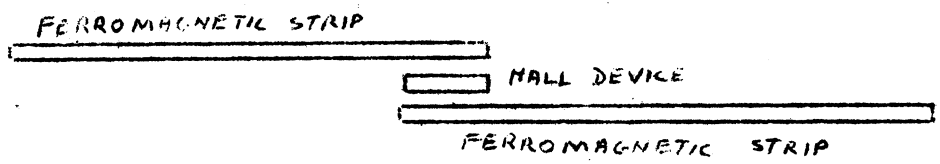


Figure 11
Flux Amplifier for Hall Fluxmeter

The probe can be "supersensitized" by the following steps:

(i) Adjust R for peak response as the probe is reversed in the Earth's field, and rotate to the null-position.

(ii) Adjust zero controls so that two peaks are equal in amplitude.

(iii) Rotate probe to null point.

(iv) Increase gain of amplifier until null potential is 5mV.

(v) Energise Hall Device with a.c. of 400 c/s, then increase current in Hall Device to 200 mA.

The sensitivity of the instrument at this stage is 2×10^{-4} gauss, or 0.1% of the Earth's magnetic field.

(The above figures are for the BH700 Hall Device, marketed by F.W. Bell, Inc., 1356 Norton Avenue, Columbus, Ohio 43212, U.S.A.).

With the ferrite intensifier described above, the field is applied along the long axis of the strips. The probe is aligned for use with the Earth's magnetic field and flux measurements made across a grid over the test locality.

To align the probe with the field lines, rotate it in horizontal and vertical axes until the maximum flux reading is obtained for the test point.

To minimize magnetic effects in the mounting, an aluminium theodolite mount would be suitable.

The advantage of this system is that apart from the expense of the circuitry it is very simple and cheap. The electronics can be built into a box 6" x 6" x 8" with a milliammeter at one end and weighing perhaps 5 pounds. Hence it is easily portable.

The disadvantage is that Hall Devices are at present unobtainable in Australia, and must be imported from the U.S., making them expensive.

Comments on this section: If a Hall Device such as the BH700 can be obtained, the above represents probably the simplest method of detecting and mapping caves from the surface possible.

It is however impossible to determine the depth with this system, so other methods must be resorted to for that.

MEASUREMENT OF CHANGES IN DIELECTRIC CONSTANT

The main use of dielectric constant is the measurement of capacitance. It is therefore feasible to use the test zone as an element of tuned circuit in an oscillator.

Figure 12 shows a Colpitt's Oscillator, for which the frequency of oscillation f is:-

$$f = \frac{1}{2\pi} \left(\frac{1}{LC_1} + \frac{1 + R/R_a}{LC_2} \right)^{\frac{1}{2}}$$

Suppose C_1 were formed of two long parallel wires strung across the test zone. A measurement of the resonant frequency is then a direct measurement of the capacitance, and hence dielectric constant of the area.

The advantages of this system are that it is physically very simple, merely requiring a Colpitt's Oscillator, several yards of wire, and a 200 volt d.c. power supply.

The disadvantage is that mathematically it is very complicated, and determining the difference in K between limestone (8.5) and air (1.0006) may be extremely difficult.

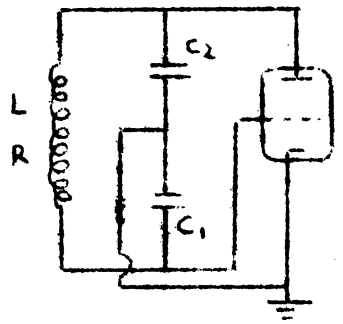


Figure 12
Colpitt's Oscillator

SUMMARY

Over the previous pages we have considered ten feasible methods for detecting either caves themselves or the more general case of an interface between changes of medium. Of these ten, the simplest is that using the Hall Effect to detect changes of magnetic susceptibility. This is not to say it is the most convenient - that is probably the parallel wire method under "Conductivity". The parallel wire method can accurately detect and map caves over an area only limited by the experimenter's power supply, and measures the depth simultaneously.

My own opinion is for the parallel wire method, followed by the Hall Effect method and radio reflection with phase detection ranging.

I would welcome comments from persons interested in this field who can reach me care of the National University Caving Club, P.O. Box 4, Canberra, A.C.T., 2600.

SOURCES OF INFORMATION

J.B. Clark	Physical & Mathematical Tables.
F.W. Constant	Theoretical Physics.
A.J. Dekker	Solid State Physics.
Encyclopaedia Britannica	
G.P. Harnwell	Principles of Electricity and Magnetism.
E. Norman Lurch	Fundamentals of Electronics.
Scientific American	September 1963 and July 1965.

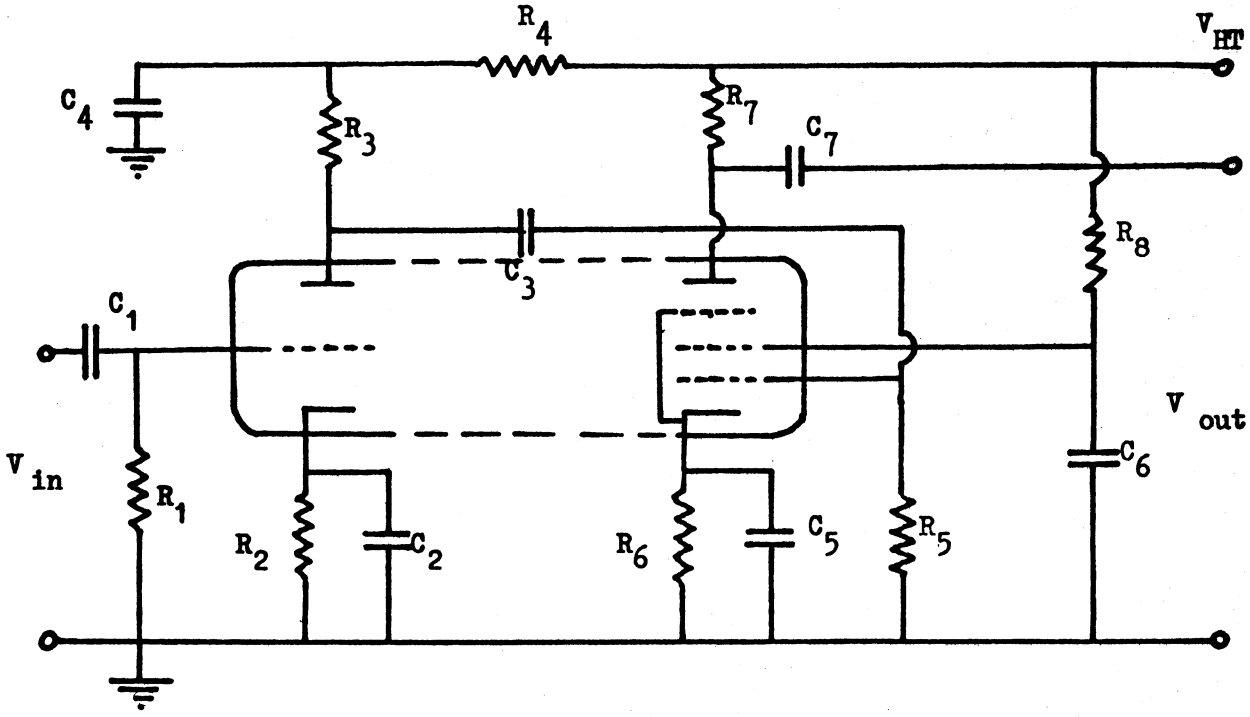
APPENDIX A

NUMERICAL DATA APPLICABLE TO THE ABOVE

Property	Limestone	Air	Units
Specific gravity	2.6	1.29×10^{-3}	grammes/cm^3
Refractive index at 100 Kc/s. (n)	2.92	1.00	
Coefficient of reflection at 100 Kc/s. (r)	0.24		
Resistivity (p)	$4 \times 10^4 - 7 \times 10^4$	10^{12}	ohm-cm.
Conductivity (σ)	2×10^{-5}	10^{-12}	mho/cm.
Dielectric constant at 100 Kc/s. (K)	8.5	1.0006	
Magnetic susceptibility at 100 Kc/s. (X_m)	-10^{-5}	3.65×10^{-7}	emu/gm.
Velocity of sound at 0°C.	3500 11480	331 1087	metres/sec. feet /sec.
Wavelength of 100 Kc/s	1.03 (L_1)	3.00 (L_o)	kilometres.

APPENDIX B

A SIMPLE HIGH GAIN AMPLIFIER



C_1	0.1	µF	R_1	12	Kohm
C_1	10	µF	R_1	680	ohm
C_2	5000	pF	R_2	68	Kohm
C_3	16	µF	R_3	8.2	Kohm
C_4	50	µF	R_4	680	Kohm
C_5	16	µF	R_5	47	ohm
C_6	0.1	µF	R_6	2.5	Kohm (10 Watt)
C_7			R_7	6.8	Kohm
			R_8		

Valve is a 6GW8 triode-pentode

V_{HT} = 300v d.c.

V_{in} = 0.1v p-p

Maximum V_{in} for no distortion = 0.6v p-p

Normal V_{out} = 150v p-p

Normal gain = 63.5 dB

APPENDIX C

THE TRANSMISSION OF RADIO WAVES IN LIMESTONE

When electromagnetic radiation passes through a medium of finite conductivity it is attenuated. A measure of this loss of amplitude is given by a factor called the skin depth which is constant for any given material, and is defined as the distance in which the amplitude of the wave is attenuated to e^{-1} (0.378) of its initial value, and hence in which the intensity (actually measured by the receiver) falls to e^{-2} (0.136).

$$D = \frac{1}{(\sigma \pi u f)^{\frac{1}{2}}}$$

D is skin depth
u is permeability of free space, i.e. $4\pi.10^{-7}$
f is frequency in cycles per second.

Consequently, in limestone the following values apply:-

f		D	
27	Mc/s	2.38	metres
8.5	Mc/s	3.84	metres
3.7	Mc/s	5.86	metres
100	Kc/s	35.6	metres
10	Kc/s	112.8	metres
1	Kc/s	356	metres

Therefore, at high frequencies, any signal received over a distance in excess of a few metres has almost certainly been preferentially transmitted through minor cracks and fissures in the rock, and, although the results will be consistent and reproducible, they will only be accurate, or even predictive, when the direction of the fissuring within the limestone is precisely known.

****

ADDITIONAL COMMENTS BY AUTHOR

CHANGES IN CONDUCTIVITY:

1. The depth coverage using the equipotential method is usually about 10% less than wire spacing.
2. The field strength used should not be greater than 2.5 volts per foot of wire separation.
3. For measuring the equipotential line I have been using a Model 8 Avo with a sensitivity of 50 micro-amps.
4. The way you take the measurements is to have the meter connected between two movable pegs, put one of the pegs in the ground between the two wires and then search for a position with the other peg so that the meter gives a zero reading i.e. both pegs are now on a equipotential line. The next step is to shift the rear peg out beyond the front one to locate the next equipotential point. And so it goes on till the whole of that equipotential line between the two wires has been found. The succeeding positions of the pegs are of course surveyed so that the equipotential line can be plotted on the map. The pegs are then moved across a reasonable distance and the next equipotential line plotted in a similar way. Polarisation of the pegs is not usually a problem with this method because the leap-frogging method of moving the pegs tends to cancel its effect out.
5. Working with wet soil is usually a problem because it effectively shorts the circuit and you can't get underneath it to get reliable readings.
6. The easiest way to attach the two outside wires to the ground is of course to put in tent pegs every ten feet or so and just tie the wire to them. However if you're in straight out limestone outcrop I've found it best to actually tape the wire straight to the rock. It's still better to get them into soil if you can so even if you have a pocket of soil in the rock then so long as the soil is not separated from the rock, put the peg into this.
7. The traces I have generally been working on are just over 300 feet in length and 180 to 250 feet in width, giving a depth maximum of between 150 to 220 feet.
8. A further experimental figure is that to get straight equipotential lines in homogeneous rock. To achieve this the test length should be at least 1½ times the test width. Otherwise the equipotential lines tend to curve as if the outer wires were more like point sources.

9. The average spacing between successive peg readings would be about 20 feet.

10. To avoid interferance from a water-table, the depth of penetration should be reduced by bringing the two wires closer together.

11. If one looks at a section of the rock end on to the two wires then the area of rock traversed by the current turns out to be approximately a square with rounded corners so that the depth penetration is about 10% less than the separation between the two wires. It also means that you can plot equipotential lines as close to the wires as about 5% of the separation.

12. The smallest cave you can detect gets larger as you go down because of bias towards the surface. The smallest cave I have been able to detect about 30 feet from the surface has been about 2 feet across. I think that at about 100 feet the smallest cave would be maybe 5 to 10 feet across and deeper than 300 feet you definitely wouldn't see anything less than 10 feet across.

****

A REPORT ON METEOROLOGICAL CONDITIONS IN WYANBENE CAVE NEW SOUTH WALES

I. Wood *

This paper was first considered when lodging my application to attend this Conference. At that time I felt that I might be in a position to present a short paper should the Conference organisers need papers or require a "fill-in" in their programme. I was somewhat dismayed to find myself allocated a definite time slot in the programme, as I did not find time to fully analyse the material in the intervening period. So rather than present a full scale paper on the Meteorological conditions which prevail in the Wyanbene Cave, I am merely going to report on the work which has been carried out so far, present the results, point out some of the more obvious features and make one or two postulates.

The study of meteorological conditions in Wyanbene Cave is a project of the members of the Metropolitan Speleological Society. I am collating and analysing the results for them. There have been two meteorological studies carried out so far, one in May 1967 and the other in February, 1968. Both were taken over 30 hour periods. The graphical results are depicted at the end of this paper. Information collected regarding moisture content in the cave atmosphere has not been included due to lack of space. Wet bulb temperature readings were taken during both studies however.

The surface stations consisted of automatic recording Thermographs, Hydrographs and Barographs, standardised at the beginning and end of each study with the instruments used in the cave stations.

The cave stations have been manually operated over the full 30 hour period, the reason for selecting such a period being to observe the Diurnal and Semi-diurnal atmospheric cycles, should they reflect their presence in the air movement inside the cave. The equipment used in the cave station has been of necessity more sensitive and accurate than the surface station due to the fact that variations in meteorological conditions are much smaller in magnitude within the cave than their surface counterparts. In these studies, the instruments used were: a 10" dia. Aneroid Barometer reading in inches of mercury to three decimal places; a mercury in glass Fahrenheit thermometer reading to 2/10 of a degree and estimatable to 1/10th;

* University of New South Wales Speleological Society

Sketch shewing the position of the

Caves south of Braidwood

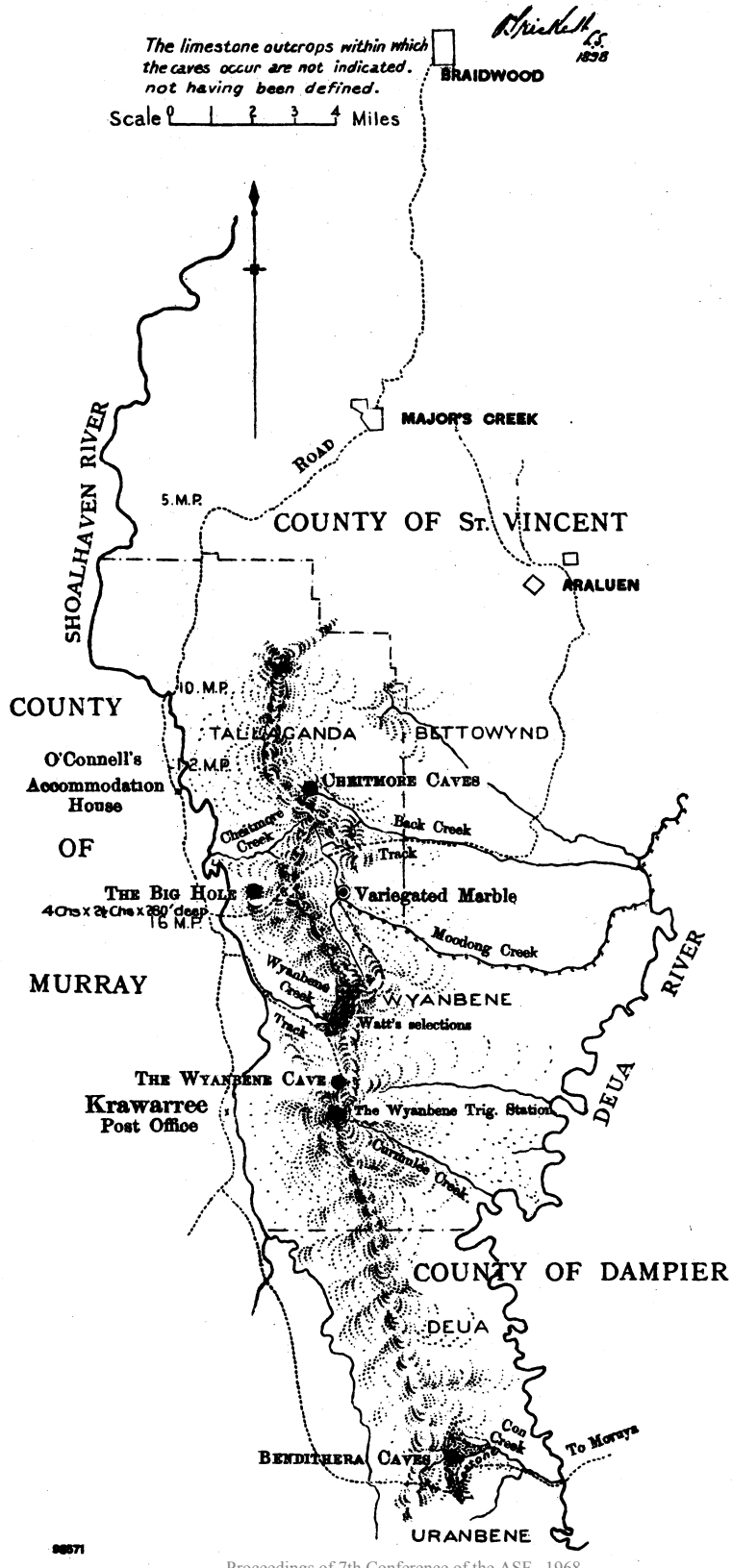
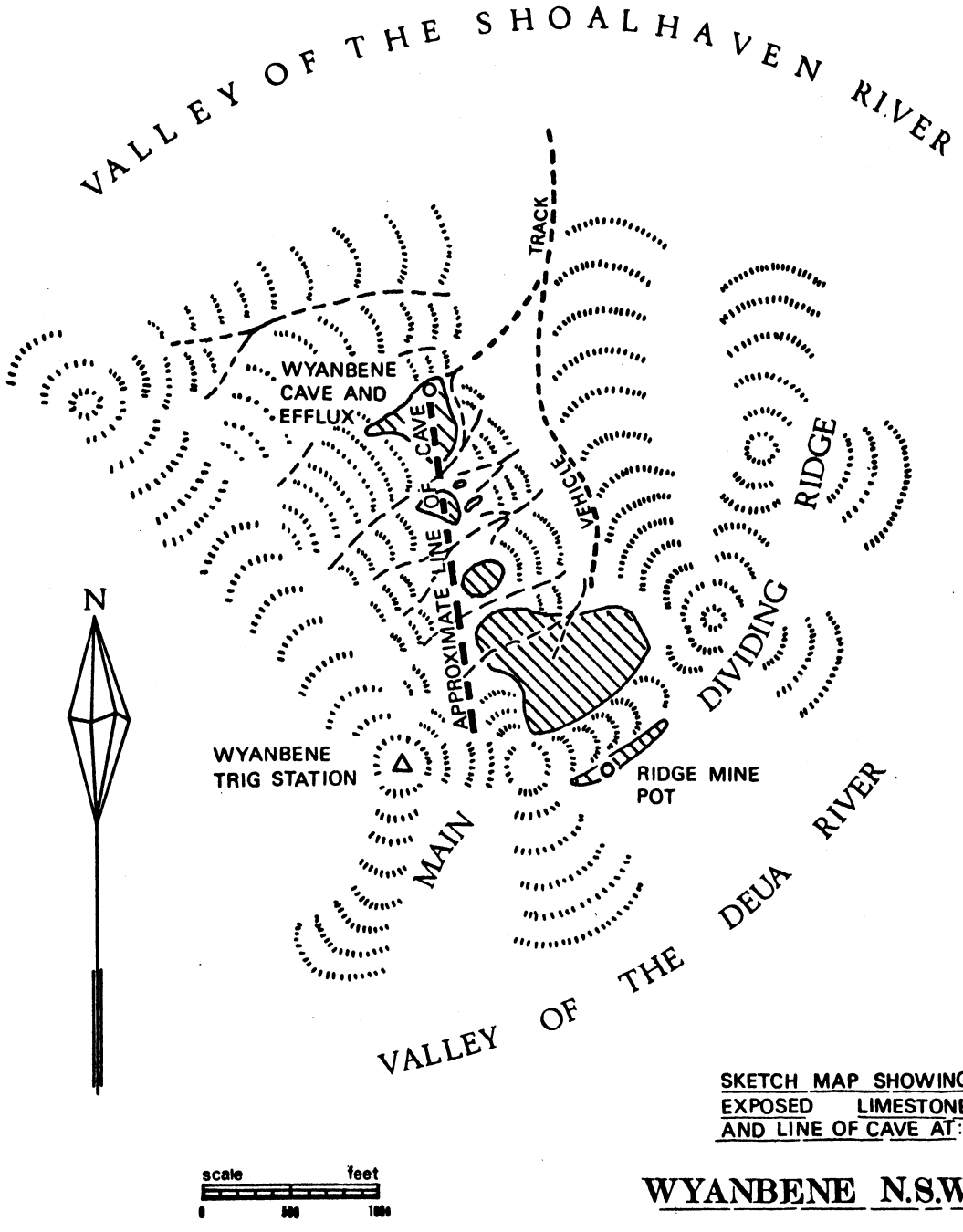


PHOTO-LITHOGRAPHED BY W.A. GULLICK, GOVT. PRINTER, N.S.W.



SKETCH MAP SHOWING EXPOSED LIMESTONE AND LINE OF CAVE AT:

WYANBENE N.S.W.

and a Sling Psychrometer. The 10" Aneroid was standardised against a Fortin Mercury Barometer before and after each study. The mercury in glass had been standardised against an Australian Standards Laboratory thermometer.

There are severe limitations in the instruments used and the methods of recording. The automatic recording instruments are very insensitive and produce results which are often difficult to interpret. They really only indicate trends occurring in surface conditions.

The major limitations underground are derived mainly from the recording and not the instruments. The fact that observers spend some time in close proximity to the instruments brings about undesirable effects. Body heat is transmitted to the instruments via fingers and breath whilst recording and can alter values in excess of the variations occurring naturally. Consequently, whilst care is taken not to handle instruments, to make observations rapidly, and to place observers sufficient distance away from the instruments, the limitations to the results remains a continuing unpredictable hazard. To obtain more consistent results would require equipment far more sophisticated than that being used at present. Apart from the difficulty in obtaining such equipment, the finance required would probably preclude any moves in this direction.

The Wyanbene Cave consists essentially of a single river passage punctuated with a series of chambers along its length. There is only one known entrance, that being situated above the Efflux. The limestone is of Silurian origin overlain with conglomerates and shales and forms part of a series of limestone deposits trending approximately North-South, 25 miles south of Braidwood in the Southern Highlands district of New South Wales.

The ridge containing these limestone deposits forms the divide between the watersheds of the Shoalhaven and Deua Rivers and rises to a height of 3600 feet above sea level. The Shoalhaven Valley to the west falls gradually to 2400 feet and the Deua Valley falls sharply eastward to a height of 800 feet above sea level. The entrance to the cave occurs where the limestone exposes itself in a ridge running northwest into the Shoalhaven Valley. Southward the limestone again is exposed in the main ridge facing the Shoalhaven and contains Bushrangers Cave and other small caves. Evidence of limestone on the Deua side of the divide is indicated by a series of dolines and limestone cliffs high on the ridge. The only other major cave apart from the Wyanbene Cave - the Ridge Mine Pot - occurs at the base of these cliffs, close to the Wyanbene trig station (see map). This is a vertical pothole having a maximum depth of 112 feet. Other dolines and minor depressions occur along the main line of the cave.

Meteorological observations were taken at the "Keyhole", a constricted area of approximately 12 square feet some 200 feet into the cave. Air velocities were taken in the Keyhole using two anemometers, one having a range 10-500 f.p.m. and the other 100-2000 f.p.m. Air flows below 10 f.p.m. were recorded as "low". Dry and wet bulb temperatures and atmospheric pressure were determined some 20 feet away in open cavern space so that air movements would not affect readings.

The maximum velocity of air recorded on both occasions was approximately 1250 f.p.m. although the directions of movement were opposite; in May 1967 the direction being inwards, and in February 1968 being outwards. The two graphs exhibit similar trends of fluctuating velocity in that they have periods of approximately 24 hours.

Cave dry bulb temperatures show a similar periodic trend, although not so apparent due to the smaller variations in readings. The maximum and minimum temperatures recorded in the first study were 56.5°F. and 53.5°F. respectively, a variation of 3°F. The maximum and minimum temperatures recorded in the second study were 61°F. and 57°F. respectively, a variation of 4°F. Ambient maximum and minimum temperatures observed in the first and second studies were 62°F. and 28°F., and 98°F. and 58°F. respectively. The first study was therefore taken under quite cold conditions and the second under hot conditions.

Plots of the variations in cave pressure are shown. In study one, the maximum pressure reached was 30.12"Hg and the minimum 29.96"Hg, with nodes at approximately 6 hour intervals. A general fall in pressure is indicated. In Study 2, similar pressures are observed, the maximum being 30.05"Hg and the minimum 29.90" Hg. Nodes again appear at nominal 6 hour intervals, however they are not so evident. A rapidly falling pressure gradient is quite evident.

Surface pressures in both studies show similar trends and values to those observed in the cave.

Normal diurnal and semi-diurnal cycles are evident in both sets of readings.

- - - - -

As stated above, both surface and cave pressure recordings exhibit semi-diurnal and diurnal cycles (with periods slightly less than 24 hours). It is evident that the trace of pressure within the cave exhibits a phase shift of some 1½ hours, i.e. the nodes of maximum and minimum pressure occur up to 1½ hours

later in the cave than they do on the surface. This phenomenon was observed in the caves of the Nullarbor Plain where a phase shift of $\frac{T}{8}$ or $1\frac{1}{2}$ hours also exists. It is interesting to note that the same phase shift can be observed under widely different cave conditions; the river passage of moderate dimensions at Wyanbene and the enormous caverns of the Nullarbor. Investigations into such parameters as ratio of cross-sectional area at observation point to average cross-section or to distance from entrance to point of measurement could prove interesting.

Dry bulb temperatures on the surface and in the cave show a one to one correspondence in both sets of observations in that variations in surface temperatures are reflected in the recordings of cave temperature. It is of interest to note the $4^{o}F$ variation and lack of time lag in the second study. Here the direction of air flow was outward. Air moving through the cave has presumably passed along at least 2800 feet of passage sometimes in low, wet crawlways and other times at very low velocities across large chambers. It would be reasonable to expect virtually no variation in cave temperature and considerable time lag if air drawn from the surface enters at the far end of the cave. It is possible, of course, that air bleeds into the cave at several points along its length, probably in the high avens. It should be pointed out though, that the trend in the plot of cave dry bulb during outflow is less obvious than during inflow and is undoubtedly due to the fact that air entering the cave from the efflux entrance has had less time to be affected by frictional contact with walls and water surfaces.

A relationship appears to exist between atmospheric pressure and cave air velocity in the May, 1967 studies, where a coincidence of nodes of minimum pressure is reflected in the velocity graph. The relationship is not apparent in the February study. Further investigations would be required to establish if any relationship exists between these two conditions.

Movements of air into and out of the cave are quite extensive. Calculations based on the velocities recorded and the cross-sectional area of the test point yielded volumes of air passing the test point in any 24 hour period to be 18,000,000 cubic feet and 16,200,000 cubic feet in Studies 1 and 2 respectively.

As this cave resembles in many ways the long, narrow slot model of single entrance similar to the Nullarbor Plains deep caves, application of Wigley's theory to the results, allowing 10% porosity for the Silurian limestone (arbitrary figure) and allowing an average cross-sectional area of 500

square feet, yielded a cave length of approximately 9 miles. As the known length is in the order of 3000 feet with a maximum of possibly 4000 feet, then this result becomes obviously impossible. Alternatively, using the known length of 3000 feet, calculation yields an average cross-section of 6000 sq. ft. It appears then that this theory of cave breathing can be discounted.

Consideration can be given to the relationship between movements of air in the cave and surface temperatures. In the May 1967 study, rises in outside temperature produced a negative inflow of air into the cave until at maximum surface temperature, airflow into the cave had stopped and a slight reversal of direction had occurred. Similarly in the second study, increases in surface air temperature induced increased outflow of air from the cave. Falls in surface temperatures increased inflows and decreased outflows. Further, in considering the relationship between the relative temperature differences between surface and cave conditions, we find that in the second study the surface temperature is always in excess of cave temperature and the flow is outwards, indicating that the cooler, denser cave air is moving towards the lower entrance. In the first study, the situation is more complicated. The surface temperature in this case both rises and falls above and below the cave dry bulb temperature. For most of the study it is in fact equal to or below cave temperature. During this period flow is inwards. For the short period where surface temperature exceeds cave temperature by a few degrees, airflow was weakly outwards. Again this inflow can be attributed to warmer, less dense air rising upwards in the cave, drawing air into the cave.

At this stage it appears that the most obvious relationship explaining the movements of air in Wyanbene Cave is that of convection. However, this presents difficulties in that only two entrances are known, both located at the efflux. Recent discoveries in the cave have located large, high chambers. One in particular, known as the Gun Barrel, is a cylindrical vertical tube of unknown height, the floor of which consists mainly of shales indicating that the overlying shales have been reached by upward mining of the limestone. On the surface, several shallow dolines lie along the direction of the cave, however their exact location with relation to the cave remains to be determined. The Ridge Mine Pot and its associated dolines is also within contactable distance of the furthest points of the cave. This cave, essentially a high aven, has two side passages. One trends north, directly towards the Wyanbene Cave, the other west. Again the exact location of the cave is yet to be determined, however, it would be reasonable to postulate that surface drainage collected in

the vicinity of Ridge Mine Pot feeds the Wyanbene System, and that air enters the main Wyanbene Cave through as yet unknown or impenetrable entrances in the Ridge Mine Pot, associated dolines and other dolines along its strike, producing a system of airflow in the Wyanbene Cave based on the convection of air. This may be modified in part by the fact that the cave conforms in some respects to the Long Slit Model giving rise to the significant lags in observed cave pressures.

ACKNOWLEDGEMENTS

I wish to thank Ian Nankivell and the Canberra Speleological Society for their assistance in supplying a Traverse of the Wyanbene Cave and information on topographical features in the area; Professor J.P. Morgan, School of Mining and Geology, University of N.S.W. who arranged for the loan of the School's meteorological equipment; and the N.S.W. Department of Mines for the location map used.

REFERENCES

Carne & Jones 1919 Limestone Deposits of N.S.W. N.S.W. Dept. of Mines. pp. 218, 327.

Jennings, J.N. 1963 Ridge Mine Pot, Wyanbene, New South Wales. Helictite 1(2):16, 17 and map.

Wigley, Wood & Smith 1966 Meteorological Aspects. Mullamullang Cave Expeditions 1966 : C.E.G.S.A. Occ. Paper No. 4 : 40-46.

Wigley, T.M.L. & Wood, I.D. 1967 Meteorology of the Nullarbor Plain Caves. Caves of the Nullarbor. Speleological Research Council Ltd. pp. 32-34.

DISCUSSION

Mike Webb: You mentioned the possibility of further entrances up the hill; this can possibly be substantiated because there's a rockfall chamber which runs back, about 1400 or 1500 feet into the cave, where we found a rather battered collection of bones, probably a fox, and there appears to be no way a fox could have got that far from the known entrance.

John Dunkley, S.U.S.S.: From your map do I take it that Ridge Mine Pot is on a different watershed from Wyanbene?

Ian Wood: Yes, there are a series of pots on the Deua River but the only one which has broken through to the surface is the Pot itself.

Glenn Hunt: That valley which runs north and south, it hasn't got an active stream in it has it?

Ian Wood: No, with the Wyanbene Cave the water runs right out to the entrance then disappears into a rock-pile and doesn't run out the actual efflux itself, except in very wet weather. The area outside is swamp for a few miles and a stream does rise about a mile away, but I don't think it has been proved that this is the rising of the Wyanbene Cave.

Glenn Hunt: In connection with Wigley's paper, he used this time lag between the outside air pressure and the air movement to support his theory that a large volume of the air rushing in and out of the cave is from the bulk of the rock itself, that is from the pore spaces within the rock, and yet here you've got the same, well a similar time lag and yet in very compact limestone. How would you interpret this apparent contradiction?

Ian Wood: I haven't determined exactly what the time lag is and will have to analyse the results more fully. But there must be porosity in the rock, and the walls of the cave must have friction, and the flow in the cave is very turbulent due to the very rough nature of the cave, so I think we could expect a time lag due to many factors. In this case though, the porosity of the rock would probably be fairly neglible.

Ted Anderson: It seems clear that you ought to be able to fit Tom Wigley's theory to this if you recall that he correlates rate of change of external pressure with the velocity of air flow in or out of the cave. Looking at your graphs, I can't see any correlation between the air movement and the rate of change of pressure. As you pointed out there is a much more obvious correlation between air movement and temperature which is quite significant, but I think it's rate of change of temperature which is more important, and I wonder whether you have plotted this out?

Ian Wood: I did do this on the first set of results just after I took them. There is one point I should mention here by the way, and that is that this is a project

Ian Wood cont: which is for the Metropolitan Speleological Society, and most of their club members have done a lot of the observational work, in fact all the first set; I was present during the second set but it is really the members of M.S.S. who are carrying out the project.

Ted Anderson: I could also add perhaps that I know how much effort is involved in getting sufficient data for just that small blackboard. It also seems clear that not too much will come out of this without more data. The present data, is over quite reasonable periods relative to what we have done on the Nullarbor, but the conditions at the time were too stable over that period to give any indication of what the variations over that period might be; the movement is in for the whole of one period and out for the whole of the other.

Ian Wood: No, I don't think so; we're interested in actual variations; the fact that it never goes into the "out" phase doesn't matter. You have the peaks and valleys irrespective of where the base-line is. On several occasions on the Nullarbor we didn't get any change from outwards to inwards flow and this had very little bearing on the calculations. Actually the relationship of these nodes with other factors - nodes in the other observations is what matters. It's purely relative.

Ted Anderson: I think the important thing is that you have complete reversals in the rate of change of pressure and these, if I remember Tom's paper correctly, fit in quite well with the reversals in velocity.

Glenn Hunt: I think another factor which we have got here, is the effect of temperature, which is an overriding effect, and superimposed on this we've got the effect of pressure. Although Tom's model doesn't quite fit this, as temperature is the overriding influence, the graphs show that external air pressure does have some effect on air movement and the fact is that these delays or lags which were registered in Mullamullang are also picked up here. You have got some correspondence between the situation at Mullamullang and the situation at Wyanbene, although the importance of the two factors has been reversed; in Mullamullang external air pressure is the most important, and here, temperature.

Ian Wood: If we go a little bit further and look at the plot of actual air movement, and these are very much stylised as the points are scattered over a wide area, there do appear to be minor peaks which also occurred in the Mullamullang observations. We did think at the time that

Ian Wood cont: some of these minor fluctuations and sudden reversals could be due to the Helmholz pulse influence as well, but there wa n't enough information there to confirm this. The same minor reversals have occurred in this set of readings also.

Glenn Hunt: I presume that no simultaneous observations have been made at the entrance of Wyanbene Cave and at Ridge Mine Pot to see whether you get this flow-in at Ridge Mine Pot and flow-out at Wyanbene Cave?

Ian Wood: We would like to do this but unfortunately we don't have the capacity, we just don't have enough equipment to do it. It would require three complete sets of instruments which are difficult enough to get now, unless somebody is kind enough to donate some.

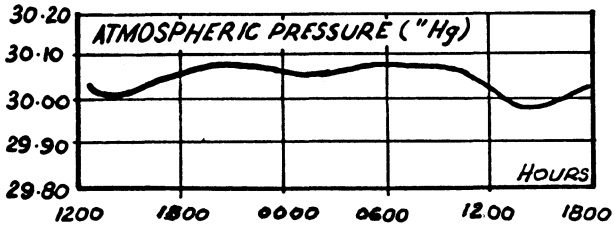
Yes I think this would be a worthwhile venture to undertake. One of the major problems in doing this sort of work is that you have to take the readings over about a thirty hour cycle to get all the possible variations, and to get people to sit in caves for 3 or 4 hours in a drafty, narrow passage when the temperature is about 55°F. and the velocity 20 miles an hour is getting extremely difficult and the number of starters is getting less and less. I can assure you that you get extremely cold.

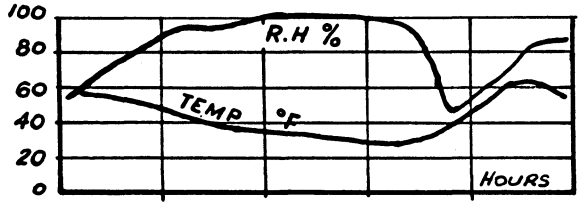
Question: Has any work been done at the junction between the two caverns?

Ian Wood: No, I think this is nearly impossible. Although I've not been past the point where we took the observations I know there are large chambers with vast amounts of mud and one section is a water-crawl where you are well and truly in the water and getting the instruments through these places would be just about impossible.

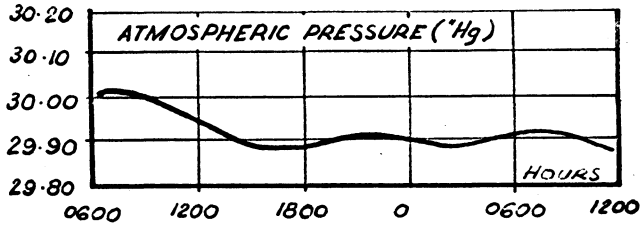
****

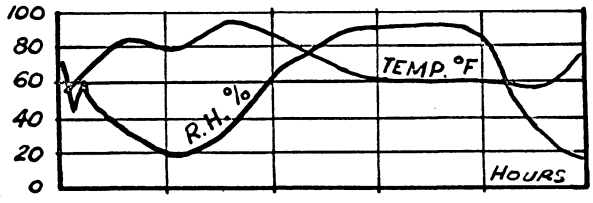
MAY, 1967



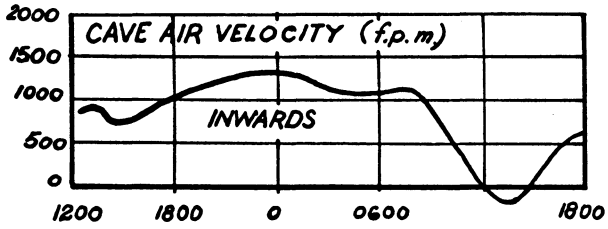


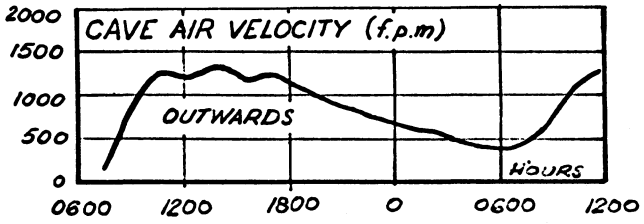
FEBRUARY, 1968

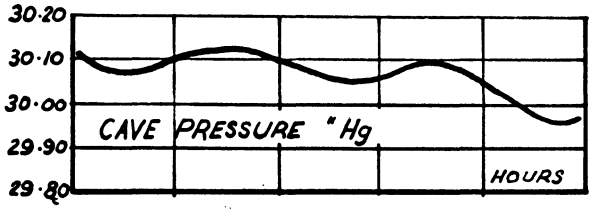


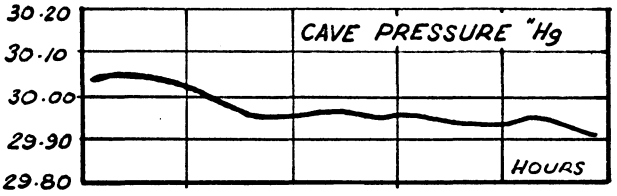


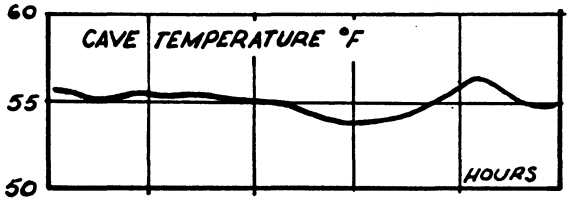
SURFACE CONDITIONS

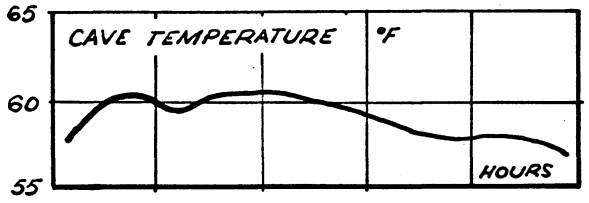












CAVE CONDITIONS

GRAPHS: Showing surface and cave Meteorological Conditions on two occasions in Wyanbene Cave, N.S.W. Viz: 17-19th. May, 1967 (Winter) & 16-17th. February, 1968 (Summer)

OBSERVATIONS recorded by members of the Metropolitan Speleological Society.

IDW 12.68

DROUGHT AND MURRAY CAVE, COOLEMAN PLAIN NEW SOUTH WALES

J.N. Jennings, I. Nankivell, *
C. Pratt, R. Curtis, J. Mendum

ABSTRACT **

The drought culminating in 1967-8 opened watertraps in Murray Cave to permit the re-exploration and survey in January 1968 of a further 1000 feet of the main passage. Previous explorations of which oral tradition persisted are now known to have taken place in 1902-3 and some details of the early visitors are presented. The characteristics of the extension are predominantly epiphreatic in nature and about half of it is episodically functioning in this way at the present time; the watertraps along it are inverted siphons in the strict sense and located at the sharpest changes in cave direction. The exploration limit consists of a rockfall beneath a doline, which appears therefore to be in part a collapse doline. Beneath two other dolines the cave has no sign of collapse, though tall avens reach towards the surface; these dolines are due to surface solution only. The forward part of the cave is overlain by a short, steep dry valley; the relationship between the two remains problematic but there is good reason not to regard the dry valley as the determinant of the cave's location. The evidence is now stronger for an earlier hypothesis that the cave was formerly the outflow cave of nearby River Cave, a perennially active stream cave. It also seems likely that the episodic activity of Murray Cave is due to flood overflow from River Cave.

The hydrological regime of the cave is compared with precipitation records of the nearby stations. The episodic flow through the cave does not require an abnormally wet winter; it can follow fairly quickly after complete emptying of the watertraps and approaches an annual event. Opening up of the watertraps is a much less frequent event. The available data do not permit determination whether a series of low rainfall years is necessary or a single pronouncedly dry year is sufficient. On either count it seems probable that the cave opened up twice or more times between the known occasions of 1902-3 and 1968 in the period 1909-53 when the cave was infrequently visited.

* Canberra Speleological Society

** Full paper published in Helictite 7(2) : 23-38 (April 1969)

THE MACROFLASH - MARK I

E.G. Anderson *

I thought I had best make some vague sort of introduction to this "thing" with a few general comments about cave lighting on a slightly serious sort of vein. What I am mainly interested in is large caverns. The problem originally arose with the caves out on the Nullarbor and this is the type of work I have got in mind; I am not particularly bothering about small cave shots.

Before we go very much further I'll give a few general comments about cave lighting. There is always the old traditional way of course, which was used on the 1963 Nullarbor trip, and which involved getting about 10,000 trogs with 10,000 troglamps and set them wandering off about the cave, leaving your camera open for about 20 minutes. Although this is very effective it does not produce quite the results most photographers are after.

Basically, there are two ways of approaching this problem of lighting a large cavern. One is stringing a lot of small light sources around the cavern and adding them all up, or, you can go about it by having one, or perhaps two, much larger sources, and the effects are very much different. I have never used this multiple-source technique myself, and it is interesting to note that most of the people who have used it seem to be the professional photographers. I don't know whether there is any significance in this or not, or whether they're just brought up that way. I believe myself that the single or perhaps double large source system is, for the average cave photographer who has not got a professional background, a much easier system to handle. The actual placing of these light sources is nowhere near as difficult as when you're trying to balance up the light from six or seven flash bulbs or carbide lamps or what-have-you spread around the cave. So from here on I'll drop the multiple technique, as I say, I have not used it myself. Nevertheless I will say that with a very experienced photographer in this technique, he can I think, produce far more interesting photographs if he employs this lighting skilfully.

The problem of lighting a cave or a large cavern is somewhat different to the normal sort of problems that studio people come across. If you like to think of it this way, you are virtually working inside out. If you look at the books on lighting for photography they show you how to light objects

* Sydney University Speleological Society

within a room or studio or something. For example, I remember one book introduced the subject of lighting by showing its different effects on a very simple object, namely an egg, and showed how the lighting could produce various modelling effects.

Now, I have the feeling that when you're photographing a large cavern you're inside the egg trying to photograph the inside of it, and this is a totally different problem. The problem of getting the proper perspective is totally different when you are working from inside something, and are trying to photograph just the walls, or even the ceiling.

When photographing in a cave and trying to get a three dimensional effect by means of shadows, it is generally conceded that you must get your light source away from the camera. This is fairly obvious: if the light is near the camera there is very little shadow, the three dimensional effect is lost, and the photograph looks very flat. Fortunately in caves like the Nullarbor caverns this is not impossible - you've got a fair bit of room to work - you can get the light away from the camera, which is more than you can do in most New South Wales caves.

However there is a much greater advantage than this, although it hasn't been taken too much notice of in the past, and that is that by placing your light appropriately near the walls of a cavern, perhaps a little behind the camera or in some cases in front depending on the particular cavern, it is possible to achieve a much better than normal distribution of the light down a long thin cavern. This is not as impossible as it sounds when you remember the effect of the relief on the walls.

The walls are not smooth but have indentations in them, so if you place your light quite hard against one wall, much of the light grazes that wall and you can control the amount of reflection off it in the foreground of the photograph. You therefore avoid overexposing the foreground excessively. Putting it another way: imagine the projections in the wall, each throwing a shadow. Now if the light is so placed that the shadow from the first bump is actually long enough to reach the next bump then there is a very small amount of light reflected off that wall. The whole wall is virtually in shadow. By this means you can control the actual spread of the light down the cave.

There is of course the effect of reflected light from the other wall of the cave bouncing from side to side but it does not travel too far because of the square-law effect. The light drops off as the square of the distance, so this

means that in large caverns such as on the Nullarbor where the width can be 50 to 80 ft, the effect of this reflective light is much reduced. However in some cases it is sufficient to spread the light right down the cave, and fairly evenly.

The problem that then arises of course, if you are using a single source to throw light 400 ft or more down a cavern is that you need a light source with a pretty high intensity. There have been various ways of overcoming this problem in the past. One of the simplest I have seen, apart from the standard flash powders of course, used a similar form to this except that you just use magnesium powder and potassium chlorate. This is a somewhat explosive mixture, it produces an enormous amount of smoke (considerably more than the "Diprotodon"), and unless you mix it on the spot it is a pretty highly dangerous sort of thing to be carting around in any quantity. But it's worth thinking about if you are doing what cavers seem to be doing these days, that is, rushing off to the Nullarbor for the weekend and not having a Diprotodon handy. Magnesium and pot. chlorate will at least give you some photographs.

The next obvious advance of course is the "Diprotodon", burning a continuous jet of pure magnesium powder, which increases the safety factor somewhat - eventually - after a lot of painful development. I took a diprotodon of ours on the 1963 trip but I was always so busy opening shutters on all the cameras and operating them that I had someone else to operate the diprotodon - I think that was wise judging by the language used at the moment of ignition.

There is another method for lighting caves which I came across in an American journal and it had all sorts of fabulous claims; one of these was that it reduced the smoke problem of burning magnesium by some considerable percentage & it was claimed to be somewhat cheaper. This is the use of "Thermite" powder, which is a mixture of aluminium and iron oxide. It is commonly used for welding railway lines. I think the fact that 99% of the energy is put out in the form of heat, not light, is sometimes disturbing. However I decided to investigate this and as I was going out to the Nullarbor after the Perth Conference we loaded up the Land Rover with many pounds of aluminium and Thermite powder from hardware stores all across the country. I had done some previous tests at Naracoorte to determine the colour temperature of the powder and discovered it was somewhere down near 2000° Kelvin. This is a little bit disturbing, because by the time you put enough blue filtering in front of the lens to bring it back to somewhere near normal you need quite a few pounds of Thermite powder to achieve the same result as you do with a

diprotodon. However it was reasonably successful and some of the best photographs I've got of the Nullarbor were done with this Thermite powder. It was cheap, and the smoke was reduced, I think, to a fairly definite extent.

That brings us now to the next possible method, and that is the Macroflash. This amazing device causes no smoke whatsoever, has a variable intensity - you can chose whatever guide number you wish quite simply, and the principle of the thing has been used for a long, long time by many people. That is, simply burn your magnesium in a sealed, controlled atmosphere and achieve ignition by electronic means. You then have complete reliability. This of course sounds all very expensive but my particular Macroflash only cost me about $5.00 to construct.

A Macroflash actually consists of a deep aluminium bowl with six PF100 flashbulbs mounted with their bases around the rim and pointing towards the centre of the bowl. The battery-capacitor power supply is mounted on the back of the bowl. It's quite simple really, all you need is a small fortune to spend on bulbs. The battery consists of two nine volt batteries in series and the capacitor is 1000 uF. That is about all there is to it.

As an example of the guide number, this particular model with six bulbs in it and using Kodachrome **X** gives a guide number of 390, that is, 100 ft at F4. This is usually all that is required in the Nullarbor caves because although most of the cave shots are a lot longer than this you don't want to over-expose the foreground, and the dropping off of light in the distance helps to give the perspective effect. When you look down a cave you normally expect it to get darker in the distance.

DISCUSSION

Evalt Crabb, HCG: I take it the bulbs are connected in parallel and that enables you to get away with using an 18 volt battery. Normal practice with multiple flashbulbs is to connect them in series. I would also question your guide number: I am quite used to using these bulbs, that is PF100/97's with 50 ASA film and generally rate these with a guide number of 270 for a single bulb and use this figure in many industrial applications. You may be using a lower guide number because of the lower reflectance of cave walls.

Ted Anderson: I got my figures from two sources: one was the leaflet which comes with these things, and I checked these figures with two other sources of literature, one a general pamphlet on all of Philips bulbs and these seem to agree fairly well. I must admit I forget now whether the guide number was in feet or in metres but anyway the results obtained bear out that I was getting the guide number I was using.

Evalt Crabb: The last thing that I want to raise is a fairly nebulous idea I have built up while you were showing the slides and that is the different effects of the diprotodon and this thing. I noticed the Macroflash seems to overexpose the foreground rather more than the diprotodon. I think perhaps the answer to this is in the characteristics of film emulsions and in particular, reciprocity departure. The diprotodon gives quite a long exposure time and I wonder if you break through a certain "inertia zone" (as far as exposure level goes) evenly right through the length of the cave with the diprotodon. You don't have this departure with the flash bulbs as the exposure time is close to that for which the film is balanced. You will get the more even lighting with the diprotodon and perhaps a diprotodon with a lower level of lighting will give a rather more even lighting throughout the cave than the earlier ones which gave out quite a blast of light.

Ted Anderson: There is another factor which comes into this I think, and that is that the particular diprotodon I was using was somewhat different to the present small models: the flame of that thing was about 3 to 4 feet long, about 3 feet high and a foot thick (the unit was built like a sub-machine gun), and in fact you could no longer consider it a point source. This may help to distribute the light better.

Alan Hill, CEGSA: What was the exposure of those early models? They were only about a second or two exposure time weren't they? The thing emptied itself almost instantaneously.

Ted Anderson: Mine didn't! Mine burnt anything from one second to half-an-hour ..... after it was dropped on the ground.

Alan Hill, CEGSA: For exposure times greater than 15 seconds, the reciprocity failure colour shift is towards blue for Daylight Kodachrome II. The diprotodon has a colour temperature below daylight which creates a shift to pink, so the two colour shifts tend to compensate each other.

Evalt Crabb: I do think a line that may be worth following is to now use different films with the diprotodon. You can't measure this reciprocity departure with these funny light levels and under such peculiar conditions. Perhaps by sticking mainly to the Kodachrome series of films, we may in fact be using the worst films for this application. I would suggest this could be a line worth experimenting with.

****

CAVES AND THEIR VISITORS

THE AMATEUR IS A USEFUL ASSET TO SPELEOLOGY

Major R. P. Webb *

AIM

The aim of this paper is to demonstrate that the amateur speleologist is of considerable importance in the development of Speleological Science. In fact it will be shown that without his assistance, the accumulation of scientific knowledge of caves would be severely retarded.

DEFINITIONS

Before starting out to prove this statement, it is necessary to define the terms used so that there will be no misunderstanding caused through ambiguity.

For the purpose of this paper, Speleology is defined as a complex amalgum of disciplines embracing the branch of any science which deals with the properties of natural cavities in the earth's crust or the inhabitants of those cavities.

From the above definition, when mention is made in the paper of 'the scientist', the person referred to is anyone with a genuine scientific interest in caves or their contents, who has had formal education in one of the Speleological disciplines. He, then, is the 'professional' even though he may receive no remuneration for his labours, as opposed to 'the amateur' referred to in the title of this paper.

The amateur is a member of the proletariat of caving society who has had no formal training in the sciences but whose interest in caves has been created by any of a variety of non-scientific stimuli; physical exercise, the spice of danger, escapism or sheer idle curiosity.

Between the black and white of scientist and non-scientist, there are a number of people who might be described as grey. It is not proposed to deal with this category of person here, not because their contribution to speleology is insignificant, but because, for a simple person like the author, they are an unnecessary complication which does not affect the validity of the thesis.

INTRODUCTION

There has been, in the past, a tendency for the scientist caver to view non-scientists at best somewhat patronizingly and at worst as a form of vermin which slowly and inexorably reduce all caves to smooth walled sewers of no scientific value. The eventual outcome may be as bad as is feared, but

* President, A.S.F.

the deterioration can be slowed down and much additional data gathered if the reserve of energy available in the form of the amateur caver were harnessed and used efficiently. To demonstrate this, it is proposed to deal with the subject in the following manner:

Firstly, to outline some of the problems which the scientist meets in his quest for information;

Secondly, to demonstrate that lack of knowledge rather than wilful destructiveness is at the root of many of the amateur's transgressions; and

Thirdly, to suggest a solution which could help to correct the problems outlined in parts one and two.

These arguments will demonstrate the place of the amateur in speleology and how professional and amateur can work together to their mutual advantage and for the benefit of speleology as a whole.

THE PROBLEMS OF THE SCIENTIST

In speleology, there are a number of problems confronting the scientist in his quest for data which are not always present in other fields. For example, it may be perfectly satisfactory for the geologist to wander about the countryside collecting rock samples on his own, though I understand he prefers to employ students to carry his specimens, but if the speleologist is to gather his specimens and samples, he will need assistance before he can even enter all but the simplest of cave systems. In all probability he would prefer to do his field work in company with a fellow professional of the same discipline, but, when one considers the breadth of speleology and the limited number of speleologists, the chances of achieving this are very poor.

Time, closely allied with chance, is another problem. Looking for caves is like looking for a needle in a haystack and a great deal of time may be lost before underground investigations can even begin. The most fertile field for the speleologist is the virgin cave and these do not grow on trees, if you will pardon the metaphor. Not only should the cave be in pristine condition for best results, but, depending on the subject being investigated, it must also be the right sort of cave. A dry cave, no matter how full of bats, is useless to the hydrologist and a smooth walled river cave is of little use in the study of crystal formations. Therefore, the chances of a scientist discovering a new cave containing the conditions which he needs are reduced to perhaps once or twice in a lifetime. Science cannot wait that long. Many searchers are required and the more the merrier.

As in geology, before any new discoveries can be fully written up, their location must be surveyed and mapped with at least reasonable accuracy. Only in this way can perspective be obtained and the true import of the discovery revealed. There will be a requirement therefore, to survey caves and no matter how learned the scientist, he cannot hold both ends of the measuring tape at once. He will need assistance for this task as well.

An essential for the progress of any science is free interchange of knowledge and ready availability of existing documentation. Speleology although a broad field, is restricted in the sense that it interests a comparatively few people. Because of this, public libraries and similar institutions do not contain a great wealth of information of use to the speleologist. What is needed, and what in fact have been established wherever there is active interest in caves, are societies and caving fraternities of one type or another. In order to be viable and worthwhile, these societies need office bearers who need little if any scientific knowledge to carry out their tasks effectively. Though we often find the scientist officiating in various capacities, these jobs take time and detract from the most efficient use of his hard earned knowledge. These tasks are best fulfilled by amateurs.

THE PROBLEMS OF THE AMATEUR

The problems referred to now will be those caused by the amateur as well as those which confront him.

There is, of course, a 'ratbag element' among cavers as in any other field of human activity. Coping with this problem is beyond the scope of the paper and apart from personal example and active discouragement of vandalism, probably little can be done to overcome it. It is ventured to suggest however, that most damage to caves is caused inadvertently through accident. We cannot avoid the latter, but much can be done to alleviate the former. Lack of information and, what is more to the point, lack of knowledge of how to gain information, is the amateur's greatest problem. In the following section a method of overcoming this problem will be suggested.

The problem of maintaining interest in the amateur is one which is perhaps not often considered. Some schools of thought would propose that the amateur should be discouraged rather than encouraged. The thesis proposed here is that the amateur is a useful asset to speleology and it therefore follows that effort spent in maintaining his interest would be a sound investment.

The number of cavers, both amateur and scientist, who are active members of caving clubs and societies are few when compared with those who have enjoyed caving in the past but have drifted away to other interests. Those drifters represent loss of capital and most of them drifted because they became bored. Having crawled through a few dozen caves, all the others are much the same from the point of view of the superficial observer. What is needed is to open the eyes of the tyro, to show him the wealth and diversity of caving and provide him with the wherewithal to continue to widen his horizons. Above all, he needs an interesting and worthwhile task to do and the knowledge of how to do it. This will keep him out of mischief and ensure that he does not commit sins through ignorance; more importantly, it will maintain his interest in caving.

THE CURE

We have discussed a number, though by no means all the problems confronting the professional and the amateur speleologist. Now let us see what can be done to solve these problems. There is no panacea for all these ills, but the cure suggested could go a long way to giving speleology more vitality with which to face the future. When the problems of the amateur and the scientist are considered together, the two sides of the argument are seen either to generate each other or to be counter-balancing. The answer then lies in unification of the two sides to cancel out the opposing forces and reach a state of equilibrium.

The scientists' problems are basically caused by two things: the need for assistance; and the ignorance of the amateur. The amateurs' problems are caused by the need to be usefully occupied in an interesting task and by the need for information. The scientist needs labour, the amateur needs information. Conversely the scientist has the information and the amateur has labour to offer.

In the past there has been haphazard use of the resources available. The scientists have clamoured, often unheeded, for people to go on trips to gather water samples or dig for bones. The amateurs have attended occasional lectures and read what literature is available in the layman's tongue to broaden their knowledge. This process is primitive and can only maintain speleology at subsistence level. What is needed is the proper organization and effective use of the information and manpower available. It is suggested therefore, that societies, as controlling bodies, should produce and follow regular training programmes in various branches of speleology. They should enlist the assistance of the scientists in their group to give a series of lectures designed to educate the amateurs in the basics of

various branches of speleology. The number of lectures and their content will vary according to the subject, (five or six might be a reasonable number spread over three months) but they must be pitched at the layman's level, they must be made as interesting as possible by the use of slides, specimens and other training aids, and they should be designed to teach the amateur those things which will make him a useful field assistant and fire him with enthusiasm to learn more.

When a series of lectures is complete, or even at appropriate stages during the series, field trips should be organised to consolidate the theory taught and demonstrate its practical application. Not all the subjects will interest everyone, and that is as it should be, but it could be almost guaranteed that the scientist would reap, as a reward for his labours, sufficient enthusiastic and capable field assistants to enable him to carry out his work effectively. In any case, the results will be directly proportional to the effort invested.

CONCLUSION

The paper has demonstrated that the scientist has problems which can be largely solved by the provision of a semi-skilled labour force. The scientists and their accumulated knowledge are the life blood of speleology and it has been shown that the amateur caver can supply, with training, the labour force which will keep the pulse of speleology throbbing. Without the amateur, speleology would die or at best subside into suspended animation. With the amateur, developed and guided by the scientist under the auspices of the societies, speleology can develop into a dynamic science. It is therefore submitted that the amateur is a valuable asset to speleology.

DISCUSSION

John Dunkley, S.U.S.S.: I think this paper is probably one of the most significant I've heard at an A.S.F. Conference and also one of the most significant ones I've read, because I think you have put your finger right on it when you say that there is a tendency for scientists to think that their non-academic fellows aren't terribly qualified to help them. At the same time I think it's also true that a lot of unqualified people are rather hesitant to undertake any work in co-operation with some of their more qualified

colleagues because they don't know where to start. I'd rather hoped when I saw that this was going to be a paper at the Conference, that we might be able to have a few people here who could give a supplementary paper on how the amateur can be of assistance in various branches of speleology. I do rather hope that we might be able to get some discussion going and although we haven't got the papers at this Conference or the personnel to present them, I hope that in the future we might have a few more papers to carry your lecture on in greater depth in particular sciences.

Roly Webb: I rather felt that various individuals have made efforts in various directions; not only this but most things that happen in speleology are extremely haphazard - speleologists are extremely haphazard people. We were speaking about poor old Edie Smith today, she was one of the greatest of these haphazard people. She hated any form of formality and so forth. I don't know whether we, as her children, have inherited or whether it's just inherent in human nature, but it seems to me that if only we could get organised, not necessarily as a military body, but at least get organised in some fashion or other we could do so much more in the limited time available to us.

Elery Hamilton-Smith: If I could just take up John Dunkley's suggestion: firstly, to comment on what I think is one of the real barriers and problems here, is the ineptness and incompetence of certain scientists. And I suspect that there is a very major area of problem on this side rather than on the speleos side.

I've been involved in a very large number of moves where various speleo societies have tried to make use of scientific personnel. Some of these have been extremely successful and some of these have been extremely unsuccessful. Speleology is, in itself, a fairly highly specialised science, and the fact that a guy is a biologist or a geologist or something doesn't necessarily mean he knows anything about speleological science and it may be that he's a bloody sight more ignorant than 90% of the amateurs. He's also quite likely to be a peasant-type person in regard to ethical issues or conservation issues: I could name one certain well known biologist who cleaned up about two-thirds of the population of Victoria's rarest bat in one fell swoop with one cartridge, and probably cleaned up about 2000 juvenile Horseshoes with the next few cartridges. I could continue but I won't - it makes me sick.

So I think there's a problem here and we have got to think in terms of a real two way system. We can contribute to helping the scientist adapt his special know-how to the special issues of speleology.

Just picking up briefly on John's point, I won't stay on my feet too long or it will be a second paper already: the amateur has made an enormous contribution to cave biology in Australia already. Most specimens have been collected by amateurs - I don't quite know where Roly rates me in this (Roly: Dark grey!). In fact, apart from the work I've done, a very large number of people, some of them are here today, have collected a very large number of specimens, many of which have been pretty significant and valuable specimens. There has been an awful lot of donkey work go in on some of these by various speleos and this certainly, is one major area of co-operation.

Alan Hill, C.E.G.S.A.: I feel that Roly has created a slightly new line of policy with this talk. I was impressed by it myself, but I do feel that to this point in our discussion we have been generalising a little bit. I was wondering if we could bring the discussion at this stage to what positive steps we can take to bring this about. We are looking for a more direct interchange between the scientific people and our own people. C.E.G.S.A. does try to follow a little bit of this policy line: in our general meetings we try wherever possible to get scientific people along to give us talks - we ask them to us - one at a time. Out of this we get most interesting, learned people. They realise they're amongst amateur types and they can speak down to us and we can communicate with them. This is only one way. I'm wondering if there are any other ways people could put forward here that we could take advantage of later on. Another effort that C.E.G.S.A. put over, with very mixed success I'm afraid, a few years ago: we tried to introduce a summer school at one of the camps over a period of several weekends not too far out of Adelaide, where we tried to bring in authorities on a mixed variety of scientific and topical subjects on caving. Unfortunately it didn't have the following we would have liked but there must have been some success out of it.

Now could I ask if there are any other positive ways that we can help to create this interchange?

Ted Anderson, S.U.S.S.: One thing that came to mind out of what Roly has said was this business of field days and practical aspects of this, apart from the lectures and what not. I have myself found in the past that when you ask some scientific person to come along and give a lecture on his particular field of activity, there is often a lot of questions as to how we speleologists should conduct ourselves in regard to this activity when we are in a

cave. What Elery has said is that very often the chap himself is very ignorant of the practical aspects of caving anyway, and he finds he very often can't answer these questions because he's not aware of what already goes on on caving trips and in caves, and therefore can't very easily make suggestions for improvement or otherwise. I think the important aspect in this instance is to have field trips and bring the person along, which provides the opportunity for interchange both ways. It's very much better if the scientist can see what we are doing, the way we go about what we are doing and at the same time take the opportunity to point out the errors and make useful comments. I think this practical side of it is not only likely to produce better results but it has the advantage of attracting possibly more of the cavers along. I know that S.U.S.S. have very often had difficulty in getting sufficient numbers to this kind of lecture because many feel they are just not interested in this particular branch of science, whereas if they happened to be on a caving trip anyway, there's a far better chance of them picking up a bit of additional knowledge.

Roly Webb: The trouble with the odd lecture that we have had in the past is that it's been isolated - we have had only one on any particular subject in a year, perhaps two or three. There has been no follow-up to it, and the lone man coming along hears a lot of stuff, some of which he finds interesting and some of which goes over his head. Then, because there is insufficient information he can put this to no good use and in the due course of time, sometimes very short, he forgets it all. So we're now back to square one again. The scientist has gained nothing from the effort he has put into his lecture - except perhaps a cup of tea - so we haven't achieved anything other than that time has passed. This is why I suggest that the scientist, and we needn't be to hard in our definition of "scientist": any of you blokes with a B.Sc. and doing active field work in a scientific fashion could look at yourselves inwardly on this, and could gather under your wing a group of people and train them. And use them. Whilst you might find some cavers that are not interested because they may have had insufficient experience or may be purely interested in the physical side of the sport, you will find some who are, and although a lot of this is just going to flow off the backs of some people like water you're going to get something back for your efforts. You're going to get some value out of the work you've put into it, and you will then be able to carry out your own studies more efficiently. You can't, obviously, hope for a 100% success or even 50% but you are going to get some, which is better than none, which you are getting at the moment.

Glenn Hunt, S.U.S.S.: I want to extend what Roly has said and what Elery has said. Most people have been talking about direct co-operation between the scientist and the amateur. However there are several cases in which the amateur makes his casual observations on a cave, records these, and the scientist gets to know these through society journals etc. We can't underestimate the importance of this. For instance, S.U.S.S. was fortunate enough to have for a member for a while Ed. Ongley, a geomorphologist, and John happened to take him into Serpentine Cave at Jenolan and he was so excited by the meandering of the passage that he wrote a paper, and a very high powered paper at that. But he wasn't satisfied with just Serpentine, he then proceeded to ask around amateurs to see if people could tell him where further examples of this sort of thing occurred, and he was lucky in a couple of instances. I think that this indirect filtering of information to the scientist from the casual observer or amateur caver is very important. So this business of educating the amateur into observing certain features of caves in which scientists might be interested, or what is more important to then go and record these in trip reports or something like this. I think this is one of the main fields of co-operation between the amateur and the scientist.

Roly Webb: Yes, you've touched on a subject which I didn't touch on and which I think is vital though rarely happens, and that is trip reports; and not just "We went there, we went in, we came out, and the following people were present". Trip reports to be of any use should be as detailed as possible and should record everything you see whether you think it's important or not. Sooner or later a scientist is going to need some information on a cave on a certain subject and he's going to delve through papers and, lo-and-behold, he finds that you've written something of unique value to him. Whereas otherwise its just lost and wasted and you have wasted your time except that you might have got a bit of exercise.

Elery Hamilton-Smith: Perhaps if I could add another comment here: there is a body called the Cave Research Foundation in the United States which is in fact a pretty high-powered research organisation, but contains a number of rank amateurs on Roly's definition, but nevertheless they have turned out in the last few years an incredible amount of really top-level scientific work. They have a publication which is very pertinent to the present discussion and which I think any society who is interested in the research side of things should see. It's, I think, called "An Integrated Cave Research Programme". It outlines the total field of research possibilities in speleology in a very clear, simple and useful way. It would be well worth looking at at society level. These sort of publications don't seem to be readily

available in Australia. There are three special bulletins put out by this organisation and this, I think, is No. 2.

Roly Webb: As a suggestion, I think it would be a great idea if A.S.F. were to organise the importation of a quantity of booklets of this type which are of great use, and which people don't know about, and have them available to people as and when they want them. It's the sort of investment on which we couldn't very well lose out.

****

SCOUTING AND CAVING

Dean Da Costa *

The object of the Boy Scouts Association presenting a paper at this conference is to make clear our reasons for promoting caving as an activity and also indicate where we hope various speleological societies can assist us.

It may be of interest to those present to learn a little of the history of the Cave Exploration Group in South Australia and its association with scouting.

In 1954, Elery Hamilton-Smith, a Scout Commissioner, and Captain J. M. Thomson prepared for a caving trip to the Nullabor with a party of Rover Scouts. As a preliminary "breaking in" exercise, the group arranged a trip to Curramulka Caves with another identity Dave Taylor. Further trips to Curramulka were subsequently arranged by the Rovers together with some Bushwalker Club members. As a result of this, it was decided to hold a meeting at Boy Scout Headquarters attended by those interested parties such as Dr. Hossfeld, Elery Hamilton-Smith, the Rover Crew, Bushwalkers and university students. The Cave Exploration Group (S.A.) was formed at this meeting. Scouting people have maintained an interest in this Group and I am sure a similar interest is maintained by scouting with societies interstate.

The section of the Scout Movement which can benefit most from caving activities is the Senior Scout Section which caters for boys aged between 15 years and 18 years. This is the age where a boy is adventurous and is looking for challenging activities. The scope for these today in the framework of scouting is tremendous. Rock climbing, scuba diving, caving and gliding are but a few. Throughout all adventurous activities we are very mindful of our Association's aim which is "to develop good citizenship among boys by forming their character - training them in habits of observation, obedience and self-reliance - promoting their physical, mental and spiritual development". We try to achieve this aim by the use of the Scout Method which, guided by adult leadership, presents activities largely in an outdoor setting which gives the boy an opportunity to accept responsibility and acquire competence, self reliance, character and qualities of leadership.

* Assistant District Commissioner, Senior Scout Section, Boy Scouts Association (South Australian Branch).

Associate Member Cave Exploration Group (S.A.)

Caving is an ideal "tool" for us to use in the Scout Method since it presents situations which can develop most of the characteristics the Movement fosters. Competence and self reliance certainly figure prominently in caving activities and given the right guidance, character development comes from an appreciation of natural beauty and a desire to conserve this beauty.

Basically, the caving which Senior Scouts will be involved in will be "sporting" caving as distinct from the more serious "scientific" caving. There is however, a place for more serious caving in Scouting particularly in the field of mapping. An example of this was demonstrated recently when a Rover Scout conducted a comprehensive and accurate survey of Sand Cave (S29) at Naracoorte for his Rover Project Badge and the resultant map has received high praise from experienced Cave Group men. With the general increase in the education standard of young people, the geological aspects of cave exploration also holds appeal for many boys.

However, it would still appear that the main motivation for caving as an activity is the spirit of adventure and this has unfortunately led some inexperienced young men into trouble.

Ill trained and sometimes unsupervised groups have attempted caving with unfortunate results. In an effort to combat this in the field we are talking about, and also in a number of other fields, it is the current policy of the Senior Scout Section to approach outside experts for assistance.

With the wide range of activities available and the specialised skills involved, the Senior Scout leader cannot hope to be expert enough to competently lead his troop in every activity. The answer as we see it is to approach groups and societies who are well trained and experienced and either associate ourselves with them on particular activities or else seek their help in training our leaders. Taking caving as an example, it is realised that the training could not hope to make a speleologist of either the leader or the boy but it would make him aware of the factors involved, both in regard to safety and conservation.

The speleological societies can assist us in a number of ways with mutual benefits. Perhaps training could be given by the societies to our leaders up to the "sporting" caver level and certain caves set aside for this type of activity. Providing these caves were non tourist but still challenging, the adventurous spirit could be satisfied and caves which are of scientific value could then be avoided and thus preserved for further study by the "scientific" caver.

Scouting & Caving

At the present time, a large number of Senior Scouts are involved in caving activities and most are being guided in their caving by speleological society members. For example, in New South Wales an estimated 250 Seniors and Rovers went on caving trips in 1968 and the speleo society ran six speleologist courses during the year. It is quite possible many more boys than this were engaged in caving but due to the area organisation, it is not possible to accurately assess the total number. In South Australia, the interest is perhaps even greater. We have been informed of at least 18 troops who have been caving this year and the total number of boys represents 10% of our Senior membership.

This large number of people heading for traditional speleologist territory must naturally concern all societies and I can assure you it also concerns us. We realise that excellent relationships have been established with landowners and responsible Government departments by societies and abuse of privileges by uninformed groups could easily jeopardise these relationships. Consequently, we feel it is in the societies' interest to not only know who contemplates visiting caves they have an interest in, but also have some control over who goes where.

Our movement is quite prepared to co-operate with all speleological societies in this regard and consequently would like consideration to be given to these suggestions.

If courses in cave safety, leadership and conservation could be arranged by our Association for Scout Leaders and run by speleo societies members, the speleo society point of view in regard to conservation etc. could be accurately presented. Along with this, the societies could suggest suitable caves for the type of activity which suits us thus avoiding to a great degree the likelihood of jeopardising landowner relationships. With well informed leaders and, if the occasion demands it, speleo society volunteer guides, worthwhile caving can be undertaken. This could easily result in a lasting interest in speleology in some lads. Although we don't anticipate our caving activities would make speleologists of anyone, we certainly encourage any lad who shows interest in it to join a society or group when he leaves Senior Scouting at 18 or even while he is still a Scout. Over the last two years in South Australia five new CEGSA members have joined as a result of scouting caving - not a great influx but sufficient to indicate caving had enough appeal for some to want to pursue it beyond the scouting level.

In an effort to co-operate further with speleo societies, the movement is prepared to have a permanent liaison with them and attempt to channel all proposed scout caving trips through

it. This would mean we would advise the societies of dates and locations etc. and be guided by your opinions as to the desirability or otherwise of the trip. In this way, you can exercise indirect control by either advising us of your wishes or advising landowners or government departments of your wishes.

A combination of these things should produce an arrangement which would be to our mutual advantage - a challenging and useful training medium for the scouts and an assurance of cave conservation for speleo societies.

The Scout Proficiency badge system caters for a Speleologist Badge, the requirements being:

(1) Have taken part in at least five caving explorations under the guidance of an experienced leader, comprising a minimum of 20 caving hours. Produce log books of exploration.

(2) Discuss kit, including ropes and rope and metal ladders, belays and belaying and personal kit including clothes, boots, lights, food and best method of carrying food.

(3) Show a knowledge of normal safety precautions and of rescue organisations in own area. Demonstrate method of removal of injured person.

(4) Know the main principles of cave formation and describe two of the better known systems.

(5) Discuss geological and mineralogical aspects of fossilisation and formation of stalactites and stalagmites.

(6) During a caving exploration demonstrate:-

(a) Making the head of a rope ladder fast.
(b) How to climb up and down a rope ladder not less than 25 feet long.
(c) How to join two lengths of rope ladder.
(d) How to belay himself and work a lifeline.

From this, it can be seen that although a high standard is not required, the lad who does qualify for this is a fairly useful caver. It is also realised that some of the requirements may not be very realistic and there are probably some obvious omissions. Perhaps the updating of this award could be another helpful contribution by societies.

It is probably worthwhile considering using Senior Scouts who have qualified for this badge as major expedition helpers. There is certain to be some support role these boys can perform and will add some meaning to their caving. I am certain there is a role for these boys in activities such as digging and mapping. A major expedition such as Mullamullang needs a reliable support crew and capable sherpas. Boys trained along the lines as suggested and given encouragement from qualified speleologists could fill the bill.

I would like to leave you with these thoughts.

Is there a place in caving activities for groups such as ours on a sporting level initially?

Is there a place for selected Senior Scouts who show a greater interest in caving than the average and express a desire to do more serious work?

Finally, what is our potential if we encourage Scouts to go caving?

DISCUSSION

Ian Wood, U.N.S.W.S.S.: I'd like to ask you where you got your information regarding the New South Wales section. For example you state that in N.S.W. an estimated 250 Seniors and Rovers went on caving trips in 1968 and the speleo societies ran six speleologist courses. Which speleo society in N.S.W.?

Alan Hill, C.E.G.S.A.: I must warn you Dean, Ian is on a N.S.W. Co-ordination Committee for N.S.W.

Dean Da Costa: What I was going to do before I presented my paper was mention that I contacted my counterpart in each of the States and they sent me information. The information from N.S.W. was sent by a little better than my counterpart, he was the Headquarters Commissioner for Senior Scouts, Graeme Mitcham.

Ian Wood: I'd like to point out that the scouts now seem to think that they have now got enough information out of the N.S.W. societies and they're now running their own

training trips and taking off into the wild blue yonder, and not worrying about speleos any longer. We are getting the reverse action to you people in South Australia where they're moving towards a society. Here the Scouts want to get as far away as possible from the societies.

Dean Da Costa: If this is an official comment from N.S.W. I'd certainly present this back to Graeme Mitcham. This is one of the purposes for which I was told to come along here anyway; to find out whether there were any complaints and where the troubles were originating. If this is general in N.S.W., that Scouts having got what they want are then drifting away and going out on their own, then this is contrary to what we intended the whole thing to be. If it will do any good I will certainly relay this information back.

Elery Hamilton-Smith: I have a number of separate points again. Firstly, I can remember talking only a few years ago to Laurie Grenham of the New Zealand Boy Scouts Association. He has been both a speleo and a Scouter in, I think, every continent in the world now. I can remember him making the comment that in every continent no group is in such disrepute or does so much harm to caves as Scouts do. It strikes me that we're very lucky that so many positive moves are being made here by some of our own societies and by the Boy Scouts Association. Although N.S.W. has had its problems, like Victoria has had its problems, perhaps some other States too, very good progress has been made towards overcoming this. There has been some very close co-operation between the two parties concerned. So I'm particularly pleased with Dean's paper today as a pretty formal expression of the view-point of the Boy Scouts Association and like Roly's I feel it's a particularly positive and valuable one.

Secondly, the information in the third paragraph is to my memory basically correct. I can comment on the first trip to Curramulka which was a trip of six people, four of whom were Rovers or Scouters, another was a very famous ex S.U.S.S. identity, David Pegum, who may be known to some of the older members of S.U.S.S., at least by disrepute.

The next comment I would like to make is just to toss in a few points on the badge requirements which might be of some value as a starting point. The first of these is the reference to rope ladders, which is obviously an inheritance from Britain. I doubt if any of us seriously countenance the use of rope ladders in Australia. Secondly, in section (4) the choice of this word "cave formation" is a pretty unfortunate one. We have tended to get rid of this word out

of our own terminology and thinking, in that it's quite ambiguous. Some people use it as a term for decoration - stalagmites and all that, and some people use it as a term, and this is clearly the sense in which it is meant here, to signify the genesis of caves and the patterns of origins which develop. So this probably needs to be replaced by a term such as cave origin or cave genesis. I personally see only two major omissions. It's very easy to build this thing up of course but it is quite unreal as it is basically an introduction to the game and I wouldn't like to see it built up too much. However I would want to see the words "conservation" and "ethics" make an appearance in it somewhere. These are quite fundamental.

The last point, climbing up and down a ladder: I think this should always be in terms of climbing up and down a free-fall pitch, and a pitch where the ladder hangs against a wall. There's a very great difference, we all know, between these two operations.

The last comment on this whole paper is that I would like to see us look at this when the Federation Committee reconvenes, to look at what in fact can be done in terms of follow-up action by the Federation in an official way, and perhaps we might even be able to have some discussion on this with Dean while he is here. Secondly, I hope that from that Committee Meeting we will see copies of this paper get into the hands of all societies, including the ones not personally and directly represented here, and that it be drawn to their attention for discussion at society level. I think it's a very valuable step forward.

Andrew Spate, V.S.A.: In Victoria recently, and in A.C.T. some years ago, it has been said to me that there is a serious breakdown in liaison between Headquarters and local groups. Is this improving nowadays?

Dean Da Costa: I can only speak for South Australia of course, but it is quite good in S.A. due to the Headquarters Commissioner we have for Senior Scouts who makes it his business to be in contact with the troops and with the boys: they would almost all know him personally. This is almost impossible in other States where the numbers are so much greater.

Andrew Spate: Even the local districts don't seem to know what their boys are doing.

Dean Da Costa: I think this happens in a voluntary organisation where a Scout Master, say, decides to say "to hang with Headquarters". There is nothing much we can do about it if we don't hear about it. If we do hear about it, well, fair

enough, we can deregister them or something like this. This is our contribution to things, we can try to straighten out our side of things - this is obviously an internal problem we've got. If we can straighten this out we would like to get your co-operation in the other side of things such as advice on where we can go and so on.

Grant Gartrell: One of the chief problems we have come across is that we would like to look after the Scout groups but we are so few in number and they are so many that we can't really make a significant contribution all at once. They are going to have to be patient with us. We have found that if there is any attempt at helping scouts out, its not one or two scouts, its the fifty or one hundred who are suddenly very interested in coming along, and obviously no caving trip can be run on decent sort of lines with this type of thing. Fair enough for a lecture, but not for a caving trip. We got around this to some extent by changing the Constitution so that the number of visitors coming on a trip could be no greater than the number of members attending. This means that we can only keep a few of the scouts happy within the framework of our own organisation so it seems natural that they would want to choof off by themselves anyway, they wouldn't have the patience to hang around for a few years. If we can train scouts who come along and join the Group and actually be bound by our own Constitution, & who can go back and run their own trips under our Constitution, then we are getting them to help themselves. Of course this obviously breaks down if it grows too fast.

Just to change the subject while I'm standing up, regarding "sporting" caving: I notice we have been changing this word to amateur in one of the other talks, however I think that sporting caving is a valid type of thing and it is distinct from this amateur sort of thing in science. Casteret was a sporting caver and anyone who started caving from reading Casteret and who holds his breath for three minutes and plunges on single-handed into a syphon might get the wrong idea of caving, but this does seem to be one of the initial aims of caving as a recreation for scouts, the idea of taking up caving as a scientific pursuit seems to be quite separate. I think most of us do sporting caving at the weekends for relaxation, but while we are there we don't waste our time completely (not always), we try and do something useful while we are engaged in the sport, and if we carry it on long enough we get absorbed in these other interests and then when you're too old for the sporting side you carry on with these other things.

Dean Da Costa: On your first point Grant, one of the things that we hope to be able to do if we could is

to just train leaders to be competent to do cave leading and cave safety, and if you people could put aside certain caves, and I can think of a few off-hand down in the South-East like Brown Snake Cave - I doubt whether anyone would be using such a cave for scientific purposes, so if we set our lads loose on that to get rid of this exuberance and kept them away from any other cave of any value, would this take away the problem of having to supply cavers?

Grant Gartrell: If I can just reply to that, I don't think anybody, or at least I certainly wouldn't be game to, ... despite the nice way you said it, it does sound like signing the death warrant of that cave in that particular context. I don't think anybody would be game to do that. Even if the cave at present is suitable for scouts to choof through for a while it doesn't necessarily mean that it will always be so; there may be something turn up.

Alan Hill: I think Grant thinks your trying to knock a brick out of our walls.

Elery Hamilton-Smith: I think this is a pretty realistic suggestion, at least in some areas. I don't think I would go along with Grant's statement in this specific example, but in Victoria in particular we're very lucky, we have got a few good, really interesting, little caves that have been so wrecked that no-one can do any more to them; so, O.K., we can line up such a group of caves for this sort of thing. Perhaps its more difficult in other areas which haven't been bashed about quite so thoroughly, but nevertheless, I think the principle is a pretty good one because, sure, perhaps this means we give up five caves for sporting caving and training - it is better than having the whole damn lot used in the same way - which is what is likely to happen if there's not some sort of cave classification system adopted for cave use. This is in line with conservation policies in other fields - classification is a recognised principle of conservation of all kinds now, and I think this is therefore a suggestion that is well worth consideration. I think one of the slight dangers here is that if you train a guy to be a leader in one of these caves - OK - its not long before he makes the transformation himself that he's a leader for caves, stop. This I think would require pretty tight control because you can't in a short time train an experienced speleologist with the judgement which is involved in taking a moderately raw party into a tricky or dangerous cave. It's something where one develops judgement by experience not by a "pressure cooker" course. So I would hope that, sure, this scheme would be adopted, that it would be fairly tightly controlled, and that the people who were trained in this way would be encouraged to also become speleos themselves and develop this kind of

judgement through long experience. This would enable them, where it was appropriate, to move off into other fields of caving or other fields of cave leaders.

Mike Shepherd: It is dangerous to make the distinction as I think you have done here between caves of scientific value and non-scientific caves. I think all caves have some scientific value and if you do classify some as non-scientific it's more or less another way of saying "anything goes".

****

TRAVELOGUES

AUSTRALIAN STAR MOUNTAINS EXPEDITION

CENTRAL NEW GUINEA, 1965.

M.J. Shepherd *

The Star Mountains form part of the main divide of New Guinea close to the junction of the Papua/New Guinea border and the West Irian Border. The Australian Star Mountains Expedition, composed of six Europeans and seventeen natives, was the first group to explore the eastern Star Mountains, and to climb the highest peaks. One of its many aims was to gauge the speleological possibilities of the area, which were expected to be highly promising in view of the fact that the bulk of the eastern Star Mountains is composed of a Miocene limestone bed which is over 3000 feet in thickness. In addition, the mountains receive an annual rainfall estimated to be 150-250 inches, and much of the drainage is subterranean.

Many limestone areas with small dolines were seen in the foothills both to the north-east of the Star Mountains, and during the rugged week's journey from Telefomin to the foot of the mountains, but time and/or equipment was lacking for their investigation. The main limestone area in the mountains is a plateau at about 9500' bordered by 3-4000' cliffs to the south and the dividing range on the north. On the plateau a bed of marlstones and mudstones about 200' thick overlies the limestone, but the surface is interrupted by three huge dolines up to nearly 300' deep and half a mile wide, and in other places where the overlying impervious strata is thicker, by polje-like basins. All of these features receive influx streams. We had detected these massive dolines and basins on air photographs prior to the expedition and had decided to focus cave exploration in this area. Equipment was air-dropped to the plateau and we examined all the major dolines and basins. In no case did we discover any sizeable cave system, but we frequently encountered blockage of the influx passages by clay or boulders. In one doline and in many basins the streams simply terminated in muddy surface pools.

The highest part of the eastern Star Mountains, the Capella Massif consists of lapiés karst and is dissected by two major sets of joints. Whilst scaling the peaks a number of shafts (100 ft. plus) were observed. We examined several but found them to be blocked with glacial or periglacial material.

* Sydney University Speleological Society

The main surface drainage feature on the limestone is the Krom River, a tributary of the Ban River, which in turn is part of the Digoel River system in West Irian. The Krom River was dry for most of the five miles of its length which we examined, but it was seen that the river must flow at the surface periodically. We descended a number of shafts along the dry river bed, but again found no sizeable caverns.

Our disappointment with the caves was more than allayed by the grandeur of the surface scenery which was both magnificent and unusual; the route along the main divide in the vicinity of the West Irian border must undoubtedly be one of the finest ridge walks in the world, with views to the Sepik lowlands in the north and the Fly Basin in the south. It is certain, however, that eventually major cave systems will be discovered in the Star Mountains, but it is possible that further caving parties would be better rewarded if they concentrated upon following up efflux streams to where they issue from the foot of the limestone cliffs. The dense vegetation would render the task a difficult one, however. In retrospect, this writer would tend to expect the major effluxes to debouche on the western boundary of the limestone near the Krom/Ban junction, about a mile from the West Irian border to the south of the main divide. The expedition did not visit this locality, but it would appear to be far more accessible than the higher parts of the Star Mountains. In addition, local food would be available.

In spite of the rugged terrain, rigorous conditions for three months, and serious setbacks with air drops, the expedition's organization was remarkably smooth and all of our major scientific and sporting objectives were achieved as planned. The main reasons for this, which may serve as a guide for future expeditions, are listed below:

1. The loyalty of our seventeen permanent native carriers. This could be partly attributed to the fact that Barry Craig, the expedition's anthropologist, had lived in Telefomin for three years and knew the carriers personally. Carriers would be indispensable for any but a light-weight expedition with extremely limited objectives. Ideally, an expedition should be flexibly organised so that it is not totally dependent upon either carriers or airdrops but can fall back upon one if the other fails.

2. Barry Craig and John Huon could speak fluent Pidgin-English. It would be very unwise to attempt to run an expedition in this area without at least one member being able to speak Pidgin fairly well.

3. The local natives were generally friendly and co-operative and when we arrived at a village always provided us with shelter and food which we were careful to pay for in the accepted local manner. Food was not available in the uninhabited higher parts of the mountains and it was necessary to periodically relay food by carrier line from the foothill villages. We were able to communicate with the local natives using our Telefomin carriers as interpreters. We had a good supply of trade goods with which to buy food and labour.

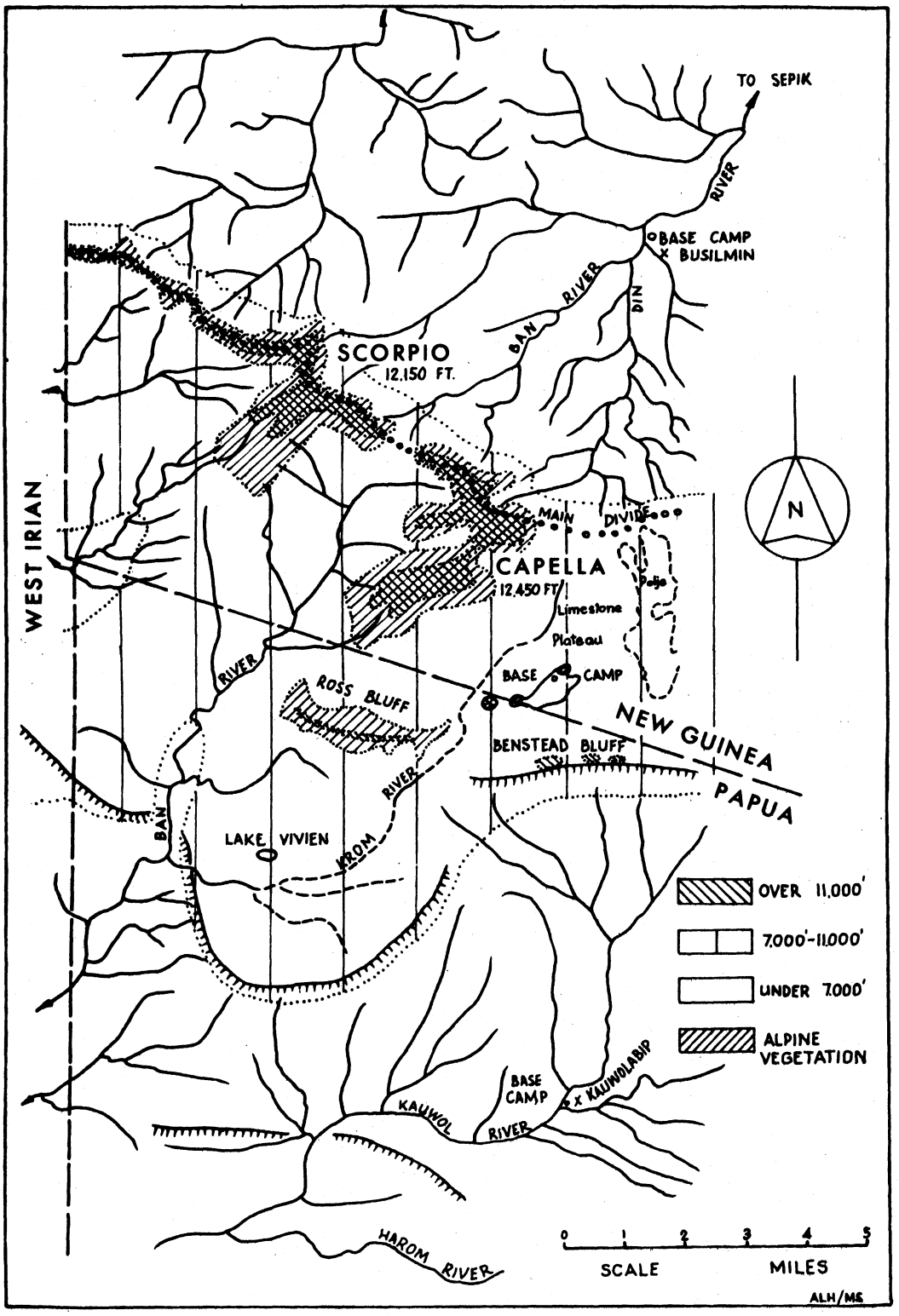
4. We provided our carriers with warm clothes for the higher parts of the mountains and we also carried two large plastic fly sheets supplied to us by I.C.I.A.N.Z. The latter were invaluable in view of the extremely high rainfall we experienced. We carried a good medical kit and found malarial suppressives invaluable to keep many of our carriers in good health.

5. Good waterproof outer-garments are essential at higher altitudes i.e. above about 6-7000 feet. Good boots are also an advantage, although we wore sandshoes at times. Dunlop work boots sewn especially with terylene stood up to the conditions much better than any other boots we had. Leather-soled boots tended to fall apart after a week or so. Otherwise our choice of clothes did not appear to be very important, although we found overalls to be particularly useful. We built spacious huts at our three base camps. These helped to maintain our morale and were necessary for our scientific work.

6. In rugged country aerial photographs, if available, are far superior to maps. The border area of New Guinea is covered by a series of aerial photographs.

7. We maintain that a minimum of four Europeans and a maximum of six or seven, would be the advisable size for a trip of this nature. A party with more than seven members would be difficult logistically; more native carriers would be needed, and local food is often in limited supply.

****



STAR MOUNTAINS AREA CENTRAL NEW GUINEA

CAVES AND CAVING IN ASIA

E. Hamilton-Smith *

The caves of the Asian continent are little-known and rarely reported in the English-language speleological literature. I was extremely fortunate, while in Asia for professional reasons, to have some chance to meet with speleologists there and to visit a few of the cave areas. This paper will briefly outline some aspects of this visit and as a starting point for further enquiry, will give some of the useful references to literature.

Japan is the only Asian country with well organised speleological societies as we know them. The Speleological Society of Japan was founded by Professor Masuzo Ueno in 1954 and was the first of these. It is a scientific society, consisting primarily of biologists and others concerned with the scientific study of caves. The Japanese Association for Caving is much more concerned with exploration and with developing techniques of exploration, while localised societies exist in a number of areas, often associated with universities. A great deal of exploration and high standard cave survey has been accomplished. So far some 700 caves are known, more than 500 of which have been subject to reasonably thorough mapping and scientific study.

I was fortunate to be able to meet Prof. Ueno, formerly professor of Zoology at Kyoto University and now Professor Emeritus of that institution. His son, Dr. Shun-Ichi Ueno, currently secretary of the Speleological Society of Japan and a world authority on Trechine beetles (many of which are troglobitic in Japan) spent several days taking me to see the Akiyoshi-dai Karst area, which is a truly remarkable area. We were also accompanied by Kiyoshi Mizushima, who has led a number of expeditions in recent years gradually going deeper and consistently extending the depth record for Japan.

The Akiyoshi-dai area is a karst plateau of about 130 sq. km. in area, with extremely well developed karst landscape features, including poljes, dolines, and lapiaz. The upper surface of the plateau has some 10,000 dolines! Exploration so far has revealed about 130 caves, but many more obviously remain to be investigated. The area is largely conserved as a quasi-national park and the conservation of the park area caves is ensured for all time, although the area outside of the park is being exploited by quarrying. Several of the major caves, notably Akiyoshi-do, a magnificent cave of about 2 km., are

* Victorian Speleological Association & Cave Exploration Group (S.A.)

open to public inspection, usually on a self-guiding basis. Some 1½ million tourists per annum pass through this one cave alone, virtually all of whom are Japanese. The profits from the development of these caves have financed the erection and construction of a fully staffed science museum on the plateau with an extensive research programme.

The Director of the museum, Mr. Isao Kawasaki, is a geologist concerned with elucidating the geological history of the plateau, while the assistant director, Mr. Tadashi Kuramoto, is a biologist who has been studying the life cycles of troglobitic species found in the caves as well as some preliminary bat investigations. Other researchers are concerned with the palaentology and archeology of the area, while the museum also carries out ecological studies of the surface fauna and flora of the plateau. They have a small but well equipped underground laboratory in a small cave named Komori-ana. The museum has also done a great deal to foster the exploration of the area and makes its transport, equipment and other facilities available to the speleological societies.

This visit was one of the most pleasant three days of my entire tour. Those who saw my photographs at the ASF Conference will appreciate the sheer beauty of the area; biologists will appreciate the fascination of seeing dozens of species of troglobites, many of them in agglomerations of thousands of individuals; but only those who have experienced the real service of a Japanese Ryokan (hotel) and the luxury of the bathhouse will really appreciate these aspects. I am convinced that the greatest improvement which would be possible in Australian caving (apart from bigger caves) would be a Japanese bathhouse in every caving area!

Malaysia has no speleological organisation as such, but a considerable amount of scientific research is conducted in relation to the caves. I was only able to visit the famous Batu Caves on the outskirts of Kuala Lumpur, well-known to most Australian cavers from the excellent film produced by Lim Boo Liat and the Malaysian film unit. It is tragic to see the complete irresponsibility about conservation in this country, where not only is the Batu massif being gradually mined away, but where new mining operations are developing, apparently without any restriction, in the nearby Templar national park. Apart from Lim Boo Liat, all of those I met who were interested in the caves were English or American workers, many of them in Malaysia on limited term stays.

In Thailand, the fates conspired against me, in spite of all my efforts, and I was quite unable to get to any cave area - Bangkok itself fortunately offered some enjoyable substitutes. However, I did meet Fred Stone, a member of NSS, who has walked over and caved under most of Asia. Fred showed me maps and described to me the fantastic karst plateau of S.E. Asia - from Burma and Northern Thailand, across Laos, covering much of Southern China, and the northern fringe of Vietnam. This area is typical tropical limestone with both towerkarst and cockpit karst. Fred has entered caves in which he has walked - or run or swum - for up to twelve miles with no sign of an end or diminution in the cave. Many of them are so immense that one could drive through if one could only drive to them. (You never can!). Unfortunately, much of this area is politically inaccessible or unsafe at present. Even those parts which are accessible would demand of any expedition some really competent local organization of transport and supplies and familiarity with local languages (usually tribal) and customs, so it is not easy. Fred feels strongly that this area will ultimately reveal caves which will dwarf the present big caves of the world.

The Philippines also contrived very effectively to place their best caves country in pretty inaccessible spots, so I only saw the Montalban caves near Manila. Here there seems to have been no speleological interest at all. Montalban revealed the fascinating spectacle of a major storage dam constructed across a gorge in limestone - accelerated cave genesis, complete with resurgences under quite a head of pressure! One of the engineers who accompanied me to the site was very interested to hear that water would actually slowly dissolve limestone! The one cave entered was reputedly the famed bat cave of Montalban - it wasn't - and was primarily of interest in that the floor was well layered with unexploded shells, cordite, etc. On returning to surface, we reached the entrance just in time to see the bat flight from a cave some 150 ft. above our heads - a seemingly solid stream of bats, some 50 ft. in diameter and two miles in length.

Although able to do some caving in New Guinea, I will not comment here on this as I cannot add anything of real significance to what has already been included in the A.S.F. Handbook.

To sum up - with the exception of Japan, there is virtually no speleological organisation; there is an increasing amount of research in other countries, but almost entirely by visitors; there is incredible potential for both research and exploration, but this will require really good organization if it is to achieve anything of note.

Some References:

For Japan, see Uéno, M. (1964). The Present Situation of Speleology in Japan, in Konan Womens' College Researches 1:253-274, or Nicholas, G. (1966). Dr. Masuzo Ueno and Japanese Cave Biology, N.S.S. News 24:171-173. Most other English language literature is confined to specialised discussion of research work. The Speleological Society of Japan is now also greatly involved in studies of South Korea, the results of which are being published regularly in the Bulletin of the National Science Museum of Tokyo. Another neighbouring area is that of Okinawa - see Rhodes, D. & J. (1967), The Caves of Okinawa, N.S.S. News 25:127-133. A recent paper which deals with part of the great karst area of S.E. Asia and which contains an excellent bibliography (mainly of Chinese, Russian, or other European languages) is Silar, J. (1965), Development of Tower Karst of China and North Vietnam, N.S.S. Bull. 27:35-46. Malaysia is well covered by Vol. 19, No. 1 of the Malayan Nature Journal which is devoted to cave studies; Sarawak and Sabah are covered in almost unbelievable detail in Wilford, G.E. (1964), The Geology of Sarawak and Sabah Caves, Bull. 6 of the Geological Survey, Borneo Region of Malaysia. For Indonesia, see Balázs, D. (1968), Karst Regions in Indonesia. Karst-és Barlangkutatas 5:3-61

****

APPENDICES

COMMITTEE MEETING

A BRIEF SUMMARY OF BUSINESS TRANSACTED

Delegates or proxies were present from CSS, CEGSA, HCG, MSS, NUSS, SSS, SUSS, TCC, UNSWSS, UQSS and VSA. KSS, NTaSS, OSS and WASG were reported as unfinancial. Apologies were received from ISS and WASG.

Newcastle Speleological Association was accepted by vote into ASF, as were the Blue Mountains Speleological Club and the National University Caving Club later in the meeting.

The President in his report spoke of the lack of activity in ASF and in particular on the problems of communication between the Executive and the member societies, and an appeal was made for societies to keep the Executive informed. The reports of the Secretary and the Newsletter Editor also stressed this lack of two-way communication.

The Newsletter Editor also spoke on production problems associated with the Newsletter, such as lack of equipment and problems with post office registration. The Treasurer's report indicated a reasonable trading surplus for the year, and the Handbook Editor reported that overseas orders for the Handbook were starting to arrive.

A Conservation Standing Committee was formed with the President as Convenor, "to examine overall conservation policies at State and National levels, and determine the means by which the ASF can make a proper contribution to Government planning with maximum effect relative to ASF policies; to determine the means which a sense of the principles and practice of conservation can be extended within all caving societies in Australia; and to act whenever and wherever possible as a self-stimulating body using full authority of the Federation".

The Edie Smith Award for outstanding contributions to Australian speleology was discussed, and rules for its implementation were presented.

Discussion followed on the publication of "Australian Speleology", and the problems arising from the publication of a transcript of papers presented. This was finally resolved by including payment for the transcript in the Conference fee and allowing "Australian Speleology" to continue as a private publication.

Conservation action included the naming of caves in the Church Creek area (in danger of destruction due to mining) after members of the New South Wales Cabinet, together with supporting motions for the Colong Committee. The "Save Texas" campaign was also supported by several policy motions.

The next Committee Meeting will be held in Melbourne (January, 1970) and the next Conference in Hobart (December, 1970).

Elections for vacant positions on the executive resulted in the following changes:

Secretary	Howard Dengate
Assistant Secretary	Athol Jackson
Newsletter Editor	Evalt Crabb
Newsletter Manager	Norm Poulter

After an Executive budget meeting, the reconvened Committee meeting voted to purchase a Roneo duplicating machine for use in printing the Newsletter.

HOWARD DENGATE,
Honorary Secretary,
Australian Speleological Federation

ASF MEMBERSHIP FOR 1969

New South Wales and Australian Capital Territory

*Blue Mountains Speleological Club (BMSC)	P.O. Box 37, GLENBROOK. 2773.
Canberra Speleological Society (CSS)	P.O. Box 530, CANBERRA CITY. 2601.
Highland Caving Group (HCG)	P.O. Box 154, LIVERPOOL. 2170.
Illawarra Speleological Society (ISS)	P.O. Box 94, UNANDERRA. 2526.
Kempsey Speleological Society (KSS)	2 Albert Street, KEMPSEY. 2440.
Metropolitan Speleological Society (MSS)	P.O. Box E120, ST. JAMES. 2000.
National University Caving Club (NUCC)	P.O. Box 4, CANBERRA. 2600.
Newcastle Speleological Association (NSA)	P.O. Box 86, BROADMEADOW. 2292.
Newcastle University Speleological Society (NUSS)	P.O. Box 4, TIGHES HILL. 2297.
Northern Tablelands Speleological Society (NTaSS)	P.O. Box 376, INVERELL. 2360.
Orange Speleological Society (OSS)	22 William Street, ORANGE. 2800.
Sydney Speleological Society (SSS)	P.O. Box 198, BROADWAY. 2007.
Sydney University Speleological Society (SUSS)	Box 35, The Union, SYDNEY UNIVERSITY. 2006.
University of New South Wales Speleological Society (UNSWSS)	Box 17, The Union, University of N.S.W., KENSINGTON. 2033

Queensland

University of Queensland Speleological Society (UQSS)	The Union, University of Queensland, ST. LUCIA. 4067.

South Australia

Cave Exploration Group (South Australia) (CEGSA)	c/o South Aust. Museum, North Terrace, ADELAIDE. 5000.

* Subject to modification of BMSC Constitution.

Tasmania

Tasmanian Caverneering Club (TCC)	G.P.O. Box 641G, HOBART. 7001.

Victoria

Victorian Speleological Association (VSA)	G.P.O. Box 5425CC, MELBOURNE. 3001.

Western Australia

Western Australian Speleological Group (WASG)	G.P.O. Box S1349, PERTH. 6001.

EXECUTIVE COMMITTEE

President	Major Roland P. Webb, c/o School of Signals, BALCOMBE. Vic. 3935.
Vice-President	Andrew Spate, Box 312, ORBOST. Vic. 3888.
Secretary	Howard Dengate, c/o Hawkesbury Agricultural Col. RICHMOND. N.S.W. 2753.
Assistant Secretary	Athol Jackson, 6 Hudson Avenue, ROSTREVOR. S.A. 5073.
Treasurer	John A. Noonan, Flat 8, 78 Holden Street, NORTH FITZROY. Vic. 3068.
Newsletter Editor	Evalt Crabb, 121 Hoxton Park Road, LIVERPOOL. N.S.W. 2170.
Newsletter Manager	Norm Poulter, 21 Collins Crescent, YAGOONA WEST. N.S.W. 2199.
Handbook Editor	Peter Matthews, c/o P.O. Box 5425CC, G.P.O., MELBOURNE. Vic. 3001.
Librarian	Graham Wallis, 20 Malvern Avenue, EAST ROSEVILLE. N.S.W. 2069.

ASF Membership for 1969

STANDING SUB-COMMITTEES

Bat Research	David Purchase, c/o CSIRO Division of Wildlife Research, P.O. Box 109, CANBERRA CITY. A.C.T. 2601.
Cave Safety	Lloyd Robinson, 67 Mt. Keira Road, MT. KEIRA. N.S.W. 2500.
Cave Nomenclature	Elery Hamilton-Smith, P.O. Box 36, CARLTON SOUTH. Vic. 3053.
Conservation	Major Roland Webb, c/o School of Signals, BALCOMBE. Vic. 3935.
N.S.W. Co-Ordination	Robert Hawkins, 285 Woolaware Road, CRONULLA. N.S.W. 2230.
Delegates - International Union of Speleology	Elery Hamilton-Smith, P.O. Box 36, CARLTON SOUTH. Vic. 3053. (also A.S.F. Sec. ex officio)

TRUSTEES

Joseph N. Jennings, M.A.	School of Advanced Studies, Australian National University, CANBERRA. A.C.T. 2600.
Barry P. Moore, Ph.D.,	Division of Entomology, C.S.I.R.O., CANBERRA. A.C.T. 2600.