

# AUSTRALIAN CAVER

No. 155

Spring 2001

ISSN 0817-8240

# Helictite

## Journal of Australasian Speleological Research

Owned and published by the Australian Speleological Federation Inc.

Publishing papers, reports, abstracts, reviews and news of the scientific study of caves and their contents, including the history of caves and technical aspects of cave study and exploration, **Helictite** covers the region of Australasia - Australia, New Zealand, the near Pacific islands, including Papua New Guinea, Indonesia and Borneo.

Since its establishment in 1962, **Helictite** has been instrumental in raising the profile of Speleological exploration, investigation and scientific research in Australia and surrounding countries. One of only four or five similar journals in the world, it has also greatly enhanced the reputation of Australasian Speleology in the international arena.

A volume of **Helictite** is currently published annually, made up of two issues. It is only available via postal subscription. The rates are quite reasonable, at AUD\$25 for Australia and New Zealand, and AUD\$27 for other international destinations. Subscriptions for Volume 38 (2002) are now being accepted. Subscriptions may also be paid for up to two years in advance. Most back issues are still available and article reprints can be ordered.

Contributions are welcomed by the editors. Authors may submit scientific papers, reports, abstracts, reviews and news. This may also include comprehensive descriptive accounts of the exploration and morphology of individual caves. Authors do not need to have a scientific background to contribute; quite a number of recreational cavers have written articles of lasting significance. All articles are refereed by two Speleologists with expertise in the particular area, and edited to meet usual scientific standards. The editors will advise and assist prospective authors as necessary.

**Helictite** now has a presence on the Internet. There are a number of useful web pages available at [redacted]. Various topics are covered such as information for subscribers, news, administration, information for contributors, obtaining back issues, the history of publication, indexes, tables of contents and abstracts.

For further information contact Susan White, [redacted]

A subscription form can be mailed out on request, or obtained from the web pages.

# Cape mining plan oppo

## World Heritage listing, unique fauna feared at risk

■ By Ruth Callaghan

PLANS to mine 350,000 tonnes of limestone on the Cape Range peninsula are in doubt after a mining warden found it would likely damage a unique cave system.

The warden said the region's chance of being listed as a World Heritage site could be ruined if the Minister for Mines granted permission for mining leases.

Learmonth Limestone is seeking 10 mining leases over 82sq km north-west of Learmonth airport. The limestone is for the controversial Mauds Landing development near Coral Bay.

The proposal includes a mining lease that would extend over Wanderers Delight — the longest known cave in the range.

Learmonth says it wants at least five of the 10 leases sought. It then would be able to move its quarry if the proposed site was unsuitable.

But in written findings handed down on Friday, mining warden Graeme Calder said Cape Range had outstanding geological significance, featuring a unique karst system of subterranean caves.

"In its present state, were the Cape Range karst system to be nominated by the State of Western Australia, it would be listed," he said.

Mr Calder said a quarrying operation would be a significant negative factor against World Heritage listing.

It was highly likely the mining operation in Learmonth's application would damage the caves and could

destroy ethnological and archaeological material.

"It is very likely that species of subterranean fauna which are unique ... will be destroyed and no means will be left whereby such species may regenerate," he said.

Mr Calder said it would be most inappropriate for the Mines Minister to grant mining leases over the whole area sought by Learmonth.

A small operation might be allowed if the Environmental Protection Authority found it would not be unacceptable environmentally.

But if the proposed quarry site was not suitable, the mining company would need to reapply for a new mining lease and submit itself to the potential for public scrutiny.

Mr Calder recommended granting no more than the minimum leases necessary for an efficient mining operation after advice from the EPA.

The decision was welcomed by caving enthusiasts who have lobbied for Cape Range to be World Heritage-listed but they want the new mines minister to reject even a small quarry on the site.

Australian Speleological Federation president Peter Berril said he could not see how a minister could grant any lease application after the warden had found that heritage listing could be threatened.

An EPA report commissioned in 1996 said karst areas had a low capacity to cope with disturbance and were difficult, if not impossible, to restore once degraded.

The cape, about 1200km north of Perth, has more than 500 caves. The WA Museum has identified almost 100 terrestrial and aquatic species, including blind fish, crustaceans and small animals unique to the southern hemisphere.

Reprinted Courtesy of The Western Australian, "Reproduction Permit". No PF 4808. This article appeared on page 11 on Monday February 12<sup>th</sup> 2001. Related articles are included in this edition at pages 7 and 9.



**Australian  
Caver Issue  
Number 155  
Spring 2001  
Edition**

Editor  
Geoff Crossley



"Australian Caver" is published quarterly in the months of February, May, August and November by the Australian Speleological Federation Incorporated.

PO Box 388, Broadway, NSW 2007  
[www.caves.org.au](http://www.caves.org.au)

This work is ASF Copyright. Apart from any fair dealings for the purposes of private study, research, criticism or review as permitted under the copyright act, no part may be reproduced without the written consent of the publishers and the inclusion and acknowledgement of the source.

The views expressed in the Australian Caver are not necessarily those of the editor or of the ASF.

**All contributions are welcome.**

**Advertising rates are as follows:**

- \$200 per full page within the text.
- \$140 per two thirds page in text.
- \$100 per one half page in text.
- \$70 per one third page in text.
- \$50 per one quarter page in text.
- \$35 per one sixth page in text.
- \$250 per full page inside back cover
- \$150 per full page inside back cover
- \$300 per full page inside front cover
- \$200 per half page inside front cover
- \$400 per full page back cover
- \$100 per full page fly sheet (reverse)

**Advertisements within the caving community cost:**

- \$70 per full page
- \$35 per one half page

Discount of 10% applies to 4 or more repeat advertisements where payment accompanies the copy.

**Coming Events**

- NSW Speleological Council Meeting - More details on page 22.
- The Icelandic Speleological Society announces that the Tenth International Symposium on Volcanospeleology will be held in Reykjavik, Iceland, 9th to 15th of September 2002 (more information on page 8).
- Under WAY Conference - October 2002.

**Contents:**

- 2. **A.S.F Annual Report.**  
( President Peter Berrill.)
- 5. **Obituary - Ken Keck**  
(Barry Cubitt, Senior Guide, Abercrombie Caves.)
- 6. **Obituary - Don Matts**  
(Joe Sydney)
- 7. **Where the Wild Things Are.**  
(Dennis Beros)
- 8. **Cape Range - Mining Court Recognises Hidden Treasures In Northern W.A.**  
(Jay Anderson  
W.A.S.G. President  
W.A.S.G. Conservation Officer.)
- 17. **Glow-worms in Tasmania**  
(Arthur Clarke.)
- 22. **Down Under All Over**  
(Norman Poulter OAM)
- 23. **Personal CO<sub>2</sub> Scrubber.**  
(David Rothery)

**Front Cover:**



"Tim Payne, Nullarbor Plain".  
(Photograph by Stefan Eberhard)

**AUSTRALIAN  
SPELEOLOGICAL  
FEDERATION Inc.**

**ANNUAL REPORT 2001**

**Presented by the President, Peter Berrill**

**Melbourne, January 2002**

**Highlights Of 2001:**

- Outstanding success in court action to prevent mining leases on Cape Range in Western Australia;
- Major concessions wrought from mining interests in mediation sessions relating to a proposed Exploration Lease on the karst at Mt Cripps, Tasmania.
- Registration as an Environmental Organisation by the Commonwealth Government
- Completion and acquittal of the National Heritage Trust grant in the NSW Central West
- Completion of a new Web-site and a web-based membership list
- Representation at cave management meetings and at the Congress of the International Union of Speleology in Brasilia, Brazil
- Significant progress towards a new, up datable Karst Index Database,
- After months of work, adequate but less than comprehensive and not inexpensive insurance

**Executive:**

Communication between the executive has increased with all members available via e-mail. The convenience of email has increased the work-load and the output of the executive and commission convenors. The executive had a face-to-face meeting in Canberra during April, a teleconference in October and exchange of thousands of email. They functioned exceptionally well this year, especially on the insurance issue. During the year Arthur Clarke resigned to devote more time to his MSc studies, and was replaced by Jay Anderson, who is organising the next Conference in Western Australia and has also been involved with the

Cape Range issue. A recipient of the ASF Certificate of Merit several years ago, Arthur has given exceptional service to the conservation of Tasmanian caves, and will no doubt always be available when needed.

**Community Honours:**

We are delighted that founding Secretary and longest-serving President of ASF, Ebery Hamilton-Smith received the award of Member of the Order of Australia (AM) in the January Honours List. The citation read (in part): "*For service to conservation and the environment, particularly in the areas of national parks, wilderness, cave and karst management*". Ebery is the fourth member of ASF to be recognised in the Honours List for services to speleology, earlier ones being Don Matts, Anne Atkinson and Norm Poulter. We greatly regret to record the passing of Don Matts, in November. The first speleologist to receive an OAM, Don was a prominent pioneer in the NSW Cave Rescue Squad.

**Insurance:**

As you all know, the insurance crisis was totally unexpected and, serious as it was in June, the future is likely to be worse after the events of September 11. Insurance has taken up an enormous amount of time and people rose wonderfully to the task. Although there was many involved in the work, I must mention that Joe Sydney, Alan Jevons, Jodie Rutledge, and Arthur Clark each spent literally days and days on the task. The search for insurance dragged on for four months and I must say that in the end it began to weigh heavy on some. Some management authorities apparently seized the opportunity to impose requirements for insurance that they had earlier survived without. Insurance is so serious a problem for community organisations like ours that some are simply folding, following up to tenfold increase in premiums. I believe that members must accept the impost for the reality it is. We must not dissipate our energies in unproductive debate about details. It is absolutely imperative that we pursue this issue in concert with other organisations and/or seek a government-funded scheme.

**Conservation:**

Early in 2001 we had what Rauleigh Webb described as a remarkable 99% success in the case against mining exploration leases on Cape Range in Western Australia. Rauleigh devoted

the spare time of a year to this task and deserves our heartfelt thanks and congratulations, as do the other individuals involved and our WA member clubs, WASG and SRGWA for their financial and other support. We must also thank the Environmental Defenders Office in Perth for acting on our behalf. Without them we would not have afforded to mount the legal Action. One result is that following the Mining Warden's recommendation; it is unlikely that the Minister will agree to an application for 82sq.km. of mining lease on the Cape Range karst. At the time of writing this report all parties were still involved by way of commenting on draft guidelines for the Environmental Impact Assessment of a smaller area for the proposed quarry (13 hectare).

At Mt Cripps in Tasmania, Arthur Clarke acted for ASF and STC in extracting major concessions from the company applying for an Exploration Lease. Although we unfortunately had to withdraw from the court case (in the light of a financially open-ended commitment), Arthur's achievements were outstanding.

During the proceedings, both of these karsts were listed by the Karst Waters Institute in the USA as one of the year's ten Most Endangered Karst Ecosystems of the world. Both of the campaigns were partly funded from the Environmental Defenders Office with a contribution from ASF and member clubs. It is clear from the detailed State Conservation reports that there is no lack of issues, but we cannot always rely on EDO involvement and there are many issues requiring common sense rather than legal solutions. As I have highlighted elsewhere, the question is how best to finance and support cave conservation issues.

Conservation consumes much of the time of the conservation convenors and others involved. We have been fighting to conserve the caves of Australia before the Federation's inception and we will have to go on fighting it seems forever. It takes a special kind of individual to be a devoted conservation convenor as the like of Rauleigh Webb and Arthur Clarke who have both now stepped aside from their roles as conservation convenors. They have both done an outstanding job over many years and made many personal sacrifices for Australia's caves. They leave us with BIG shoes to fill but we must fill them.

### **Natural Heritage Trust Grant – Central West Catchment, NSW:**

Early in 2001 a supplementary documentation report was prepared as part of this project and the \$27,330 grant was acquitted with Environment Australia. Nine clubs and about 65 members contributed to the field work and to the fencing and vegetation rehabilitation work; for its outstanding success we particularly have to thank Peter Dykes, Denis Marsh and Bruce Howlett. The main report received very favourable reviews, as it was the first in the region to deal with vegetation on karst. There appears to be interest from managers interstate in the report and as all copies have been distributed to landholders etc., if necessary we will reprint it.

### **Environmental Fund:**

Following Constitutional changes at the last Council Meeting, Environment Australia has registered the Australian Speleological Federation Inc. as an Environmental Organization. The registration is a flow-on of the Mt. Etna Campaign. CQSS solicitor Stephen Comino suggested the idea of registration to me after we had received enormous donations and support for our cave conservation stand. It has taken almost three years of work to become registered and I must thank John Dunkley for the enormous amount of time he put into the application. Work on the operation of the Fund will begin in 2002 with information and circulars sent to all clubs for involvement. We received an offer of a donation to initiate the Fund associated with this, on a \$-for-\$ basis from ASF, and I strongly recommend to the Council that this be accepted.

### **International Union of Speleology:**

A dozen or so members attended the 14<sup>th</sup> IUS Congress in Brasilia, Brazil in July. Dr Julia James retired as IUS President but we congratulate Dr Armstrong Osborne on his election to the IUS Executive Committee. Former President of the Linnaean Society of NSW and a world authority of palaeokarst, Armstrong was the 1997 recipient of ASF's Edie Smith Award.

### **Speleo- E-Bulletin:**

Introduced in 2000, this innovation has proven remarkably successful, thanks largely to Angus Macoun. Some members have asked that its status in relation to the journal be clarified.

**Helictite:**

As advised last year, ASF now publishes the long-established scientific journal *Helictite* under the management of Sue White, Ken Grimes and Glenn Baddeley. Unlike our sister organisations in UK and USA, we do not mandate a subscription to this as part of our membership fee, but we would like to see more members subscribe. There is also the suggestion that those joining ASF as individual members be given the option of receiving either Australian Caver or Helictite. There has been a stock-take of Helictite and other SRC titles, several sales and some outstanding orders for back issues. We aim to publicise these more in 2002 and consider reprinting some.

**Representation on Other Bodies:**

ASF's representative on the Board of the Jenolan Caves Reserve Trust, Patrick Larkin has been appointed to the Executive Committee of the Board. It is pleasing that speleologists are demonstrating their expertise; two other members of the Board, including the Chairman Richard Mackay, are present or former ASF members.

**"Discovering Caves" kit from Australian Geological Survey Organisation:**

This excellent kit, produced by AGSO last year with assistance from ASF & ACKMA, is well worth buying just for the large wall map. Check it out at your nearest show cave.

**Australian Cave and Karst Management Association (ACKMA):**

I am pleased to report that following the widespread dismay expressed at the last Council Meeting, ACKMA swiftly acknowledged and apologised for the breach of ASF copyright in preparation of a CD on cave and karst management. Special thanks for their common sense in concluding this matter are due to Chris Bradley and to former ACKMA President Brian Clark. The core issue here is not who owns what, but a wish by speleologists to be acknowledged and respected for the work they do – see also my comments in the next section. John Dunkley represented ASF at the ACKMA Conference at Wombeyan in April, and presented two papers.

**Intellectual Property and Products:**

Following my report on this last year, we received further valuable legal advice in 2001. Thank you to Bob Dunn for facilitating this.

Several clubs enquired about the advice; it is very comprehensive and is available on a need-to-know basis. I believe it is imperative that speleologists act professionally in all dealings involving maps, charts, data-bases etc., whether published or not. To do this, we all need to act from an informed position and not make assumptions of a bush lawyer variety.

**Web-site and Membership List:**

Thanks to Carol Layton the Web site is well established. Clubs are reminded that the list at [www.caves.org.au](http://www.caves.org.au) is our Register of Members for insurance purposes and that it is their own responsibility to maintain it accurately and up-to-date at all times.

**Karst Index Database:**

The data originally held on a mainframe computer has been transferred to the Web site and limited fields are available for perusal. Mike Lake has circulated a Discussion Paper to each State Coordinator on a new updateable database and we expect to let a tender possibly before the January meeting for the necessary programming.

**Archival and Historical Material:**

At its April meeting the Executive decided to begin a process of assessment of the ASF archives. Good deals of our records are still in the possession of some previous executive members scattered throughout the country. When we have a report as to the extent of the archives we will then decide what to do with them. Most recently some early records thought to have been lost have been re-located.

**Public Relations:**

For some time many have stated that ASF needs to improve its public image. On any objective assessment our achievements are quite staggering, and many members have devoted much of their life to conserving caves and karst, often at considerable personal cost. Yet there is a perception in some quarters that only 'professionals' are involved in looking after Australia's caves. On the contrary, an increasing number of management and academic people interested in caves and karst have no background in those areas, and as always, memory is short. The issue of Public Relations is not an area in which we have great expertise and I would welcome advice on how we should proceed.

**Where to Now?**

I recommend to members that our priorities for 2002 be:

- Pursuing the insurance issue, particularly working with other organisations and
  - political lobbying to bring about a more reasonably priced product for members
  - Improving public relations with cave managers
  - Establishing the Environmental Fund including matching the founding donation
- Launching a new updateable Karst Index Database
  - Making information available on intellectual property attached to club maps and the like
  - Strengthening support for Helictite to improve the standing of speleology in Australia
  - Greater support for Australian Caver which is our primary source for “*what’s happening on the caving scene in Australia*”

**Obituary – Ken Keck**

Barry Cubitt,  
Senior Guide,  
Abercrombie Caves



*2001 saw the passing of Metropolitan Speleological Society's only Honorary Life Member, Ken Keck. The following extracts from the eulogy delivered by Barry Cubitt, Senior Guide Abercrombie Caves, at a memorial service for Ken, were kindly forwarded by Richard Neville, President of MSS.*

Ken was born on 24<sup>th</sup> October 1924 in Christchurch, Kent, England.

During WWII Ken served in the Army as a Sergeant in Signals in the Sydney area and afterwards worked for several large accounting firms.

Since the 1960's Ken has been well known for his keen interest in exploring and researching caves. In fact 35 years ago he was one of the founder members and was the only life member of the Metropolitan Speleological Society based in Sydney.

Over the years Ken spent many weekends and holidays exploring caves almost everywhere in NSW. He even worked for several years as a

Casual Cave Guide at both Jenolan and Abercrombie Caves. However, Ken fell in love with Abercrombie and so he concentrated most of his efforts here. When he retired, he decided to move from Sydney to Trunkey Creek to be closer to Abercrombie. He built his new home in Church Street, where he lived until 1997

Whilst he was living in the village Ken was a very active member of the community. He was a member and an office bearer of the Trunkey Progress Association for over 10 years.

Ken continued his interest in the caves by organising many members of the caving group to visit Abercrombie, to explore, survey, map and research the caves.

Ken was even able to combine his love for music with the caves by being a regular performer in Cave Concerts, which became known as "The Underground Music Show"

In recognition of his support and efforts, Caves staff and friends organised a testimonial dinner in 1994, at which Ken was awarded "Key to the Caves". In 1995 he also received a special award from the Australian Speleological Federation [the Edie Smith Award].

Although he was unable to take part in caving activities during the last few years he still maintained a very keen interest in Abercrombie Caves.

Ken will be greatly missed by all of his caving friends.

## Obituary – Don Matts

Passing of  
an old caver  
– Don Matts!

It is always  
with sad regret  
that when an  
old caver  
passes, you  
lose not just a  
resource of  
valuable  
caving  
information



but also a great caving companion.

For those that did not know Don, he lived for caving!

Don Matts was born in Paddington in 1931. He grew up in Sydney, living in Cronulla and Bankstown. He decided on a trade as a Woodworking Machinist and was employed at various companies during his apprenticeship. During his teenage years in Bankstown he formed a permanent friendship with Roy Derrick and many tales they could tell of those years.

When he was about 20 he joined the Bankstown Theatrical Society and it was here that he met Grace aged 16.

In 1953 he went to Darwin to work on a hospital there and later on a pipeline out of Darwin. He bought a Bantam BSA bike and in 1954 he headed back home on it. His adventures in Darwin were many. While there he assisted the local Theatrical Society in its productions.

On arrival home he again worked at several places using his trade until in 1955 when he took a job with Kreisler Radio and TV in their Research and Development department. Here he met an interesting group of men and later became involved in their hobby of caving.

In 1956 he and Grace were married. Holidays were always spent with Roy Derrick at Barraba where fossils abounded - another interest of Don's. Kaelene arrived two years later in 1958

and Terry in 1962. These years were spent with lots of weekends away caving at Cliefden Caves.

Around 1964 it was decided that the Kreisler Caving Club would take "the wives" caving. From then on Don was never to have a weekend caving without Grace and the children (although sometimes they could get away without the children).

In 1966 during a trip with the Kreisler Caving Club to Colong they met up with the Sydney Speleological Society who were involved in a combined Australian Speleological Federation trip to try to save the wilderness area and the caves at Church Creek. The family were encouraged to join the Sydney Speleological Society and were elected to the committee almost immediately.

1968 was their first trip to Chillagoe Caves and the beginning of another lifetime friendship with Vince Kinnear.

Don's Godson, Michael Derrick came to stay with them in 1967 so he could do his apprenticeship, and stayed until his marriage in 1972. He was also initiated into the joys of caving and together with Grace's brother, Ray, they had some amazing adventures.

During the 70's Don worked at many places including Sebel furniture, Stegbar and for a boat building company, getting involved in a race around Port Phillip Bay, Victoria and ending up stranded on a beach.

This preceded another period of work with Butts Timber where he started a weekend business of "additions and subtractions" to buildings. This business with a mate from Butts' finally became so busy that it required a full time commitment. Unfortunately Don was a trusting fellow and never believed a mate could 'do the dirty on him' so the partnership ended in a financial disaster after just two years. Don went back to work with Sebel furniture in their Research and Development Department.

In 1972 Don organised a cave rescue exercise for the Australian Speleological Federation at Bungonia Caves and from this came the NSW Cave Rescue Group, later called the NSW Cave Rescue Squad, a passion of his. In 1974 the Cave Rescue Squad was affiliated with the NSW Volunteer Rescue Association, and from then on

he was a passionate supporter of this organisation. For his efforts in caving safety and the Squad, Don was awarded the first Hon. Life membership in 1989.

In 1981 Don and Grace attended the International Union of Speleology's Congress in USA representing Australia at the Cave Rescue seminar. Don was able to impress the American's with Australia's knowledge and rescue procedures.

In 1989, after assisting in the organisation of several expeditions to Chillagoe Caves for the Explorers Club he was accepted as a member of this prestigious organisation in USA.

In 1993 he was awarded the OAM for his services to cave rescue and to speleology.

During 2000 his health gradually deteriorated until by 2001 he was unable to travel further than the local club. Walking any distance was impossible. He had developed osteo and

his spine was degenerating so that he was unable to straighten up and was hunched over. He was in constant pain from his back as well as not having enough breath to do anything.

He wanted to die at home and stopped breathing as the ambulance officers took him to the hospital on the evening of 29th October 2001.

What we all remember fondly about Don was the perfection in all he did. Nothing but the best effort was good enough - but it had to be done his way - as any good caver would!

I'd like to imagine him now doing what he loves best, caving!

---

A compilation of notes as taken from friends and relatives!

Joe Sydney  
A friend of the Matt's




---

## WHERE THE WILD THINGS ARE

Dennis Beros

Ningaloo Reef! A 240 kilometre profusion of life, midway up the Western Australian coastline. A place of exceptional natural beauty where arid red hinterlands meld through a fantasy of white sand and coral reefs into the deep blue waters of the Indian Ocean.

Unlike the Great Barrier, Ningaloo is a 'fringing' reef and in many places comes right to the shore. A sub-tropical secret, well kept by virtue of its isolation on the western edge of the Cape Range. Now on the verge of being 'discovered' its vulnerability to visitors and its openness to inappropriate development are cause for great concern.

The southern reaches of Bateman Bay are an extraordinary part of this very special wilderness. Here the Ningaloo Reef's barrier to ocean swells meets Point Maud, creating a huge lagoon, and here a rich suite of ecological values overlap.

Resting humpback calves take sustenance from their mothers, growing strong for the long journey to Antarctica. Huge manta rays gather, up to a hundred of them cutting great vertical

arcs through the water, sometimes becoming airborne. Slow and dignified, dugong feed on the placid beds of *Halophila* seagrass. In the warm shallows, a hundred black-tipped reef sharks gather, often following each other in perfect circles. Endangered Loggerhead hatchlings scurry toward the waters edge, their one goal to return to this beach some day to mate, in the tradition of turtles. Whale sharks, silent speckled giants, sift the eternal blue for their minute foods. Tiger sharks prowl for something more substantial.

**Imagine the impacts of placing at the heart of this a massive marina resort capable of servicing 2,500 people and hundreds of private power boats. Think restaurants, hotels, palm-lined beaches (with shark netting). Think Cairns. Think beach umbrellas. Think pina colodas. Oh, with a fish-freezing service, of course!**

The repercussions of such an increase in boating traffic would be disastrous. Hundreds of boat trips directly across the movements of whales, whale sharks, mantas, turtles, and dugong every day. And this before we even

Developers are currently arguing the environmental sustainability of just such a resort at Maud's Landing. The Coral Coast Resort is proposed to sit on the boundary of a sanctuary zone within the Ningaloo Marine Park. The developments centrepiece is an inland marina, a \$60M hole with 200m seawalls built across a turtle-nesting beach to create an entrance channel. Such marinas have been banned in other parts of the world as environmentally problematic.

If it went ahead, the resort would cover 312 hectares, including 371 residential lots and handling 240 or more boats at a time. And this is just Phase 1! There will be little holding the development from growing into a major regional town.

Maud's Landing was zoned as a townsite in the 1890's when a settlement existed there, primarily for shipping local wool. At one time it is said to have boasted a turtle-canning factory. For more than 50 years it has been returning to its natural state. This repurposing, under a 100 year old gazettal, is testimony to a seriously flawed planning system in WA.

Conservationists in WA are calling for the establishment of an Environmental Protection Policy over the whole area (Ningaloo/Cape Range Peninsula /Exmouth Gulf). Under state law this would provide legal protection for the environment and foster a holistic approach to development in the area.

Many conservationists believe that there is a rare opportunity inherent in the Ningaloo/Cape Range area, which has long been considered a likely candidate for World Heritage listing. Relatively undeveloped as much of the area is, and unspoiled by the types of development currently proposed, this area could be managed as a genuine best-practise wilderness tourism destination.

The region is certainly not without its environmental problems. Sadly, it sits atop substantial reserves of oil and gas; and the limestone that comprises the Cape has its commercial admirers too. Fishing pressures on northern parts of the reef close to Exmouth have already had their impacts.

But by world standards, much of Ningaloo is still a pristine wilderness and many savvy world travellers visit here each year. The guest-book entries they leave behind are filled with a common sentiment "Don't let them destroy this!".

The positive trends in tourism are clear. The traveller of the future wants the wilderness experience and demands that their own presence does not negatively impact the environments they are visiting.

The task now is to get governments to see that the window of opportunity is quickly closing on Ningaloo, one of Australia's most impressive remaining wild places. Government has a double responsibility here. One is to protect this extraordinary environment. The other is to not let the irreversible opportunity to become a world leader in 'true' ecotourism slip through their fingers.



What you can do?

Visit [www.save-ningaloo.org](http://www.save-ningaloo.org) for more information

Contact Dennis Beros at the Conservation Council of WA [REDACTED]

25<sup>th</sup> September Public Talk

**Tenth International Symposium on Volcanospeleology**

This is the first announcement to be made and more detailed information will be sent out later. The symposium will take place in Reykjavik, two days are intended for sessions on volcanospeleological issues, an excursion to the Reykjanes peninsula is being planned and additional cave trips will be organized. The final itinerary will be released soon. Those who are interested are encouraged to contact Sigurdur S. Jónsson, chairman of the ISS, <[ssjo@os.is](mailto:ssjo@os.is)> to be kept posted on further development. The ISS and the symposium are being supported by:

- National Energy Authority.
- University of Iceland.
- Nordic Volcanological Institute.
- Icelandic Parliament.
- Icelandic Institute on Natural History.

## **MINING COURT RECOGNISES HIDDEN TREASURES IN NORTHERN W.A. !!!**

### **BACKGROUND**

Halfway up the Western Australian Coast, 1200 kilometers north of Perth, is the Cape Range peninsula, also called the North West Cape peninsula. Situated on the Western Australian coast, it is a breathtaking place of world heritage significance. The Cape Range in north west Western Australia has been called "one of the great geological set-pieces of the State" Main (1993, p.108). It encompasses an area bounded by the Ningaloo Reef (that stretches along the coast about 260 km's) to the west and the Exmouth Gulf to the east.

Most Australian's know of the Ningaloo Reef as an outstanding part of our natural environment. Few people are aware that the reef is part of a unique reservoir of our natural and cultural heritage. It is Australia's longest and most spectacular fringing coral reef. The waters and colourful reefs contrast strongly with the rugged red land of the peninsula. The reef is habitat for many species of coral, mollusks, fish, mammals, turtles and birds.

The karst system of the Peninsula is world renowned due to the subterranean fauna that reside there. The unique diversity of subterranean fauna that live in the underground (air or water filled) caves and mesocaverns of this karstic limestone is a treasure hidden under an arid desert surface. Although the area is still largely unexplored, there are species that have been found to occur nowhere else. The cave systems support troglobites, stygofauna, spiders, millipedes and mollusks. Of the species listed, some also are registered under the Western Australian Wildlife Conservation Act as rare and likely to become extinct.

The Cape Range region of Western Australia is a place of world significance for many reasons. These exceptional attributes have been recognised, for example, by the listing of the peninsula on the Register of the National Estate. Additionally, a report by the Department of Environmental Protection found that the

Peninsula had the necessary values for it to be nominated for World Heritage Listing. A significant portion of the eastern foothills of the Cape Range has been recommended to be included in the Cape Range National Park.

### **GEOGRAPHY**

The North West Cape peninsula is formed in Tertiary limestones. The Cape Range is 311 m high and 16km wide and fringed by a coastal plain. It is comprised of calcareous sedimentary rocks which have karstified and been extensively eroded. The upper layers of the range consist of the Tulki and Trealla Limestones, that exist to a depth of approximately 100 meters.

As the Trealla Limestone and most of the Quaternary deposits have been eroded off the top of the Range, the older Tulki Limestone and Mandu Limestone have been exposed. The coastal plains consist predominantly of the shallow marine and aeolian Pleistocene Bundera Calcarinite. This geomorphological description of Cape Range can be combined with an aesthetic one which shows the Range to be a beautiful series of colourful gorges and hills with intriguing limestone sculptures frequenting the surface limestone. Beneath the surface - Cape Range has produced over 500 cave features, most with vertical development. There are many more caves to be discovered as cavers more extensively explore the range.

### **WHY IS THE CAPE RANGE SO IMPORTANT?**

Besides of its obvious aesthetic qualities, the Cape has provided a wealth of information regarding Australia's past. The fossil records, the flora, the geology and the above-ground and below-ground fauna have all contributed to our extensive and increasing knowledge of our past. One of the attributes of the Cape Range, which make it so special, is its subterranean fauna. It is the limestone of the Cape Range, that is filled with underground caves and mesocaverns, that provide the habitat for subterranean fauna of great rarity and variability. It is this special region of "karst" that has the interest of Speleologists in Australia and other professionals around the world. Significant discoveries of cave fauna have been made within these caves. So significant, in fact, that Hamilton-Smith et al, (1998) state that "the most celebrated attribute of the Cape Range karst at present is its cave fauna.

It is the richest and most diverse troglobite community in Australia and probably the world”.

The cave animals of Cape Range have only been studied extensively over the last decade (Grey 1989, Harvey 1988, Harvey 1991, Humphreys *et al* 1989, Humphreys 1993, Humphreys 1994). These studies by Museum staff in conjunction with members of A.S.F. caving groups throughout Australia have shed new light on the country that we live in. A recent discovery in a water-filled cave at Cape Range has been compared to finding a living dinosaur! This small aquatic animal is believed to have been living on earth since the time of the dinosaurs and was truly an exciting discovery.

In 1995, in response to competing land use interests, the State government accepted a controversial dual-purpose policy, brokered between the Department of Minerals and Energy and the Department of Conservation and Land Management. This policy allowed the State government to propose the setting aside of a significant area of the south-eastern foothills of Cape Range as a 'section 5(h) reserve' for the apparently inconsistent purposes of conservation and limestone mining. The area is currently under pastoral leasehold, with compensation to the leaseholder for the excision of the 5(h) reserve remaining unresolved.

Despite the fragility and acknowledged importance of the karst and reef systems, the area is under pressure from Tourism, Oil and gas Industries, mining and other human activities. Only a small part of the karst system lies within the National Park. This area is also of interest to the mining industry, for extraction of the limestone that forms the karst system

## THE LAW AND MINING LEASES IN WA

In Western Australia, The *Mining Act 1978* and the Mining Regulations regulate the grant of mining tenements. The required procedure is that an application for a mining lease must be lodged at the office of the mining registrar. If an individual or group wishes to **object** to the grant of a mining lease, then they must lodge the objection at the office of the mining registrar within 35 days of the date of application for the lease.

When a notice of objection is lodged, the Mining Warden must hear the application for the mining

lease in an open court. The Warden may give any person who has lodged a notice of objection an opportunity to be heard. After the hearing, the Warden makes a **recommendation** to the Minister for Mines. The Minister may grant or refuse the mining lease (on such conditions as the Minister considers reasonable) and is also subject to the *Mining Act*, but the **Minister's Decision** is irrespective of the Warden's recommendation.

There are two situations where the Environmental impact of mining proposals may be assessed:

1. objections to an application for a grant of mining lease (on public interest grounds) are taken to the Mining Warden's Court, and/or
2. The Department of Environmental Protection undertakes an Environmental Impact Assessment (E.I.A.) of the proposal, on behalf of the Environmental Protection Authority (EPA). Typically, these assessments occur *after* the grant of the lease. There are several level of E.I.A.

## THE PROPOSED MINE AND LEASES

During 1999, Finesky Holdings Pty Ltd (now transferred to Learmonth Limestone Pty Ltd) applied for a grant of 10 mining leases over 8,250 hectares of Cape Range, covering approximately 80% of the proposed "5 (h)" reserve area, and over which the company holds mining exploration licenses. They intended to convert the existing exploration leases into mining Leases.

The area suggested by Finesky Holdings as their first preference for a mine was on the eastern edge of the escarpment, some 3 kms west of Learmonth Air Strip. Finesky stated that the depth of limestone in the area is approximately 30 meters and that the mine would be a quarry type development. The area was chosen due to the quality of the limestone resource. It was envisaged that the quarried limestone would be transported by road to a shipping facility at Coral Bay, some distance to the south of the Cape Range.

In discussions, Finesky Holdings revealed that the actual mine site would cover an estimated area of 20 hectares. However their lease

applications cover a total area of approximately 8,000 hectares. The first mine proposed by the applicant was for the production of limestone blocks for the construction of Maud's Landing, near Coral Bay (a proposed tourist resort coastal development yet to receive development approval).

Environmental impact assessment of the proposed mine on Cape Range had not been undertaken prior to the objections being lodged, as the proposal to mine had not been referred to the EPA. This may have been because the proponent sought to obtain the grant of the mining leases before the EPA assessment of a mining proposal (the role of the EPA would be reduced to setting conditions on a lease already granted by the Minister for Mines).

### **ACTIONS TAKEN IN THE LEAD UP TO THE HEARING:**

There were a number of objectors, on environmental grounds, to the grant of the mining leases. The Western Australian Speleological Group (W.A.S.G.) and the Speleological Research Group Western Australia (S.R.G.W.A.) were the Objectors that were represented by the Australian Speleological Federation (Inc) (A.S.F.). Representation of the Speleological Groups was made in court by the Environmental Defenders Office. The Australian Speleological Federation *Conservation Commission Co-convenors*, Rauleigh Webb and Ric Brown coordinated a response from the W.A. Speleological Groups. Objections were lodged with the Carnarvon Wardens Court on behalf of A.S.F., S.R.G.W.A. and W.A.S.G. Other independent persons also lodged objections.



Jay Anderson (W.A.S.G. President), Bill Humphreys (W.A. Museum), Andy Spate, Elery Hamilton-Smith, Rauleigh Webb (W.A.S.G. & then A.S.F.

Conservation Co-Convenor), Sandy Boulter (E.D.O.) and Michael Bennett (E.D.O.).

**29/6/1999** The ASF Conservation officer's attention was drawn to the application by Finesky Holdings Pty Ltd to convert numerous exploration leases on the Cape Range in north-west Western Australia into mining leases (a total of 10 applications were lodged). One exploration lease encompasses an area 16km X 4km in one block, the other is approximately 4km X 5km. The proposed mine site is approximately 3 km directly west of the Learmonth airstrip. The closing date for objections with Carnarvon Wardens Court was 9/7/99.

**6/7/1999** Rauleigh Webb formulated the draft objection grounds and after discussion by, S.R.G.W.A., W.A.S.G and the A.S.F., the formal objections were agreed upon. The objections were signed by both Rauleigh Webb and Ric Brown on behalf of the A.S.F.. All objections were forwarded to the Carnarvon Wardens Court.

**9/7/1999** The objections were first heard in Carnarvon Wardens Court. It was around this time that the A.S.F. application for legal assistance was lodged with the Environmental Defenders Office, Perth, W.A.

**13/7/1999** Written advice was received from the Wardens Court that the next 'mention only' date was set for 16/8/99. Copies of the objections had to be served upon Finesky Holdings Pty Ltd prior to this date. Affidavits were completed to prove service of the objections.

**23/7/1999** The Environmental Defenders Office advised that it would accept and represent the A.S.F. case – the lawyer is Michael Bennett.

**1/8/1999** A letter was forwarded to Carnarvon Wardens Court requesting the transfer of any subsequent hearing to the Perth Wardens Court for convenience. Finesky Holdings Pty Ltd agreed to this.

**3/8/1999** The Australian Conservation Foundation (A.C.F.) advised us that \$37,500 had been set aside for WA Conservation issues and that we could possibly access a portion of these funds to finance our court case.

**20/10/1999** A fax was sent to the Perth Wardens Clerk seeking further 2 months adjournment to allow the parties to meet. Finesky Holdings Pty Ltd also agreed. Rather than have several objection hearings it was decided that the objections of S.R.G.W.A. and W.A.S.G were of similar substance to those lodged by the A.S.F.. Permission was therefore given for the

A.S.F. to represent S.R.G.W.A., W.A.S.G. & Individuals Susan & Nicholas White at the hearing. Letters from the objectors, stating this, were faxed to the Wardens Clerk. The Environmental Defenders Office was also sent a copy of these faxes.

**22/10/1999** 'Mention only' date – Perth Wardens Court.

**27/10/1999** A letter was received from the Perth Wardens Clerk advising of the adjournment of the case to 23/12/99 for further 'mention only'.

**22/12/1999** A meeting was held between Rauleigh Webb, Ric Brown, Michael Bennett and Finesky Holdings Pty Ltd executives and environmental staff. Finesky were unable to establish exactly where the proposed mine would be, stating that they had a few different options. Their first suggested area is prone to flooding. At A.S.F. suggestion they would employ local W.A.S.G caver, Darren Brookes, to do a surface survey for features. No real common ground was identified however the meeting was amicable and they seemed receptive to our arguments and input.

Finesky stated that such large mining lease applications were of benefit because their initial mine was small and would take a long time to become exhausted. This would mean the remainder of their lease would remain untouched for many years. They further stated that if the size of their lease was restricted then other mining companies could apply to mine the areas, resulting in many small mines whereas they only wanted one. A.S.F. representatives argued that any mine would severely impact on the mooted listing of the area as World Heritage.

**23/12/1999** Another 'Mention only' date – Perth Wardens Court, and further adjournment to 24/2/2000.

**11/2/2000** Rauleigh Webb and Ric Brown met with Sandra Boulter - EDO lawyer. Discussed the case plan and witnesses at length.

**24/2/2000** Perth Wardens Court – Further 'Mention only' date. Objections now to be listed for hearing over a 4 day period in August 2000 (10-11, 24-25)

## THE HEARING

The environmental attributes of the Cape Range Peninsula, and in particular the value of its subterranean fauna, were considered at a hearing in the Perth Mining Warden's Court. This hearing took place over 8 days during 1999 (August 12-11, 24-25, September 21-22). The applications covered an area of 82 square kilometres of the Cape Range karst system. The

initial proposed limestone mine is to provide stone for the proposed 'Coral Coast Marina Development' (Resort) at Maud's Landing, Coral Bay. There were a number of objectors to the grant of the mining leases, on environmental grounds. The Australian Speleological Federation (A.S.F.) was one of the objectors, who had lodged objections to the grant of the mining leases. It was represented in court by the Environmental Defender's Office.

The Australian Speleological Federation (A.S.F.) holds the view that Cape Range contains a karst area of considerable significance, which should be protected from mining. There were 8 grounds for objection. They were:

- The unnecessary size of the 10 combined mining leases,
- The visual impact of a mine within the proposed Mining Lease;
- The potential impact on the karst aquifer within the proposed Mining Lease;
- The potential impact on the karst within the proposed Mining Lease;
- The potential impact on the caves within the proposed Mining Lease;
- The potential impact on the cave fauna within the proposed Mining Lease;
- The potential impact on the proposed listing of the Cape Range peninsula on the World Heritage List, and that
- In all of the circumstances it is in the public interest that the application should not be granted.

A number of witnesses gave evidence to the warden regarding the environmental and global significance of the Cape Range karst system. Evidence was presented through the Environmental Defender's Office (E.D.O.), by both expert witnesses and documentary evidence, on matters such as the World Heritage attributes of the Cape Range, the value of the subterranean fauna of Cape Range and the impacts of mining on that fauna; the history of government proposals for the extension of the Cape Range National Park; and the occurrence of archaeological evidence of past human occupation of the Cape Range. All of the witnesses recommended an alternative site at Rough Range to the south of Cape Range. Some of the Witnesses were:

- Elery Hamilton Smith provided details of why the Cape Range should be

placed on the World Heritage List, how that process is conducted and why the granting of the mining lease would impact on the listing.

- Andy Spate provided geomorphology information to the Warden particularly relating to micro and meso-caves in the Cape Range Karst.
- Bill Humphreys provided details of the unique nature of the cave fauna at Cape Range and how any mining activity may adversely impact the fauna.
- Stefan Eberhard provided details of the impacts of pollutants on cave fauna – in particular the impacts of quarry activities on the Ida Bay karst.
- Kate Morse provided information on the anthropological and archaeological significance of the Cape – with respect to Aboriginal occupation and artefacts, rockshelters, middens and evidence of the earliest of human decorative traditions.
- Darren Brooks provided further information on the caves of the Cape Range and the particular area under submission, in reference to his “Cave Survey Report”.

## THE WARDEN'S DECISION

On Friday 9th February 2001 at 9:45am the Mining Warden gave his recommendation (to the Minister for Mines) whether or not to grant 10 mining leases, over the pristine and environmentally significant Cape Range, to Learmonth Limestone Pty Ltd. Mining Warden Graeme Calder recommended that limestone mining should not occur over 99.98% of an area in the Cape Range Peninsula covered by mining lease applications because of its extraordinary subterranean fauna and world heritage values. Although the Mining Warden's verbal presentation only took about half an hour, the 40 page document is summarized below.

In relation to the environmental values of the area, Warden Calder found that the area applied for “is located within a unique karst system which is outstanding on a world scale in terms of its location, geological structure, subterranean fauna inhabitants, both aquatic and non-aquatic, and its integrity... in its present state, were the Cape Range karst system to be nominated by the state of Western Australia for World Heritage listing, it would be listed.” He agreed that Cape

Range contained extraordinary and unique subterranean fauna, and that it is likely that unique fauna would be destroyed by a mining operation. He also noted a high potential for significant undiscovered anthropological sites. Warden Calder also found that if permission were given to commence a quarrying operation, such permission “would be a significant negative factor to be taken into account before World Heritage listing could be achieved.”

It was clear that Warden Calder accepted the evidence of several experts called by the A.S.F. indicating that granting the proposed mine would have a significant impact on the karst system and the subterranean fauna. He stated that “it is highly likely that if a mining operation of the type contemplated in the draft N.O.I. (notice of intent) is undertaken in the area presently identified in the N.O.I. that there will be an adverse impact upon the karst system and the subterranean fauna in and adjacent to the area of the quarry itself”. The Warden went on to say that “it is very likely that species of subterranean fauna that are unique.....will be destroyed and that no means will be left whereby such species may regenerate” or that due to the mining operations and the destruction of the environment “the discovery and identification of unique species will not occur”.

The A.S.F. had information that the Cape Range karst contained features of considerable significance which should be protected from mining. Several witnesses for the Objectors gave evidence about the importance of the subterranean fauna from Cape Range. The Warden stated that “its highly likely that the whole of the Cape Range karst system will contain in different places unique species and variations of subterranean fauna....and that many areas of the Range will be a source of extremely valuable ethnological and archaeological material, much of which has the potential to be destroyed or damaged in the course of mining operations”.

The Warden believed that it would be inappropriate for the Minister to grant mining leases “over all of the ground applied for by the applicant”. This conclusion was a combination of the “size of the area coupled with its uniqueness in terms of the karst system, the known and potentially extraordinary subterranean fauna, the high potential for the existence of significant undiscovered anthropological

material". The Warden recommended that a small quarry might be developed, if it was found after environmental assessment by the EPA that it was environmentally acceptable.

It was proposed by the Applicant, that 350,000 tonnes of limestone would be mined from an area of 13-15 hectares in size. It was the Applicant's submission that if the whole of the 10 mining leases were not granted, then it would be appropriate for 5 leases to be granted so that mining could be carried out at the site already selected by the Applicant, or at an alternative site should the chosen site be unsuitable for mining operations to occur. The Warden did not agree with this submission.

The Warden stated that "if it is appropriate for any mining lease or leases to be granted to the applicant, it is not appropriate that any more be granted than is absolutely necessary to enable the applicant to conduct an efficient mining operation". Furthermore, the Warden stated that if "information became available which had the consequence that mining operations could not or should not occur within any area granted, then before the applicant could move to any other place within the areas applied for now, but not granted, it would be appropriate in the public interest that the applicant should be required to make a fresh application for a mining lease over the proposed new area.....and thereby submit itself to the potential for public scrutiny in the form of a hearing before a Warden following objections being lodged to the grant of a lease together with possible examination of its proposal pursuant to the Environmental Protection Act".

In summary the Warden recommended that subject to a prior approval of the Environmental Protection Act, "the Minister for Mines should grant a mining lease over an area of land which is no greater than that which would be necessary to allow the applicants to conduct the quarrying operations set out within the draft N.O.I. whilst at the same time giving full effect to the conservation objectives.....the Minister should refuse to grant a mining lease or mining leases over any area applied for other than the area which I have previously referred to".

On the evidence relating to government policy which fostered the creation of the dual purpose reserve, the Warden found that there was a public interest in the existence and the operation of the policy, and that this interest may form the basis of objections to the grant of a mining lease.

However, the Warden determined that it was beyond his jurisdiction to make a finding about the suitability of the policy to create the 5(h) reserve for mining and conservation (despite the objector's evidence about the process that led to the creation of that policy).

### SHORT SUMMARY OF WARDEN'S RECOMMENDATIONS

The Warden recommended that, if it was considered acceptable by the EPA for the proposed mine to operate in the 5(h) reserve, then his recommendation was qualified as follows:

- A mining lease should only be granted for the area presently proposed to be mined (thereby rejecting 99.98% of the area applied for).
- The mining lease should only cover an area that is necessary for the proponent to conduct an efficient mining operation.
- This small mining lease should only be granted if the E.P.A. finds that the proposal to mine is environmentally acceptable.
- E.P.A. assessment of the proposal to mine should be made (contrary to present policy) *before* the Minister makes his decision.
- If it is found that the mine should not be sited where it is presently proposed, then the applicant should not put the mine in any other site within the lease area without going through the process again.
- The Minister for Mines should take advice from the Department of Minerals and Energy and the E.P.A. before making a decision about the mine site, if the Minister is minded to grant a mining lease large enough to move the mine to an alternative site.

Speaking on behalf of the Western Australian Speleological Group, Jay Anderson said, "We are pleased that the World Heritage value of the area has been recognised. The acknowledgment by the Warden has significance in the protection of the extraordinary karst system that is contained in the Cape Range Peninsula. The Warden's recommendations are quite favourable towards continuing to protect the area. We hope that the EPA will now find that the quarry proposal is environmentally unacceptable."

The Australian Speleological Federation President, Peter Berrill Commented, "that although we are happy with Mining Warden Calder's decision in so far that he has accepted the evidence presented by the Federation's expert

witnesses which recognises " that the entire area of Cape Range has significant environmental values worthy of World Heritage listing", we are disappointed in his recommendation to the Minister that, "a small quarry might be developed". Mr Berrill stated further that, "I can't justify this decision when he has stated that even a small quarry has the potential to irreversibly impact on the karst systems, destroying the unique subterranean fauna, resulting in a negative factor to be taken into account during World Heritage assessment. In light of this I call upon the Minister not to grant any mining lease in the Cape Range area."

### ENVIRONMENTAL IMPACT ASSESSMENT (E.I.A.)

After the close of the hearings, before the Warden's decision was handed down (and unknown to the objectors), the proponent referred the proposal for the mine to the E.P.A. for evaluation (under section 38 of the *Environmental Protection Act*). During November, the E.P.A. set a level of assessment, however the A.S.F. lodged an appeal, arguing that the level of assessment was inadequate.

The level of assessment was set as a Public Environmental Review (P.E.R.). Objections to the level of evaluation (P.E.R.) were lodged during December, with the A.S.F. recommending for a change to a Proposal Unlikely to be Environmentally Acceptable (P.U.E.A.). The outcome was that the level of assessment was changed from a P.E.R. to an Environmental Review and Management Program (E.R.M.P.). Once again, this is a positive outcome, and the Minister also allowed an extended period of public comment (10 weeks instead of 8 weeks).

During late July 2001, the E.P.A. published the "E.R.M.P. Draft E.P.A. Guidelines: proposed limestone quarry located 35km south of Exmouth near Learmonth, Cape Range (Learmonth Limestone Pty Ltd)" with submissions closing on the 13/8/2001. The A.S.F. W.A.S.G., S.R.G.W.A. and various individuals made submissions regarding the draft guidelines. It should be noted that the draft guidelines were some of the most comprehensive developed for the assessment of karst in W.A. However there were some of areas that were not included in the Guidelines:

- The potential destruction of unknown karst features, including caves, that occur on the site.

- The leaching of water into the water table, through microcaverns and mesocaverns.
- The impact of water with high sediment levels on cave fauna and caves.
- The Run-off of high quantities of water (in a storm event) into caves/cracks in the quarry and the potential pollution of the karst system and water table by blasting residues, sedimentation or spillage's that infiltrate into the ground.

Some of the areas suggested for inclusion in the Guidelines were:

1. Develop a plan for what is to occur when a cave or karst feature is intersected during mining activities. Procedures need to be developed where speleologists assess the karst features as soon as they are entered by mining activities.
2. Develop procedures to assess/manage the impact of sediment and large quantities of water on karst features, cave fauna, and the water table.
3. Develop a comprehensive quarry rehabilitation plan that includes the management of karst features.
4. Ensure that experienced speleologists or karst management consultants are employed to assess each environmental issue.

### CONCLUSIONS

The Warden's recommendation highlights some very important issues regarding the Cape Range of Western Australia. His decision makes a careful distinction between the role of the Mining Warden's Court and the W.A. State government mining policy in determining the appropriateness of mining activities in relation to conservation goals. It highlights the uncertainty that the creation of dual-purpose reserves presents for industry and the community.

It is known from past fauna studies that there is a large variety of troglobitic fauna in the Cape

Range area. Preliminary information regarding the fauna collected (from drill holes placed on the proposed mining lease) indicates several possible new species. The Fauna Report indicates that there are several new genus and species of troglobitic fauna identified. One species had not been previously found in the Cape Range or elsewhere, while another is a new family record for Australia. It will be interesting to see what the Proponent does with these results.

We are now waiting on the proponent to release their environmental review document for public submission, at which time we will make further comments in a formal submission. However, it is the Minister for Mines, who will have the final decision regarding the granting of the mining leases. W.A. Speleological Groups encourage all Australian Speleological Group members to share the information regarding this issue with their friends and families. We would request that Individuals write letters to Government Minister's and send submissions regarding the Cape Range Issues.

Finally, the A.S.F. and the W.A. Speleological Groups really appreciate the huge amounts of work that was undertaken by the lawyer's of the Environmental Defender's Office and their staff in the preparation and execution of this case. It is to be hoped that the new government in Western Australia adopts the recommendation of the Mining Warden *against* the grant of mining leases in Cape Range, and examines the nearby Rough Range as a suitable alternative for a strategic limestone reserve.

Whatever the outcome of this case the A.S.F. will need to continue to:

- oppose limestone mining on the Cape Range peninsula
- call for the Government to remove the strategic limestone mining purpose from the proposed 5(h) reserve
- enlarge the Cape Range National Park
- advocate for and nominate the Cape Range peninsula for World Heritage Listing.

Jay Anderson  
W.A.S.G. President  
W.A.S.G. Conservation Officer

The author wishes to thank Michael Bennett and Sandy Boulter of the EDO WA (Inc), and Rauleigh Webb for all their hard work during the process.

---

## REFERENCES

- Hamilton-Smith, E, Kiernan, K and Spate, A, 1998, Karst Management Considerations for the Cape Range province Western Australia: *A report Prepared for the Department of Environmental Protection, March 1998*
- Harvey, M.S. (1988). A new troglobitic schizomid from Cape Range, Western Australia (Chelicerata:Schizomida). *Records of the Western Australian Museum* **14**: 15-20.
- Harvey, M.S. (1991). The cavernicolous pseudoscorpions (Chelicerata: Pseudoscorpionida) of Cape Range, Western Australia. *Records of the Western Australian Museum* **15**: 487-502.
- Humphreys, W.F. 1993. The significance of the subterranean fauna in biogeographical reconstruction: examples from Cape Range peninsula, Western Australia. In Humphreys W.F. (Ed) *The Biogeography of Cape Range, Western Australia. Records of the Western Australian Museum* **45**: 165- 192.
- Humphreys, W.F., Adams, M. and Vine, B. (1989). The biology of *Schizomus vinei* (Chelicerata:Schizomida) in the caves of Cape Range, Western Australia. *Journal of Zoology, London*. **217**: 177-201
- Humphreys, W.F. (1991). Biological research into the Cape Range karst area, North West Cape peninsula, Western Australia. Pp 6-14 in S. Brooks (ed.) *Cave Leeuwin - Proceedings of the 18th Biennial Conference of the Australian Speleological Federation Inc., Margaret River, Western Australia*. 30 December 1990 - 5 January 1991. Australian Speleological Federation, Broadway, New South Wales.
- Humphreys, W.F. (1993). The significance of the subterranean fauna in biogeographical reconstruction: examples from Cape Range peninsula, Western Australia. In Humphreys W.F. (Ed) *The Biogeography of Cape Range, Western Australia. Records of the Western Australian Museum* **45**: 165- 192.

Humphreys W.F. (Ed) (1993). The Biogeography of Cape Range, Western Australia. *Records of the Western Australian Museum. Supplement No. 45*

Humphreys, W.F. (1994). The subterranean fauna of the Cape Range coastal plain, northwestern Australia. *Unpublished report to the Australian Heritage Commission and the Western Australian Heritage Committee*. 40pp

Main, A R, (1993) Synthesis and Prospect: in W F Humphreys (ed) The Biogeography of Cape Range, Western Australia 1993: *Proceedings of a WA Museum Symposium held in 1992, p.243-248.pr*

Sutton, D. (2000). The Treasures of Cape Range. Australian Conservation Foundation : *Habitat Australia* – February 2000, p.16-19.

Watson, John, Hamilton-Smith, Elery, Gillieson, David, and Kiernan, Kevin (Eds.), 1997. *Guidelines for Cave and Karst Protection*, IUCN, Gland, Switzerland and Cambridge, UK. 63pp. ■

## Glow-worms in Tasmania

Arthur Clarke

### Introduction:

The glow-worms commonly seen in a number of Tasmanian caves are insect larvae, not worms; they are in fact the larval form of a fly (the insect group referred to as Dipterans). The Tasmanian glow-worm (*Arachnocampa tasmaniensis*) is typical of those insects including flies that have four stages of development in their life cycle: egg, larva, pupa and adult. Renown for their bioluminescence, the glow-worms found in caves or other dark and sheltered places (in wet or humid settings) are a predatory species of gnat (a type of fly): a fungus gnat, which in adult form resembles the size and shape of a large mosquito. Now belonging to the dipteran family Keroplatidae (Matile, 1986; 1989), these bioluminescent fungus gnats were formerly classified in the family Mycetophilidae. There are four described species in the genus *Arachnocampa*, three in Australia and one in New Zealand; however, recent studies suggest there maybe further species present in Australia (C. Baker, pers. comm.).

### Life history stages, prey capture and bioluminescence:

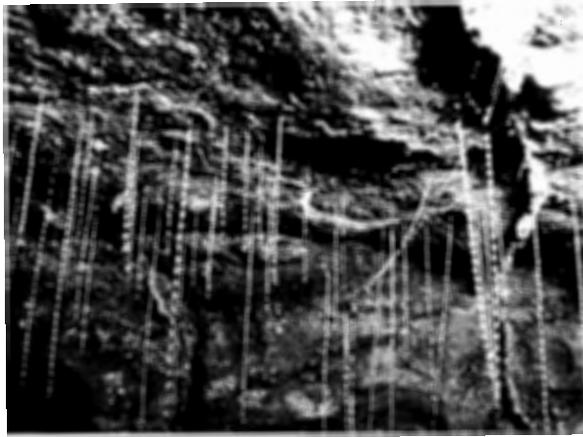
The larval stage of the glow-worm is divided into a number of sub-stages of growth or instars (between moults) as the larva develops. Considered as the major growth or feeding stage (and the longest living stage), the complete

larval stage (5 instars with 4 moults) of the glow-worm lasts up to 9 or 10 months or more and up to a year in warmer areas where there is a more marked seasonality effect. The translucent larvae live inside long thin tube “nests” composed of mucous and silk secreted from salivary glands in the larva’s mouth. The tubes are suspended across a lattice of horizontal threads, from which the larva drops down a large number (30 to 50, sometimes up to 70) silken snare threads or “fishing lines” used to trap their prey. As shown in the accompanying close-up photograph, the larvae secrete small beads of mucous that envelop these vertically hanging snare threads to create a “sticking” point of attachment for prey. These mucous droplets also contain an acid fluid (mainly oxalic acid) that kills the prey sticking to the snare thread fishing lines (Matile, 1989).

Glow-worm larvae have a bioluminescent organ in their abdomen that creates a glow in darkness to attract its prey, which gets captured by their mucilaginous snare threads. The prey of Tasmanian glow-worms includes a range of flying insects: midges, mosquitoes, other small flies and the adults of aquatic insects: mayflies, stoneflies, caddis flies and lacewings (Richards & Ollier, 1976). Glow-worm larvae are also cannibalistic; apart from devouring their own adult flying forms, they also prey on other young glow-worm larvae. During observations in *Mystery Creek Cave*, I have seen juvenile cave crickets (mainly the tiny 1<sup>st</sup> or 2<sup>nd</sup> instar nymphs) ensnared on the mucous-coated threads, plus hapless small spiders and

occasionally a small cave harvestman or cave beetle.

Once ensnared by the glow-worm larva, its jaws haul up the vibrating or "weighted" threads and the prey is consumed: either having its juices sucked out or actually being eaten by the larva (Richards, 1960; Baker, 2000).

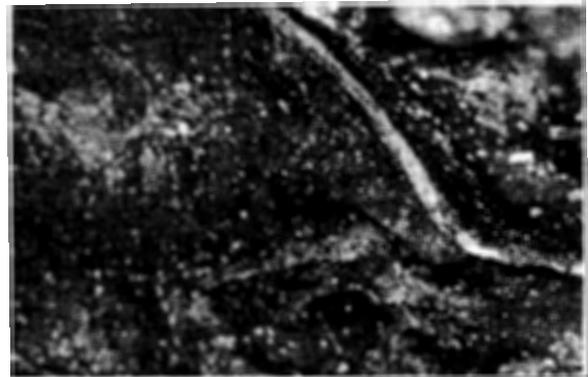


*Glow-worm larva with its mucous beaded snare threads in Mystery Creek Cave at Ida Bay, Tasmania.*

*"Photo by Arthur Clarke (Copyright Arthur Clarke)".*

At the end of its 5<sup>th</sup> instar larval stage, the glow-worm larva shrinks in size, becomes opaque and removes or absorbs some of its snare threads as it pupates. In this non-feeding pupal stage, the glow-worm larva "transforms" or metamorphoses to the adult form. At this pupa stage, we see the first evidence of sexual differences in the species; the female is longer, larger and slightly wider than the males. Although less evident and more intermittent, bioluminescence continues during the pupal stage, but in the case of pupal males, the glowing stops altogether some 2-3 days before the male emerges. However, in the case of pupating females, the bioluminescence intensifies - up until around the time it emerges laden with eggs - to attract mating males. It is interesting to watch the number of adult males hovering around or actually sitting on the female pupa - waiting to mate - just before the female adult emerges. The actual action of a male adult landing on the female pupa may cause the female to increase its luminescence (Frederikson, 1983). If per chance there are no males in waiting, the adult female will continue to glow till a male is found. Her adult life is short; after a short period of mating - a few

hours at the most - she deposits her clutch of 130 or so fertilised eggs then dies, only living for 1-3 days. The male adult glow-worm flies can mate several times and lives up to 4-5 days. After "hatching" from the eggs, a new cycle of glow-worm larvae appear.



*Two adults copulating after the larger female (LHS) has just emerged from its now empty pupal case above in Mystery Creek Cave at Ida Bay, Tasmania.*

*"Photo by Anthony O'Toole - Photo Copyright: The University of Queensland".*

Although there have been no known specific life history studies of the Tasmanian glow-worm species (*Arachnocampa tasmaniensis*) - at least not in Tasmanian climatic conditions - it is likely that the duration of life history stages for *A. tasmaniensis* are similar to those of the New Zealand species: *A. luminosa*. A re-examination of the morphology of the Tasmanian species by Harrison (1966) indicated that it was closely related to the New Zealand species and Richards and Ollier (1976) subsequently demonstrated a similarity in the biological and ecological relationships of *A. tasmaniensis* to *A. luminosa*. Studies of the glow-worm species at *Waitomo Caves* in New Zealand indicate that the adult fly emerges from its pupal case after 12-13 days (Richards, 1960), so it is probable that in the slightly cooler caves of southern Tasmania, the glow-worm fly emerges from its pupal case after about 12-15 days. In the warmer climate of southern Queensland, the pupation period for the glow-worms (*A. flava*) at Natural Bridge in Springbrook National Park is around 6-7 days (Baker, 2000). Laboratory studies with collected specimens of the Tasmanian species (*A. tasmaniensis*) reared in controlled

temperature incubators at 20°C at the University of Queensland reveal a similar pupation time to the Queensland species (C. Baker, pers. comm.) In New Zealand, the eggs of *A. luminosa* take 3 weeks to hatch (Richards, 1960; Frederickson, 1983), but in the 20degree laboratory temperatures at University of Queensland, the eggs of *A. flava* take only 7-9 days to hatch into larvae (Baker, 2000).

The bioluminescence of glow-worms results from a chemical reaction involving several components. The process involves a little bit of complex physiology and organic chemistry – so you may want to skip this bit! In basic terms, the bioluminescence is the by-product of a metabolic process involving the breakdown of waste products. The light organ of the glow-worm is produced from the swollen tips of four thin-walled excretory tubules (malpighian tubules) that lie in a reflective layer of respiratory tissue (tracheal tubules) in the posterior end of the glow-worm's body (Frederikson, 1983). A self-produced biological enzyme (luciferase) acts as a catalyst on luciferin: a waste product from the insect's metabolism formed in the digestive system of the glow-worm. In conjunction with the enzyme action on luciferin, the biological energy molecule ATP (adenosine triphosphate) combines with oxygen from the extensive system of respiratory tubes to form an electronically excited product capable of emitting light. Written as a chemical formula, you have: luciferin + luciferase + ATP + oxygen = "excited product" + luciferase, emitting bioluminescence (Frederikson, 1983). The chemistry involved in glow-worm light emissions is similar to that used by other self-luminescent living organisms and there is a particular similarity with the physiology and biochemistry of bioluminescence in fireflies or lightning bugs (McElroy & Seliger, 1962).

### Occurrences of glow-worms in Tasmania:

Glow-worms have been reported from Tasmanian caves since the 1840's when tourists first visited the *Chudleigh Caves* (*Wet Cave* and *Honeycomb*) at South Mole Creek and then more latterly in the late 1880's/ early 1890's following the discovery of the *Queen Victoria Caves* at Ida Bay, subsequently known as the *Queens Caves*, *Ida Bay Caves*, *Entrance Cave* and now as *Mystery Creek Cave* (Clarke, 2000). The latter developed some international repute in the mid-1890's, when the *Ida Bay Caves* were

described in an 1895 edition of *Scientific American* as "*The Glow-worm caves of Tasmania*". In graphic journalistic style, this report stated that "...the ceiling and sides of the cave seemed studded with diamonds...an effect due to millions of glow-worms hanging to the sides of the walls and from the ceilings..." (Anon., 1895). Although not formally identified till 1925, A.M. Lea is attributed as being the first collector of adult glow-worms from Tasmania (in December 1909) and his holotype male and allotype female specimens are purportedly in the South Australian Museum (Clarke, 2000). Lea's collection label states: "*Ida Bay Caves, Tasmania. Arthur M. Lea, December 1909. In total darkness fully ¼ mile from entrance.*" (Ferguson, 1925). Hence, *Mystery Creek Cave* is the site locality for the Tasmanian glow-worm (*Arachnocampa tasmaniensis*).

Although *Waitomo Caves* (in New Zealand) is probably better known internationally as a glow-worm site (by virtue of being a long established visitor attraction), based on the reports of cavers and entomologists who have seen the glow-worm displays at both Ida Bay and Waitomo, the population densities and total numbers of glow-worms in *Mystery Creek Cave* (and *Exit Cave*) are probably far greater than Waitomo. Apart from *Mystery Creek Cave*, which is occasionally visited by adventure cavers and school groups, *Marakoopa Cave* at Mole Creek is well known for its glow-worm displays and is probably the only cave in Tasmania where large numbers of glow-worms are seen on a regular basis by tourists. Glow-worms are recorded from caves in 24 karst areas of Tasmania and in the dolerite, granite and sandstone caves of three non-karst areas (Clarke, 1997). There are also reported sightings of glow-worms from several other cave areas in Tasmania, plus in abandoned mine adit workings, old railway tunnels, under bridges and in drain conduits.

As mentioned previously, caves are not the only sites where glow-worms are found in Tasmania. They occur outside of caves in other sheltered areas of darkness where their glow has effect in attracting prey species. Although found in lesser numbers, glow-worms can be seen at night in many wind-sheltered rainforest areas: under large rotten logs or on moist rock walls – often near filmy fern or at sites near water spray, e.g., near waterfalls – and in wet forest adjoining rivers and streams. The larvae and adults of this surface dwelling glow-worms tend to be smaller than the cave forms and show more evidence of seasonality with fewer larvae present in the

warm and drier summer months. Conversely, in Tasmanian caves where the ambient air temperature is relatively constant all year round, there appears to be more constant overlap of all life cycle stages present at all times, even though they may appear more abundant and brighter around October-November each year.



*Amanda Smith, Claire Baker & Debbie Hunter looking for glow-worms in Sassafras Cave at Mole Creek, Tasmania.*

"Photo by Arthur Clarke (Copyright Arthur Clarke)".

### Taxonomy of glow-worms:

In terms of taxonomy – the classification of plant or animal species – glow-worms are classified as a type of fly, belonging to the Order Diptera: one of the largest orders of insects (Class Insecta). In taxonomy, an Order is subdivided into family and sub-family groups; themselves divided into a number of genera and species. The Tasmanian glow-worm: *A. tasmaniensis* (Ferguson, 1925) is one of four described species of the genus *Arachnocampa*, with two other species in Australia: *A. flava* (Harrison, 1966) from southern Queensland and *A. richardsae* (Harrison, 1966) from the old Newnes railway tunnel near Lithgow (NSW), plus the New Zealand species *A. luminosa* (Skuse, 1890) from Waitomo. For almost a century, all these glow-worms have been referred to as mycetophilids - belonging to the Family group: Mycetophilidae (with *Arachnocampa* placed in the sub-family of Keroplatinae). Following a revision of this dipteran group in 1981, by the French entomologist Loic Matile, the *Arachnocampa* genus was raised to a sub-family rank (Arachnocampinae) and reassigned to the

Family Keroplatidae in the super-family Mycetophiloidea (Matile, 1986).

Based on Matile's revised classification (detailed in his 850page PhD thesis along with keys to the world's genera), this "new" family group (Keroplatidae) has three subfamilies: Arachnocampinae, Keroplatinae and Macrocerinae (Matile, 1986; 1989). The sub-family Keroplatinae was divided into two "tribes" (Keroplatini and Orfelini) that include a number of predominantly non-glowing keroplatid species, including cave-dwelling predatory species of the genus *Neoditomyia* found in tropical areas of Central America and northern South America (Jackson, 1974). During the field trips associated with the recent IUS Congress in Brasilia, I photographed some 3-4cm long larvae - species of *Neoditomyia* – along with their snare threads, in several caves of southern Brazil. Dave Merritt (pers. comm.) suggests that this genus (*Neoditomyia*) may possibly be the same or similar genus for a species of non-glowing larvae with long snare threads that I have recently collected from caves in SW China. The so-called "threadworms" or webworms seen in caves in USA – where web-spinning larvae sit in spider-like hygroscopic (moisture sensitive) webbing - are members of sub-family Macrocerinae: genus *Macrocera* (Coher, 1996).

### Disturbance threats and habitat preferences:

Severe disturbances within a cave or outside in the cave catchment can interfere with the natural ecology that supports the viability of glow-worm populations. This is particularly applicable in the instances where stream ecology is affected, resulting in a reduced input of aquatic insects and associated small flying insects (Richards and Ollier, 1976; Frederickson, 1983). Apart from prey deprivation, glow-worms are particularly susceptible to desiccation due to decreasing humidity, warm breezes or increases in temperature (Merritt & Baker, 2001). Any developmental changes in the morphology or shape of a cave and interference with the cave entrance are likely to affect the cave climate, impacting on glow-worm populations (Frederickson, 1983).

Cave visitors often affect glow-worm displays and can also impact on glow-worm numbers. Although most larvae "shutdown" their glows within a minute or two's exposure to cavers headlights or torches, the glow-worms usually

recover quite quickly when lights are turned off and darkness returns to their environment. Glow-worm light emissions also stop rapidly in response to loud voices or when the cave wall is tapped sharply (McElroy & Seliger, 1992). Interestingly, as an aside, Debbie Hunter (pers. Comm.) claims that glow-worm light emissions improve in response to certain sounds or music and some visitors to *Sassafras Cave* at Mole Creek claim to have seen marked improvement in displays during her flute playing performances. The worst long-term effect on glow-worms probably comes from the desiccating heat emanated by light globes (and carbide lights of course), when cavers view the glow-worms closely. Although the glow-worm larvae expend some of their energy in hauling up their silken snare thread fishing lines to devour their prey or clean and re-coat their threads with mucous, human interference can lead to further expenditure of larval energy. Visitors to glow-worm sites may inadvertently brush against the mucous beaded "fishing lines" causing tangling of the snare threads. Similarly, the threads may simply become entangled in the air current created as we walk past them or as we exhale when as curious and inquisitive onlookers, we stand too close to glow-worms.

### References (and further recommended reading):

Anon. (1895). The Glow-worm caves of Tasmania. *Scientific American*, November 23: 332.

Baker, C. (2000). A biological basis for management of glow-worm (Diptera: Keroplatidae: *Arachnocampa flava*) populations of ecotourism significance. Unpublished BSc Honours thesis, Zoology and Entomology, School of Life Sciences, University of QLD, (Submitted November, 1999). 63pp.

Clarke, A. (1997) *Management prescriptions for Tasmania's cave fauna*. Report to the Tasmanian Regional Forest Agreement Environment and Heritage Technical Committee. March 1997. 167pp.

Clarke, A. (2000) Records of the Tasmanian cave fauna known or purported to be in the South Australian Museum. *Helictite* 36 (2): 23-37.

Coher, E.I. (1996) Cave-associated tropical American *Neoditomyia* (Diptera: Mycetophilidae). *Pan-Pacific Entomologist*, 72 (3): 152-159.

Frederikson, R (1983) *The New Zealand Glowworm*. Waitomo Caves Museum Society Inc., Waitomo Caves, New Zealand. 32pp.

Ferguson, E.W. (1925) Description of a new species of Mycetophilidae (Diptera) with luminous larvae. *Proceedings Linnaean Society, N.S.W.*, 1925, Vol. L: 487-488.

Harrison (1966) Australian glow-worms of the Genus *Arachnocampa* Edwards (Diptera: Mycetophilidae). *Pacific Insects*, 8 (4): 877-883.

Jackson, J.F. (1974) Goldschmidt's dilemma resolved: Notes on the larval behaviour of a new neotropical web-spinning mycetophilid (Diptera). *The American Midland Naturalist*, 92 (1): 240-245.

McElroy, W.D. and Seliger, H.H. (1962). Biological Luminescence. *Scientific American*, December 1962, Vol. 207 (6): 76-89.

Matile, L. (1986). Recherches sur la systématique et l'évolution des Keroplatidae (Diptera Mycetophiloidea). These de Doctorat d'Etat et Sciences Naturelles, Muséum National d'Histoire Naturelle et Université Pierre et Marie Curie, Paris. xxx + 850 pp

Matile, L. (1989). Family Keroplatidae. Chapter 8 (pp. 128-133.) in Evenhuis, N.L., (Ed.) 1989: *Catalog of the Diptera of the Australasian and Oceanian regions*. Bishop Museum Press, Honolulu & E.J. Brill, Leiden. 1155 pp.

Merritt, D. and Baker, C. (2001) Australian Glow-worms in Caves. *NewCaves Chronicles*, Vol.16 (January 2001): 42-44.

Richards, A.M. (1960) Observations on the New Zealand Glow-worm *Arachnocampa luminosa* (Skuse) 1890. *Transactions Roy. Soc. N.Z.*, 88: 559-574.

Richards, A.M. and Ollier, C.D. (1976). *Investigation and report of the ecological protection of Exit Cave near Ida Bay in Tasmania*. Report to National Parks and Wildlife Service - Tasmania. 72pp.

Skuse, F.A.A. (1890) Description of a luminous dipterous insect from New Zealand (fam. Mycetophilidae). *Proc. Linn. Soc., N.S.W.*, 1890, 2<sup>nd</sup> series, Vol. V: 677-679.



**Down Under All Over**

Much has happened since SRG's last contribution to DUAO. The Group's environmental monitoring of the atmosphere in the Leeuwin-Naturaliste Ridge's Crystal Cave has moved from a two week log four times a year to that of a year-long exercise starting from this March. Members of CLINC will be assisting the project by changing batteries once a month. A similar but longer-term project, funded by CALM but using the Group's other data logger, began in the Calcified Tree Root Extension of Calgardup Cave late last year. The Extension will probably be opened to restricted tourism some time next year, once data baselines have been determined. Results so far indicate that both caves exhibit quite a stable temperature and humidity with the temperature varying only about 0.3°C and humidity a few percent throughout the year. A more detailed report will be presented as more data is obtained.

SRGWA member Vicki Bresnan has undertaken the arduous task of extracting hourly readings from the Crystal data. Readings were taken every 5 minutes during the 2 week logs every 3 months last year and every 10 minutes during the current year-long logs, downloaded every 3 months, [this to provide background information] and relate it to hourly readings from a "nearby" automatic weather station. CALM employee Tracey Robins is doing similar work on the Calgardup data.

Norman Poulter OAM was co-opted by the ASF Awards Commission during the Cave Odyssey Conference to present ASF Awards to four Western Australians that have been outstanding since the 1997 Quorn Conference. He decided to achieve this by way of a special ASF "Mystery" Dinner held at Lake Cave Tearooms and CaveWorks Museum on the evening of April 21. This highly successful event was attended by 55 adults and 5 children representing WASG, CLINC, SRGWA, CALM,

WA Museum and the Augusta-Margaret River Tourist Bureau who kindly provided the CaveWorks building and auditorium as the venue for the Awards presentation. Three Certificates of Merits were presented to Wayne Tyson [WASG-SRGWA], Keith Tritton [deceased] and Peter Bell, both of the Augusta-Margaret River Tourist Bureau. An Award of Distinction was then presented to Dr. Bill Humphreys of the WA Museum. An illustrated report of these presentations should appear in this or a later edition the Australian Caver.

During the course of the ASF "Mystery" Dinner, the announcement was made of the time, venue and name of the 2003 ASF Conference - UNDER WAY - to be held at the Bunbury Cathedral Grammar School from January 2-6, 2003. This announcement was made jointly by chief conference organizer Ida Newton [Chair of SRGWA], and Fran Head of WASG. Preparations for the Conference are thus, well under way!

During April, the locally famous Christmas Tree decoration of Dingo Cave 6Wi-71 was broken during the course of a school excursion. SRGWA was called in to assess the damage and advise possible remedial action. This resulted in a report to the land manager, CALM - a copy of which is now in the ASF Library.

SRGWA has changed its official address to PO [redacted]. This address will also service the forthcoming 2003 "Under Way" Conference.

We also have a new web site, found at [redacted]

Norman Poulter OAM



**April 2002**  
**NSW Speleological Council Meeting.**  
**Place:** To be held at Jenolan Caves, the school house at the number 2 carpark.  
**Date:** Saturday 13<sup>th</sup> April 2002, 10am - 4pm.  
**Contact:** Megan Pryke [redacted]

## PERSONAL CO<sub>2</sub> SCRUBBER

David Rothery

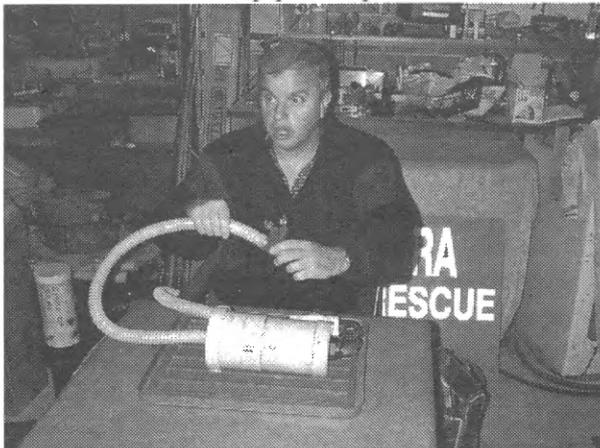
### Background

The desire to build a personal carbon dioxide scrubber was based on the premise of others, that the body is more sensitive to an increase in carbon dioxide concentration than to a corresponding decrease in oxygen concentration.

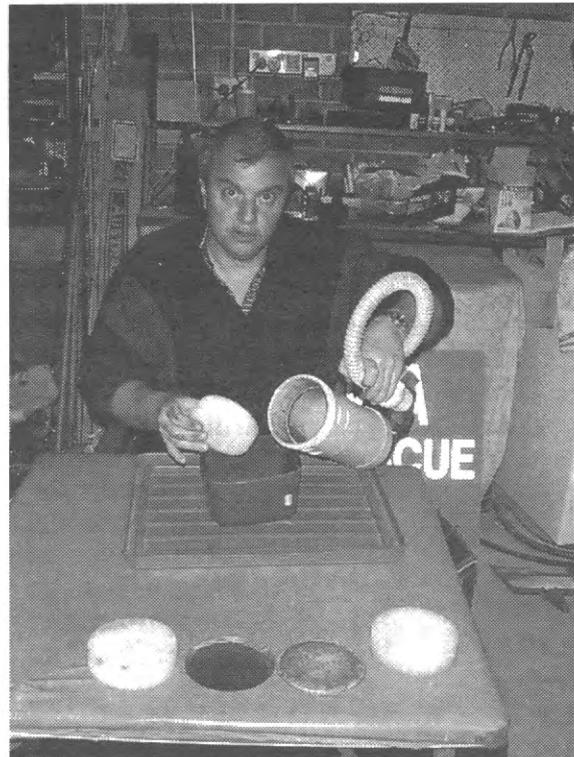
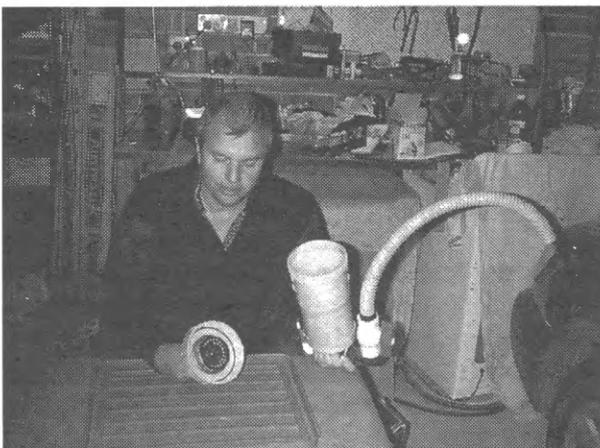
Corresponding to the opportunity to go on a trip in the B4-5 Extension, was an opportunity to test out a personal scrubber in an environment with moderate CO<sub>2</sub> levels. The existing known terminus of the B4-5 Extension is named St Patricks Lake. Visitors to this spot are unanimous in their stated desire to turn tale and exit as soon as arriving. This anxiety is believed to be due to elevated carbon dioxide levels.

### Construction

The scrubber canister was constructed from 100mm PVC sewer pipe components.



This provides a robust light-weight, water-tight container for the chemical contents. A coarse stainless steel strainer fixed in position covers the inside of the entry and exit ports.



Inside the canister the first component is a 20mm coarse foam diffuser to spread the airflow. On this is stacked silica gel to dry the air. The next chemical in the stack is Lithium Hydroxide to bind with the carbon dioxide. To confine the powder from moving, a fine 1.6mm thick HEPA filter is placed on either side of it. The NASA designed HEPA filter will remove dust and other particles larger than 0.3 microns. This is smaller than smoke particles or bacteria. Finally in the stack, a layer of activated carbon is added. The activated carbon will absorb many organic and a number of inorganic compounds including Hydrogen Sulphide which is a poisonous product of rotting vegetation.

A mouthpiece was selected for caving rather than a face mask, which has been trialed on units in the past. This may be because a face mask is required for military gas masks on which the designs were based. The mouthpiece would stop the face from overheating during periods of activity. The mouthpiece would also be better for communication as it can readily be removed. In the cave atmosphere there is no environmental requirement for a face mask. The mouthpiece consists of a commercially available snorkel mouthpiece with exhaust flap valve. The mouthpiece is connected to the canister with a ribbed flexible hose such as would be used for a washing machine drain hose. A second flap valve was machined down and pressed into this

hose to limit air movement to a single direction, and prevent the entry of water.

From the base of the unit a ball valve manually controls the entry of water for purposes of entering a swim such as exists in the B4-5 Extension.

## Results

Usage of the unit was adopted in an area where the carbon dioxide level was later found to be 3%. Oxygen levels were found to be 16.6% further down where the carbon dioxide level had risen to 4%.



The unit was easy to transport despite a temporary belt attachment, which proved troublesome. This initial design had an intake tube to permit snorkelling. It was quickly found to be a hindrance as the end of the tube was often blocked on the back of the overalls. The next version will have a strainer intake, which cannot be sealed off accidentally.

The performance from this model was disappointing. The contents appeared to pack down after a short period of usage in elevated carbon dioxide levels. The packing down is characterised by being initially unable to draw breath without great effort. Once the air breaks through then the remainder of the breath is easily obtained. The anxiety caused by not being able to draw breath without great initial effort caused the use of the unit to be terminated. The packing down had not occurred with trial usage on the surface, where it was found to operate easily.

The mouthpiece design was excellent. It could readily be removed and stored when not in use to keep it clean. Unlike divers, cavers cannot readily wash out a mouthpiece.

## Conclusion

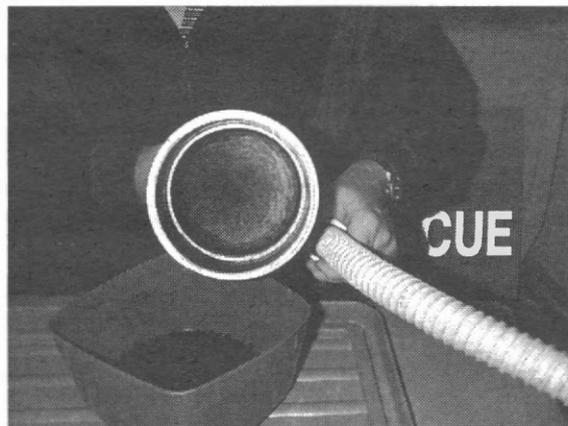
Without the use of a carbon dioxide scrubber the effects of this environment type were clearly felt once again. The clear intentions of the trip were rapidly abandoned. Some have since proposed that this would be due to the diminished oxygen level affecting the ability of the brain to function clearly. Until an effective personal scrubber is available, and tests conducted, we may not know for certain.

A successful start on production design, but it is back to the drawing board for the next trials.

## Post Trial Examination

Following the trial the canister was emptied and the contents examined.

The activated carbon was found to be sooty, which had unnecessarily used up the capacity of the following HEPA filter. It was decided that next time the activated carbon should be washed and baked dry prior to usage.



The Lithium Hydroxide was found to have totally vacated the compartment where it was intended to have been. Later it was found to be in the bottom of the canister and partly blocking the intake hose. It was found to be still in powder form contrary to expectations. The only explanation for the blocking effect may be the total blocking of a HEPA filter which had its seal compromised by heavy sucking; or the containment of the Lithium Hydroxide in the piping at the bottom of the canister.

The Silica Gel was in place and had clearly changed colour.

The filters need to be rearranged to prevent migration of the fine Lithium Hydroxide in either direction. The Lithium Hydroxide could be stacked in place easily using the coarse diffuser pads and placement of a HEPA filter below the Lithium Hydroxide.

The CO<sub>2</sub> Scrubber Exposed



