

# CAVES

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# **REQUEST FOR ARTICLES 2025**

OCTOBER

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NOVEMBER, FEBRUARY(2026), MAY, AUGUST

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DIGITAL CAVES AUSTRALIA IS INCLUDED WITHIN ASF MEMBERSHIP FEES.

COVER: CAVERS PROGRESS ALONG THE NEWLY DISCOVERED JEWEL CARRIAGEWAY, GOAT CAVE, NULLARBOR, PHOTO BY ALAN PRYKE

# **AUSTRALIA**



Researcher Christoph Gert Hopel searching for aquatic crustaceans of the *Psammaspididae* family - Photo by Garry K Smith



Warbla Cave - Nullarbor - Photo by Garry K Smith



Sil in Labyrinth Cave - Photo by Marcos Silverio

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A moment in time at Tantanoola - Photo by Renee Wilton



Photo by Garry K Smith

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# **Editor's Note**

"Life begins at the end of your comfort zone." 
Neale Donald Walsch

WOW — what an extraordinary issue! This *Caves Australia* reflects just how much is happening in the caving community right now. It came together right on deadline, and I want to sincerely thank everyone who contributed their time, stories, and images to make it happen. The content is current, relevant and highlights the ongoing energy and dedication within the Australian caving scene.

One highlight that stands out is the incredible Cave Rescue event, a shining example of teamwork, preparation and the strength of training systems. These kinds of stories remind us why we train so hard — because when the unexpected happens, our community rises to the occasion. I couldn't be more proud of the cavers involved who came together to ensure the safe retrieval of a fellow explorer. It's a testament to what's possible when skill, trust and calm under pressure come together underground.

This edition also features some excellent photography and documentation of exploration work happening across the country. It's always great to see how both new and experienced cavers are contributing to discovery and documentation in their own ways.

Whether you're reading this underground between trips or catching up from home, I hope this issue offers something that informs, engages and maybe even challenges your perspective a little.

**Nadine Muresan** 



Watching Bogdan be the test causality at Mole Creek, Tasmania - Photo by Grason Mason

# President's Report

As the winter chill takes hold across much of the country (for those in the "sillier" cold parts of Australia), I hope you're keeping warm—or at least enjoying the warmth found underground! I've just returned from a month of hugging rocks beneath the Kimberley, and I'll admit, the return to the cold has been a shock to the system.

Last month saw the conclusion of the 19th International Congress of Speleology, held from 20-27 July in Belo Horizonte, Brazil. This quadrennial event, hosted by the International Union of Speleology (UIS), is a major gathering of the global speleological community. A 'bakers dozen' of Australian cavers attended, representing ASF and Australia's vibrant caving scene. We look forward to hearing their insights, experiences and stories when they return.

Some early highlights have already emerged. The next Congress has been confirmed for Romania in 2029—so now's the time to start planning and saving! There was also encouraging news from UIS about a global initiative to establish a UNESCO International Day of Caves and Karst, tentatively set for 13 September. The proposed day would raise awareness around cave and karst environments, their scientific value, and the importance of their protection. ASF will be pleased to support this initiative. For more information, visit: uis-speleo.org.

Closer to home, significant progress has been made on the National Heritage Listing for the Nullarbor. More than 50 letters have been distributed to potential stakeholders—including Traditional Owners, pastoralists, local government, and community groups—inviting participation in the process. Our consultant Anne, alongside a team of experts, is now drafting the Statement of Significance. Site visits and community meetings are being planned as part of this important consultation phase. It's a substantial undertaking, and I'd like to thank everyone involved. We won't get every detail perfect—but we are moving forward, and that matters.

Also on the Nullarbor front, ASF submissions earlier this year have helped shape outcomes around the proposed Western Green Energy Hub. The WA Environmental Protection Authority has now approved the project's Environmental Scoping Document (ESD). The proponent must now undertake detailed studies, with a reporting



Collecting critters for science - Photo by Steve Milner deadline of December 2026, and a further public consultation phase set for July 2027. Thank you to everyone who contributed to this process. If you would like to view the ESD, please contact the ASF Conservation Commission.

In science news, ASF has been invited to host a panel session at the Australian Citizen Science Association Conference, themed "A Catalyst for Change," to be held 13–15 October 2025 in Melbourne. Representatives from the ASF Executive, Conservation Commission, Science Commission and Karst Conservation Fund will present on ASF's contributions to citizen science and explore new opportunities for funding and collaboration. It's a fantastic chance to showcase how cavers contribute to cutting-edge science.

A reminder that the 2026 ASF Council Meeting is just six months away, scheduled for 11 January 2026. Now's the time for clubs to confirm their delegates, prepare Commissioner and SIG reports, and consider nominations for the Executive.

Finally, I want to acknowledge what I value most about the ASF community: the chance to work alongside and learn from so many brilliant, passionate people. This year marks CEGSA's 70th Anniversary, and I'm looking forward to joining in the celebrations in Naracoorte at the end of the month. If you're nearby, come along!

Whether you're out exploring a cave or enjoying this issue from the comfort of home with a warm cuppa—happy caving!

**Andrew Stempel** 

# 34TH ASF CONFERENCE 2027: A LITTLE UPDATE AND A LOT TO LOOK FORWARD TO!

Chillagoe, Queensland, June 2027



Tower Karst - Photo by Jan Pope

While we don't have any big announcements just yet, rest assured that plenty of work is happening behind the scenes to prepare for the 34th ASF Conference in Chillagoe in 2027. Planning a conference two years out has its challenges - a common reply we get is: "We'd love to help, but get back to us six months out!" So while some pieces can't fall into place just yet, the Chillagoe Caving Club is steadily laying the groundwork to make this a truly unforgettable event.

In the meantime, we wanted to share a little inspiration for why you should mark June 20-26, 2027 in your calendar. Chillagoe isn't just a caver's playground - it's a place of geological wonder, scientific significance, and outback charm.

### **Tower Karst**

Chillagoe's iconic limestone towers rise steeply from the savannah in dramatic formations. This fascinating karst landscape hides a vast and varied network of caves - from tight squeezes and sporting climbs to massive chambers with intricate decoration. New caves are still being discovered, and almost 600 entrances have already been tagged.

# **A Fossil Treasure Trove**

Chillagoe has yielded some of Australia's most important fossil discoveries. The most complete fossilised skeleton of an Elasmosaur (a long-necked marine reptile from the age of the dinosaurs) was unearthed here.



Black Friday Scutigera - Photo by Peter Bannink



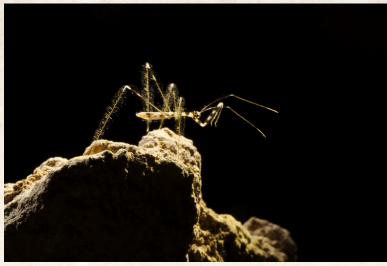
Fossils - Photo by Jan Pope

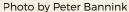


Beautiful moth - Photo by Peter



Green tree frog - Photo by Jan Pope







Bower Bird - Photo by Jan Pope

A life-sized sculpture called Dave now stands on the road into town. Other megafauna fossils found in the region include the *Thylacinus cyanocephalus* (Tasmanian tiger), *Quinkana fortirostrum* (land-dwelling crocodile), *Propleopus chillagoensis* (a giant carnivorous kangaroo), and *Palorchestes azael* (a "marsupial tapir").

# Wildlife Wonders

From dusk bat flights to shy nocturnal hunters, Chillagoe is teeming with fascinating wildlife. Keep an eye out for Tawny Frogmouths perched motionless in trees, Australian Bustards strutting across the plains and the elusive Chillagoe Ringtailed Gecko found only in this part of the world.

# Cool Off the Outback Way

After a long day underground, there's nothing better than cooling off in one of Chillagoe's local waterholes. The Weir is a peaceful spot where water spills dramatically over the wall in a gushing cascade, perfect for a refreshing dip or a picnic by the water. The Bogey Hole is a nearby swimming hole shaded by beautiful paperbark trees, with a small waterfall tumbling into its clear waters. Both are must-visits for any Chillagoe trip.

The full conference program including talks, trips, speleosports and workshops will be released closer to the date. Early bird tickets go on sale 20 June 2026.

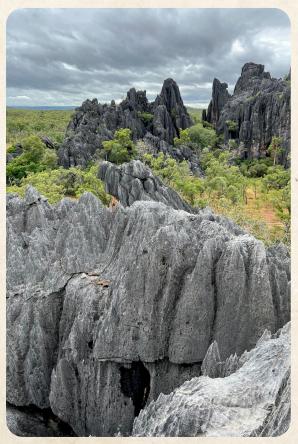
In the meantime, visit

<u>www.asfconference2027.com.au</u> or email us at <u>asfconference2027@chillagoecavingclub.org.au</u> to stay up to date.

We can't wait to welcome you to Chillagoe in 2027 for a week of caves, sun and speleological fun!



Chillagoe ring-tailed gecko - Photo by Jan Pope

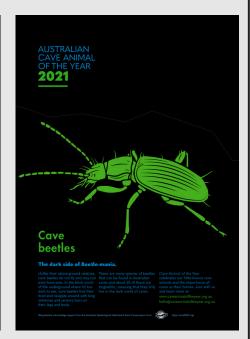


Tower Karst - Photo by Jan Pope

# LIMITED EDITION REPRINT!





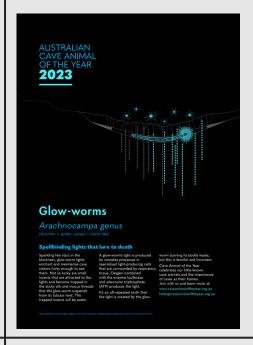


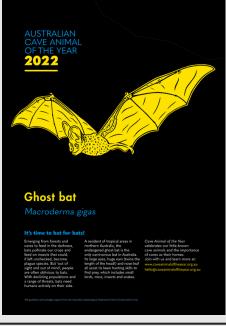
At the request of the cavers attending the Buchan conference, Cathie has agreed to produce a limited edition reprint, available exclusively in a set of only 25 copies.

The set comprises six exquisite posters, which are visually stunning when printed. **\$160** includes all six posters, packing and post. Delivered to your door. \$100 from each order donated to the Karst Conservation Fund and a tax-deductible receipt will be provided.

Those interested in this exclusive offering are kindly invited to contact Nadine Muresan via email at <a href="mailto:asf.cavesaustralia@gmail.com">asf.cavesaustralia@gmail.com</a>.

This is a unique opportunity to acquire a collection of remarkable artworks, and we encourage you not to miss out.















Opening Ceremony - Photo by Justin Wilkinson

What was five and a bit weeks in Brazil like? Absolutely great. David Butler and I have just arrived home from our travels, the impetus for the trip being to attend the 19<sup>th</sup> International Congress of Speleology in the city of Belo Horizonte, in the state of Minas Gerais.

Brazil is a large, diverse and fascinating country. A population of about 212 million people, with the fifth-largest country by landmass in the world. The country's history of varied indigenous societies, invasion from 1500 and Portuguese importation of more than 2.8 million enslaved African people over more than 300 years are just some of what makes for a very multi-cultural country. Portuguese is the most spoken and official language. Opulence and poverty and much 'in between' are all obvious. Nine percent of Brazil is karst. Mines are many and large and the tensions conservation and between development considerable. Political conflicts between left and right aligned are clear with any viewing of CNN, even if it's being reported in Portuguese.

# https://en.wikipedia.org/wiki/Brazil

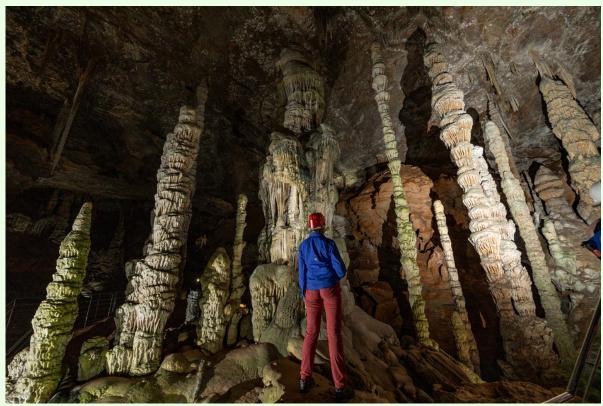
The International Congress of Speleology (ICS) is planned for every four years (Covid delaying the 18<sup>th</sup> ICS from 2021 until 2022). The event is a program of the International Union of Speleology (UIS), but the host country is reasonably independent in its organisation of the event (within the UIS protocols) and does a heck of a lot of hard work to get the event together, as our small Australian organising team for the 17<sup>th</sup> ICS knows only too well.

The hosts of the 19<sup>th</sup> ICS were the Brazilian Speleological Society and the National Center for Cave Research and Conservation.

The event was also the 38<sup>th</sup> Congress of the Brazilian Speleological Society. Unlike the 17<sup>th</sup> ICS in Australia, there was very big sponsorship. The mining giant Vale was the major sponsor, supported by other big industrials including steel-maker Anglo-American and Samarco. The later being the owner and operator of the tailings dam that collapsed in Minas Gerais in 2015 with catastrophic environmental and social effects. <a href="https://en.wikipedia.org/wiki/Mariana">https://en.wikipedia.org/wiki/Mariana</a> dam disaster

Another big difference between Australia and Brazil is that there's many more cavers in Brazil, with many younger-aged Brazilian cavers volunteering, presenting and attending the ICS. So, a definite upside for the ICS was this involvement of youth and I feel a BIG plus for the ICS was the involvement of all these young cavers at this international event. Brazil has many economic, environmental and developmental challenges and it can only be good for conservation efforts for caves and karst to have had this event and young students and researchers having the opportunity to be part of it.

For me, who only speaks English, it was frustrating at times to select a presentation to attend and get to it and find it was being delivered in Portuguese, or sometimes Spanish. Some details on the program could have helped here. But I quickly learnt to 'pivot' (as we were taught with covid) and there was always something else to go and do. There were great displays and exhibitions, the Speleo Media program was fantastic (you could have spent several days there alone) there were always other presentations happening, commission meetings, people you wanted to catch up with or a stall that you hadn't visited. Not to mention watching the Speleo Sports.



Mid-Congress trip to Reii Do Mato Cave - Photo by Justin Wilkison

A daily highlight were the keynote lectures. There were six of these and they were all terrific. I'd like to be putting some links to these in this article but do not have these yet. (Even though the 10-volume hard copy sets of the proceedings were available at the congress.)

Paul Williams from New Zealand presented on UNESCO World Heritage Caves and Karst: Present Situation and Future Prospects. This excellent talk looked at what cave and karst areas were on the World Heritage List, and which types of caves and karst were not represented on the list. Professor Williams made the case that you can't just keep adding to the 'best of the best' without undermining the value of what's already on the list. With respect to examples of karst types not included on the list, he made a very strong case for both the Kimberley and Nullarbor karst areas being added to the World Heritage List.

A keynote address from Stefano Mammola was on Global Conservation of Subterranean Biodiversity. The talk considered threats to 'Out of Sight and Out of Mind' subterranean fauna and Dr Mammola had surveyed 155 subterranean biologists for their input on threats and protection. Inspiring for me that, along with land protection and management, legislation and policy, the responses from his survey had supported education as a priority conservation action. Stefano's talk gave me inspiration to rev up my efforts to promote Australian cave fauna. So pleased I was able to be there.

I must include a few words on Hazel Barton's talk. For those who don't know of her Professor Barton is a microbiologist, caver and cave diver. Her presentations are always great. She inspires you to love cave microbes and her talk was Cave Microbes: How Caves are Going to Save Us All and Professor Barton described research work being done on growing cave microbes so that paint can be repaired, hence reducing the amount of paint being required with subsequent reductions in carbon. Another research project is using cave microbes to reduce plastic waste. There are already patents on products being developed as part of these projects. Sorry to say that our trip to Brazil showed that those of us avoiding water in plastic bottles are not making much difference to singleuse plastic. In Brazil it's everywhere: water bottles, throw-away capes at the hair salon, plastic wrappers on toothpicks, plastic...everything! And no one seems to mind.



Mid-Congress trip to Maquine Cave - Photo by Justin Wilkison

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Mid-Congress trip to Reii Do Mato Cave - Photo by Justin Wilkison

Besides the congress, David and I along with other Australians Greg Middleton, Jim Crockett and Marcia Kaye attended a terrific eight-day post-congress trip to the Chapada Diamantina region in the state of Bahia. We had fabulous leaders (thank you again Fernando and Riccardo) bus driver, local guides and accommodation and restaurant hosts. David's and my time in Brazil, accompanied by Greg Middleton, also included trips to Iguacu Falls and to a remote community-operated eco-tourism venture in Amazonia.

# https://www.amazontrip.info/web/en/

It was all fabulous and a reminder of how big and varied the world is and how 'small stuff just doesn't matter'. Learning a few Portuguese words from an app, and Justin Wilkinson introducing me to Google Translate, meant that I could communicate with people and not just asking for directions etc. as I was able to have some close conversation with people and that made for so many nice interactions.

The 20<sup>th</sup> ICS will be held in Romania in 2029. Details are sketchy at present, but I'll include information in *The Cricket* as it becomes available.



Mid-Congress trip to Reii Do Mato - Photo by Justin Wilkinson



Inspirational Brazilian cave animal tee-shirt
- Photo by Cathie Plowman

# Cavers Score Trifecta in 2025 King's Honours!

Philip Fleming

Included in the Order of Australia awards in this year's King's Birthday Honours list were three prominent cavers Julia James, Joan Crabb and Grace Matts.

Whilst the Australian Speleological Federation already has a number of Order of Australia recipients in its ranks, what is really noteworthy and deserving of full recognition is to have three women receive an award on the same occasion for longstanding contributions and service to speleology.

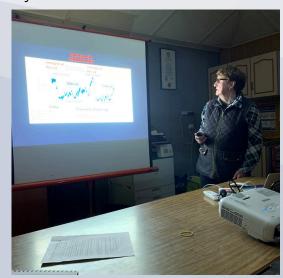
The Order of Australia was established in 1975 by the Whitlam Government as an alternative to the Imperial honours and awards system (knights, dames etc.) which had been in place since the early days of British settlement in Australia.

Most Caves Australia readers would probably not realise that no fewer than thirteen ASF members received Order of Australia Honours between 1993 and 2022. See:

https://caves.org.au/administration/commissions/awards-and-awardees/

But regardless, the three women recognized in this year's honours have given many years of service to speleology and the community and the separate nomination of each of them for an Order of Australia award in 2025 is not only a happy coincidence but well overdue.

A summary of their service and achievements follows.



Dr Julia talking on climate change and caves.

Photo by Phil Fleming

Dr Julia James was made a Member of the Order of Australia (AM) For significant service to scientific research, particularly in the field of speleology. Julia is a recognized identity on the Australian caving scene and has been active as a speleologist over a number of decades.

Julia is a graduate of London University and joined the staff of the University of Sydney in the department of Inorganic Chemistry becoming a senior lecturer and later associate professor. Julia has made significant contributions to speleochemistry and environmental geochemistry and is internationally recognised for documenting cave discoveries and for karst geomorphological research all over the world. She is a prominent science educator and has done much to popularize speleology including her stint as the Royal Australian Chemical Institute Nyholm Memorial Youth Lecturer.

Julia is an active member of Sydney Speleological Society (SSS) and was the first woman and only Australian to be elected as president of the International Union of Speleology (UIS). Julia is a Fellow of the Australian Speleological Federation (ASF) and the Australasian Cave and Karst Management Association (ACKMA). She has led expeditions in Australia, New Guinea and overseas and authored numerous papers and book chapters on caves, speleology and chemistry.

Julia served as NSW Department of the Environment and Heritage Deputy Chair, Greater Blue Mountains World Heritage Area Advisory Committee and on the Karst Management Advisory Committee for the NSW National Parks and Wildlife Service. She has been active for many years on the Jenolan Caves Reserve Trust and notably has been Project Coordinator for the Jenolan Caves Survey Project.

She was an editor of *Helictite - Australasian Journal of Cave Science*, Australia's only academic journal dedicated to speleology from the 1970s through until the 1990s.

Joan Crabb was awarded the Order of Australia Medal (OAM) for service to speleology and the community. Joan has been involved in speleology since the 1950s and is a co-founder and member of the Highland Caving Group since 1959. She is a Life Member of the Highland Caving Group and served as president from 2014 to 2025.

As well as her involvement in speleology, Joan has given a lifetime of service to a wide range of community organisations and to the union movement in NSW.

Joan received the Fraser Environment Award from the City of Liverpool, NSW in recognition of her involvement in numerous environmental activities ranging from major issues such as pollution and water quality issues in the Liverpool area through to tree planting and promotion of environmental awareness. She has also been active in Scouting at the Group, Area and State level.

Joan has been an office bearer and volunteer for numerous community organisations including the Rural Refugees Association, Royal NSW Institution for Deaf and Blind Children (now Nextsense), the Fairfield Progress Association and the National Seniors Association.

She continues to be active in the union movement as a member of Unions Shoalhaven, a retired unionists group. Joan was awarded Life Membership for her service to the Community & Public Sector Union.

Joan always has been and remains an activist. If you want to know her views there is usually a sign about a current issue on her front lawn!



Joan in the outdoors - Photo by Delia Sidler

Grace Matts, ESM was awarded the Order of Australia Medal (OAM) for service to the community through a range of organisations. Grace has given a lifetime of service to speleology and the community. She has been a member of the Sydney Speleological Society (SSS) for over 50 years and served as ASF treasurer from 2000 – 2018. She has received the ASF Certificate of Merit, Edie Smith Award and was elected a Fellow of ASF in 2015. Grace has represented Australia on the International Union of Speleology.

Grace is also a long-standing member of the Highland Caving Group and the Jenolan Caves Historical Preservation Society.

Grace is well known for her longstanding activities and service in the field of volunteer rescue. She is a member of the Australian Civil Air Patrol and CREST NSW Inc (Citizens Radio Emergency Service Team). Grace is an Honorary Life member of St Johns Ambulance NSW and has acted as a volunteer first aid instructor, assessor and examiner.

Notably, Grace is a founding member and honorary life member of the NSW Cave Rescue Squad. She is a life member of the NSW Volunteer Rescue Association and has been recognized with a number of awards including the Emergency Services Medal, National Emergency Medal, with Clasp 'Bushfires 19/ 20', the NSW Premier's Bushfire Emergency Citation, 2020, President's Award, Australian Civil Air Patrol, 2017.

These women have all spent a lifetime devoted to the pursuit of speleology and service to the community. Furthermore they have all been prominent as leaders and mentors to many of us in the caving community. It is absolutely fabulous and high time to see their service finally recognized!



Grace Matts pushing her way through the squeeze competition at the 33<sup>rd</sup> ASF Conference in Buchan - Photo by Glenn Pez



**Teamwork and Training in Action** 

By Allison Irvin, Mayer Cook-Tonkin and Liz Irvin

On 28th July 2025, on an expedition to Broken River, west of Townsville, Queensland, a day of caving turned into an urgent helicopter rescue. This experience was a strong reminder of why rescue training, first aid skills and teamwork are essential when exploring caves, especially in remote areas.

Tremendous thanks go to the incredible rescue crew from Queensland Government Air (QGAir) who attended the cave rescue, and were able to expertly help save an injured caver. Thanks also to Cave Rescue Victoria, with support from the Chillagoe Caving Club and the Australian Cave Rescue Commission, for cave rescue training that was vital for a successful rescue.

# **A Caving Trip Turns Critical**

The day's caving trip consisted of group of six cavers including Paul Osborne, a caver with almost 50 years' experience and a passion for adventure; Peter Bauer, a long-time caver and coauthor of *Under Bungonia*; Cole Neering, an enthusiastic caver who has been exploring caves all over Australia; Sarah Burnell, who has been caving for a year and has completed an advanced first aid course; Allison Irvin, who has been caving in Chillagoe all her life, including many trips to Broken River; and Liz Irvin, a long-time caver having returned to caving three years ago.



The rock that did the damage! - Photo by Allison Irvin



Sarah watching the monitors - Photo by Mayer Cook-Tonkin At 3:20 pm, the team was making their way through a rarely visited section of a cave when disaster struck. A large boulder dislodged, breaking Paul's femur and pinning Peter's back beneath its weight. Cole sprang into action, pushing the boulder off Paul and Peter. The splint that Sarah had been carrying in her first aid kit for more than a year was put to good use. The group assessed the situation: while Paul's injury wasn't immediately life-threatening, it was clear that walking out of the cave was impossible. A serious extraction in rough, remote terrain was ahead. The razor sharp karst outside was challenging to navigate even for uninjured cavers.

# **Triggering the Rescue**

With no phone reception, Allison scrambled to daylight to trigger an SOS via her Garmin InReach. She sent short bursts of information: broken femur of a 72 year old male in a cave, urgent helicopter extraction required. Soon after, Liz Irvin took over so Allison could return to Paul. Just four days earlier, Allison had completed her remote and wilderness first aid course.

Meanwhile, despite severe hip pain, Peter managed to make the journey over jagged karst terrain back to camp with Cole's help. There they raised the alarm to Mayer Cook-Tonkin, a nurse with four years' caving experience, and Grace Mason, a skilled cave rescuer and co-founding member of Cave Rescue Victoria. The trio drove back with a car already loaded with gear.

Mayer's nursing expertise helped keep Paul as comfortable as possible while Grace's cave rescue skills came to the fore. With minimal gear, Allison and Grace began preparing the site for a vertical extraction: rigging a counterbalance haul system on a four metre pitch and setting up a Z-drag for the final lift to an appropriate surface for winching.

# The Arrival of Queensland Government Air (QGAir)

At 5:55 pm, just before dark, the welcome sound of the helicopter could be heard approaching, until it became overwhelmingly intense as it hovered overhead. The QGAir helicopter lowered three rescue professionals: Doctor Phil Laramie from LifeFlight, paramedic Micky Paulson from Queensland Ambulance Service, and rescue crew officer Jy Vickers from QGAir.



Paul waiting for the stretcher -Photo by Mayer Cook-Tonkin



Paul's strapped leg - Photo by Mayer Cook-Tonkin



Looking down the pitch - Photo by Mayer Cook-Tonkin

Phil, a rock climber in his spare time, quickly assessed the situation, asking if the boulder still posed a threat and if there were other loose boulders. As he was climbing down, he assessed the rigging that Grace and Allison had already set up, later saying "Using other people's gear is super rare. I looked at the system initially—the ropes, the pulleys—and I knew we could use it." After borrowing a helmet from Cole, he descended into the cramped space where Paul was lying. Mayer assisted Phil with connecting monitoring equipment to Paul and preparing for the intravenous cannula. Paul was given pain relief, which meant he could be moved into the basket stretcher with the help of many hands. Due to the confined space, a challenging manoeuvre was needed to move Paul less than two meters to the base of the counterbalance pitch. The team had to manhandle Paul less than a foot at a time before climbing to new positions. In one section, a boulder protruded just centimeters above Paul. To move him, he was lifted only a few centimeters off the rock to shift him under the boulder. Phil was a natural at planning and coordinating the move through the cave, while ensuring Paul was closely monitored.

On the surface, every available set of hands helped with the counterbalance system, pulling Paul upward metre by metre. Grace was brilliant on the counterbalance, guiding the rescue professionals in how to assist her. Once Paul reached the top of the pitch, there were still a couple of awkward metres to negotiate, hauling him up and over onto the final rock. This was achieved through muscle and the aid of a Z-drag. Micky later said, "This was the most challenging rescue in my 33-year career. The terrain was difficult, getting him out was difficult. I'm glad you were there because it was not going to be an easy rescue."



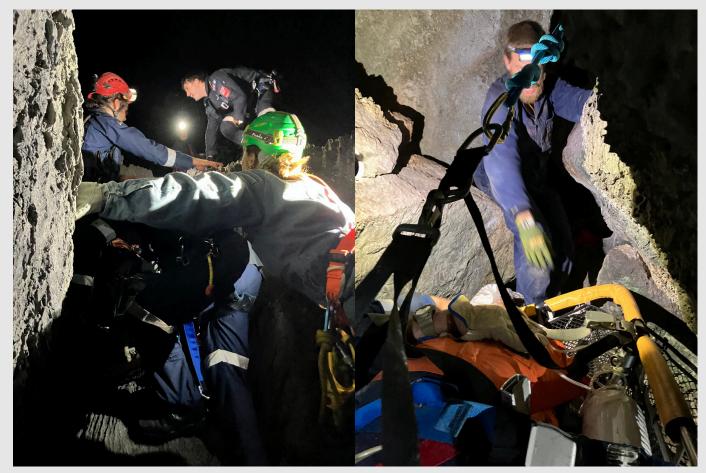
The excruciating transfer into the stretcher - Photos by Mayer Cook-Tonkin

Out of the cave at 7:20 pm, Paul was in a position where his medical care could be continued. Micky and Phil worked together to provide more pain relief and stabilise the femur with a traction split. It was a challenging environment, with sharp rocks and chasms on all sides. The helicopter was notified that Paul was ready for extraction, but it remained an hour away. When it arrived, the helicopter could only hover for a few minutes before needing to circle to relieve the strain on the engine, requiring several passes to winch everything and everyone out.

Jy did an exceptional job of managing the winching from the ground. Night winching is incredibly rare and dangerous - this was Jy's first in two years on the job. Hovering the helicopter so close to the ground at night surrounded by karst peaks was an incredible effort for the talented pilot. Under the guidance of the winch operator, the winch was delivered directly to the hands of the rescue crew. For the cavers, it was a seamless operation and an astonishing feat to watch.

Gear and equipment went up first, followed by Micky, then Paul in the basket with Phil attached, and finally Jy. As the helicopter disappeared into the night sky at 9:30 pm, relief washed over the cavers on the ground. They made their way carefully off the karst back to the road. Thanks to the local police officer Dave, and Douglas and Mary Ann Irvin, who were a great support on the road, providing food and water. Douglas and Mary Ann are veteran cavers of almost 50 years and discovered many of the caves in Chillagoe.

Paul reached Townsville University Hospital around midnight, and was in surgery the following morning. He was discharged from hospital a few days later, able to gingerly walk and hoping to be sufficiently recovered to return to skydiving the following month.



The exchange to the exit team - Photo by Mayer Cook-Tonkin

Cole helping with the transition out of the cave
- Photo by Mayer Cook-Tonkin

# The Value of Training

This rescue highlighted the value of training and preparedness. Remarkably, all the cavers involved in the extraction took part in the cave rescue training exercise in Buchan in January. Many of the cavers had also taken part in multiple other cave rescue training sessions in the months prior, including a four day course organised by Chillagoe Caving Club and delivered by Cave Rescue Victoria. The training meant that key people on the ground knew how to rig hauling systems and how to move casualties in confined spaces. The cavers were able to demonstrate to the professional rescuers that they knew what they were doing, and could be trusted to help extract Paul.



Under the helicopter waiting to be airlifted - Screenshot from film

by Allison Irvin

# **Gratitude to Our Partners in Rescue**

This rescue would not have been possible without the collaboration of multiple organisations:

- Queensland Police Service coordination and command of the rescue operation, and Jy's experience as a rescue crew officer.
- Queensland Government Air (QGAir) providing the helicopter and expert crew.
- Queensland Ambulance Service (QAS) for Micky's 33 years of experience in paramedicine.
- LifeFlight for sending Doctor Phil, whose skills and composure underground were extraordinary. His enthusiasm to enter the cave, combined with his rock climbing expertise, proved essential for a smooth rescue.
- Cave Rescue Victoria especially Bo and Nadine Muresan - for the training that prepared cavers for this moment.
- Chillagoe Caving Club, Australian Cave Rescue Commission and the Australian Speleological Federation – for hosting cave rescue training and providing funding.

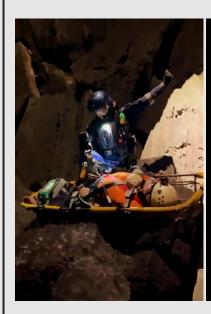
As Doctor Phil put it afterwards, "There was a lot of luck in this bad luck." However, training, teamwork and preparation played the biggest roles in bringing everyone safely back to the surface that night.



RCO Jy Vickers on the left and Dr Phil Laramie on the right - Photo by Mayer Cook-Tonkin



The amazing team - Photo by Mary Ann Irvin







Paul's extraction - Screenshot from film by Allison Irvin



The whole team of rescuers - Photo by Allison Irvin

Grace dealing with the gear post rescue- Photo by Allison Irvin



Grace and Sarah playing in the helicopter - Photo by Allison Irvin

The rescue helicopter - Photo by Allison Irvin



Everyone safe and home - Photo by Debbie Osborne





Andrew Stempel with extreme halite extrusions - Photo by Alan Pryke

Goat Cave, on the Hampton Tablelands of WA, has likely been known since the early days of settlement due to its large doline collapse entrance. Until recently, the known cave was mainly a large entrance chamber, from where cracks here and there emitted breezes. A serious attempt was made in the late 1990s to early 2000s to push the breezes, hampered by dead ends. Caving exploration, particularly since 2022, has expanded the known extent of Goat Cave.

Currently, the survey extent of Goat Cave is 9.6 km. Passages and chambers discovered from 2022 start with a challenging entrance series. Tight crawls, a near to vertical rift climb and acrobatic twists through a rock pile make up what is referred to as the entrance series.

In 2021 the most likely of the strong breezes was identified as a lead possibility. In 2022, the descent of the vertical rift was made. Beyond this tricky, tight rift, a steep, sloping passage was traversed, later named the Goat Track. Survey work ensued in 2022, with time running out in a rock pile area.

Alan and Megan Pryke returned on a post-ASF Conference trip with Bert DeWaele and Brett Wiltshire in 2023. The purpose was to complete the survey though we were secretly hoping that there would be more passage. A large passage was sighted below not long into the survey. A route through the rockpile descended to a distinctly new level with a large passage heading both eastwards and westwards. The suggestion to visit other caves was no longer on the agenda as each new day in Goat Cave yielded more. Survey and exploration continued for the rest of the 2023 trip (6 days), then subsequent trips in 2024 and 2025. It was an exciting find and interest in visiting other caves was dwarfed by enticing discoveries.

The route to the lower level is dubbed the entrance series. The lower level east-west passage has a trend of two parallel passages, which were named the Jewel Carriageway as the tube passages are crystallised with halite, with Jewel sounding like dual.



Chamber with Brett Wiltshire and 4 m halite columns - Photo by Alan Pryke

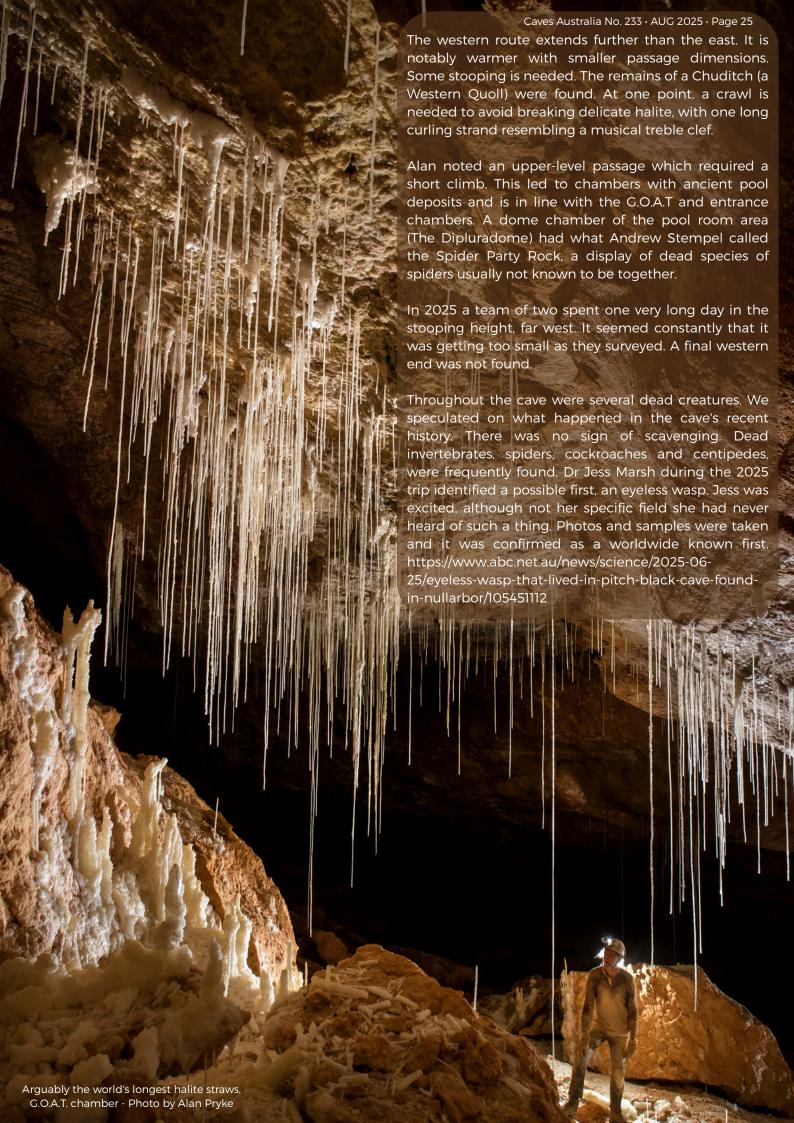
A passage to the east passed through rock pile, then a section of halite flakes, to reach Spaghetti Junction. The name was inspired by numerous halite straws, however, subsequent surveys have revealed many passage junctions in the area. Soon after, the halite decoration intensifies. A climb up led to a room we named the Bigger Bamboo. A reflector and string route guides cavers around the edge of the Halite Room. Track marking to confine impact to one route has been installed in areas starting from the Goat Track

Soon after the Halite Room, the eastern route arrives at the hundred-metre-long Peak Hour Passage, where cavers are reduced to a crawl. Initially, it needs a belly crawl, then hands and knees, then some low belly crawling again passing between fine halite strands. Brett and Alan initially pioneered Peak Hour Passage to what seemed to be opening up into a dome.

The following day the whole team returned. The onwards dome passage ascended into a spacious collapse while turning anti-clockwise. Spectacular halite decoration is found on the southern side of the dome. The inexplicable Lasso was amongst this. There were several dead cockroaches in the dome. I was on point, Brett and Bert explored for the walls, Alan was

on book and was finding it hard to keep up. I knew from the angles that we had turned to the west as we descended. We thought that we may find an easier way back than Peak Hour Passage, that was more pleasant. The large passage lost height. Just before a very low grovel, a cluster of halite hairs was called The Angora Curtain. After another low belly grovel the passage opens up to a thirty metre wide and eight metre high passage, which descended, then ascended into a large chamber. We named this the G.O.A.T. (Greatest of All Time) chamber. Halite straws up to five metres were found, most likely the world's longest. Exploration beyond G.O.A.T. chamber ascends, and after careful negotiation through delicate halite crystal we found a small high level chamber with dry calcite decoration. It looked more like other smaller, shallower caves in the area.

Back at the entrance series junction, the passages continue to the west of the base of the entrance series. The two distinct, parallel elliptical routes continue. Along these halite-encrusted passages, mummified possums were found. A detour around a collapsed section also has a passage network to the south. In this southern area, a large halite flower cluster was named the Rocktopus. Also, more mummified possums were noted.





Mummified possum, Jewel Carriageway - Photo by Alan Pryke

Troglodiplura specimen - Photo by Megan Pryke

Kenny Travouillon of the WA Museum was very interested in the mammals. Dr Jess Marsh was interested in the invertebrates, particularly spiders. Thus April 2025 saw a large group numbers-wise at Goat Cave. A cave rescue-style exercise was completed on Percy, known as the pretty possum who looked like it had gone to sleep. Also, other animal bones and remains were collected from Goat Cave. Before the Goat Cave trip, the WA scientists had visited other caves with WASG which Bert deemed similar in technical difficulty to prepare them for the entrance series.

Dr Jess Marsh also attended Goat Cave, removing samples of many invertebrates from the far reaches. Collection location information included nearby survey station numbers, thus survey data is being used in the analysis of genetic information.

Also attending the 2025 trip was Dr Jo De Waele, an internationally famous geomorphologist, and twin brother of Bert. Jo confirmed that Goat Cave is a flank margin cave. Jo believed it was likely that the halite straws in the G.O.A.T. Chamber were the longest in the world due to the geological stability of the Nullarbor karst compared to other areas in the world with similar halite formations. They were certainly the longest he had seen.

By the start of the 2025 trip, I thought that the remaining survey would be of smaller passages. I was on a team that on the first day of surveying started to look at gaps in the survey around where the entrance series meets the horizontal east-west passage. An eighty-centimetre gap in the wall led to a route heading southwards. After a tight section, we found three irregularly shaped holes in the floor with a tenmetre drop in a spacious cavern.



Filigree halite, Western Distributor - Photo by Alan Pryke



Bert De Waele and Andrew Stempel view halite cluster - Photo by Alan Pryke

The following day we brought in rigging gear and descended the pitch, landing in a large passage. It runs parallel to the other major passages, up to forty metres wide and mostly a very comfortable height. It is as though it is a different cave which has been intersected by the connecting small route. It is the only Nullarbor cave I know with an internal pitch. This passage also has dead invertebrates which have not been sampled. It added another kilometre to the survey. The western end descends then starts climbing up, ending where the floor meets the roof. The eastern end goes to the easternmost extent of the cave. It has a few ups and downs with far sides that curve downwards like a toenail bed. An upward, crawly climb leads to a forty-metre-wide dome chamber. Time for exploration ended after a descent to passage that once again became restricted in height.

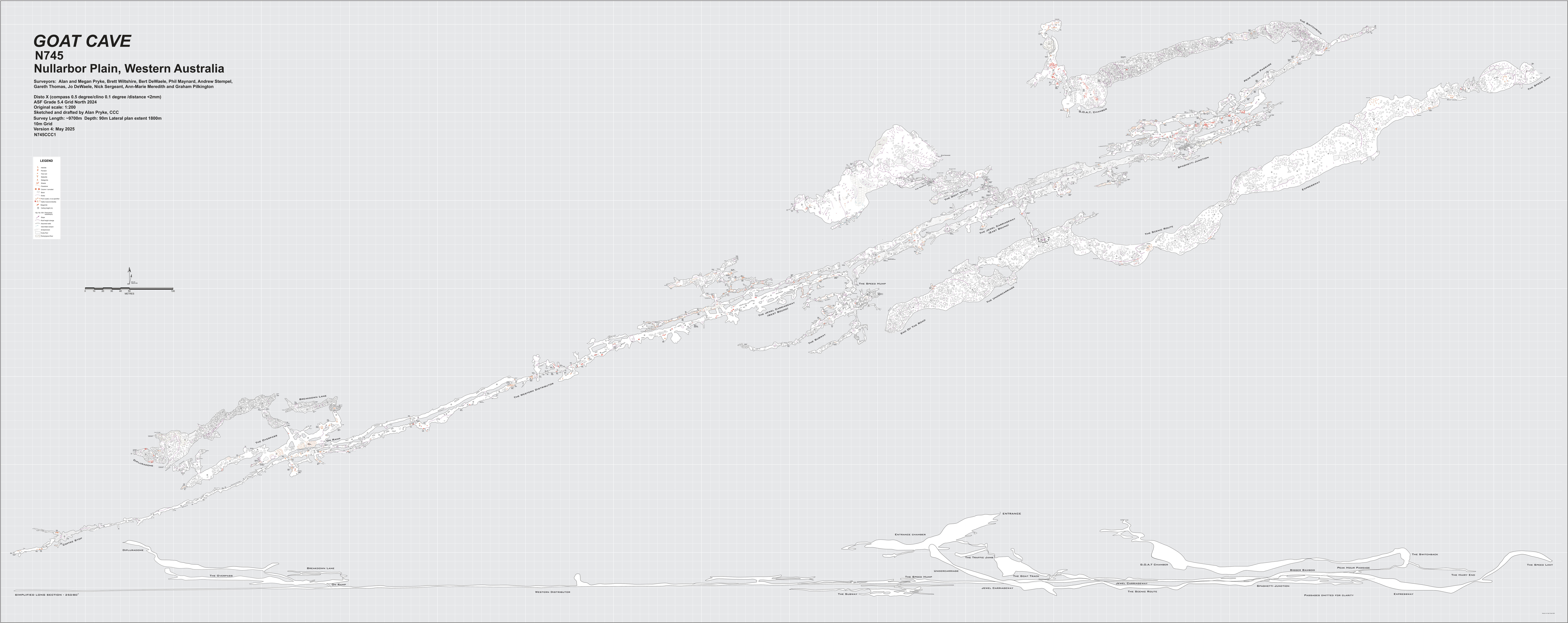
Thus, Goat Cave, previously mostly one major entrance chamber, has become one of the biggest known caves on the Nullarbor. It has greatly added to the volume of scientific knowledge about the Nullarbor. It is a rewarding cave for those who can negotiate the entrance series with spectacular halite and a variety of passages and decorated chambers.



"Angora Curtain" halite formation with Brett Wiltshire - Photo by Alan Pryke



Megan Pryke and extreme halite rope - Photo by Alan Pryke



# Origin of the White Nose Syndrome Fungus Introduction to North America Australian Perspective

Nicholas White

The White Nose Syndrome (WNS) fungus that killed many cave dwelling-bats in NE USA was first noticed at a show cave, Howe Caverns, in New York State in 2006-2007. It was shown to be a bat-specific fungal disease which thrived in low temperatures, named *Pseudogymnoascus destructans* (PD) and affected several different species of cave-dwelling bats. The fungus was shown to have come from Europe but also occurred across into Asia where it did not have significant mortality or disease events as shown in Northeastern USA. The original introduction into USA was presumed to be via human contaminated clothing or boots but may have been via bats hitchhiking in shipping containers.

The high mortality in USA cave dwelling bats was presumed to be due to the North American cave-dwelling bats being immunologically "naïve", whereas in Europe the bats had developed inherited immunity from exposure over many generations.

Recent research has studied the fungus DNA of over 500 samples from the USA, Europe and Asia (Fischer *et al.* 2025) and classified them into two species. Those from Northern America were all shown to derive from caves in the Western Ukraine, a site with the longest gypsum cave in the world, Optimisticheskaja Cave (Klimchouk 2004). A news item in the journal *Science*, linked this to caving records of caver exchanges between New York and Ukraine in the late 1990s and early 2000s, that cavers in all probability accidentally introduced fungal spores into New York caves and consequently the cave bat populations.

The consequence for Australia has led to biosecurity concerns for cave dwelling-bats in Australia which are assumed to be also immunologically 'naïve'. Although the WNS fungus is not known to be present in Australia at present the Wildlife Health Australia study on the risk assessment on the introduction of the WNS fungus into Australia concluded that: "Almost certain to occur at least once within the next 10 years." It listed eight bat species at risk. (Holz et al. 2019).



Little brown bat exhibiting infection with White-nose Syndrome fungus (M Marvin US Fish and Wildlife Service)

At the UIS Congress of Speleology in Sydney in 2017, ASF instituted scrutiny of cavers' boots and clothing of those participating in the pre- and post-congress field excursions. An awareness survey of participants about WNS knowledge was conducted at the Congress (Saleh 2021). This revealed Australian and North American cavers were much better informed than European or Asian cavers. ASF cavers should be aware that our caving codes specify using clean clothing and footwear for each trip <a href="https://caves.org.au/administration/codes-and-standards/">https://caves.org.au/administration/codes-and-standards/</a>>.

ASF has worked closely with Wildlife Health Australia and the latest fact sheet on White Nose Syndrome provides context to the biosecurity issues for Australia of the introduction of the fungus into the cave-dwelling bats of Australia (Exotic 2025). ASF has also supported bat research especially as ASF cavers are able to provide specific cave information.

This confirmation of cavers being responsible for transfer of the WNS fungus from one continent or country to another reinforces the need to reduce transfer of bacteria and fungi from one cave to others. This can only be done by adequately cleaning gear between caves and particularly between trips.

# References

Exotic 2025: White-nose syndrome Fact Sheet March 2025 https://wildlifehealthaustralia.com.au/Portals/0/ResourceCentre/FactSheets/Exotic/EXOTIC\_White\_nose\_Syndrome.pdf

Fischer (2025). Two distinct host-specialized fungal species cause white-nose disease in bats. *Nature*. 642, 1034-1040 <a href="https://doi.org/10.1038/s41586-025-09060-5">https://doi.org/10.1038/s41586-025-09060-5</a>

Holz, et al (2019) Does the fungus causing white-nose syndrome pose a significant risk to Australian bats? *Wildlife Research* 46, 657-668, 2019

Klimchouk, A. 2004 Ukraine Gypsum Caves and Karst p745-748 in Encyclopedia of Caves and Karst Science John Gunn, editor. Publisher Fitzroy Dearborn, Taylor and Francis Group.

Salleh, S, Cox-Witton, K, Salleh Y, & Hufschmid, J. 2021 Caver knowledge and biosecurity attitudes towards White-Nose Syndrome and implications for global spread. *EcoHealth*, 17: 487-497. https://doi.org/10.1007/s10393-020-01510-y

Stokstad E2025 Explorers of Ukrainian caves may have brought deadly bat fungus to U.S. Science

https://www.science.org/content/article/explorers-ukrainiancaves-may-have-brought-deadly-bat-fungus-u-s doi: 10.1126/science.ztyzru7

# A FOOLISH PARADISE

Clare Buswell

In the third week of July 2025, the Federal parliament reconvened after the April election and subsequent long break. The large majority that Labor now commands in the Lower House at least, means it can implement its legislative agenda. However, its return to the House was overshadowed by a bit of a political mess as far as the environment is concerned.

The newly minted Environment Minister, Murray Watt's actions, in giving the go-head to Woodside Energy's North-West Shelf (NWS) gas project on the Burrup Peninsula, made him few friends. Then South Australia's algal bloom, and the retreat from renewable energy, wind and hydrogen by major energy companies, such as BP, added to the gov't's environmental headaches. Even the International Court of Justice (ICJ), got in on the act, stating that countries had an obligation under existing international law to take more than voluntary action to address climate change or face serious fines.

Ken Henry, former Secretary of Treasury, addressed the <u>National Press Club</u> during the first week of sitting, and got stuck into the issues of economic development, renewable energy and the hold-ups in approvals due to the EPBC Act's failures. Conservation groups also joined the political bunfight calling not just for species loss to be addressed in any redevelopment under the EPBC Act, but to include the issue of climate change and establish a national Environmental Protection Authority.

For the caving community, the above political machinations may not seem relevant, particularly as the Arrowsmith wind and solar farm appeared to rise from the ashes, when one of its previous board members, and a former Woodside boss, Peter Coleman, decided in July, to reinvest in Infinite Green Energy (IGE), the company that proposed the Arrowsmith development in the first place. IGE is currently in administration and facing the courts over unpaid debts. Meanwhile the WA EPA is currently assessing the development, just in case the proposal sees the light of day.

Then, in late July, the WA EPA released the scoping document concerning the Western Green Energy Hub. The public does not get to comment on this document, but WGEH must respond to all the issues raised within it, and they have until the end of 2026 to do so. Bear in mind that the WGEH had 2027 as the year in which to finalize all financial support, with construction to start 2028.

However, for those of us who like life under a rock, our concerns with the above remain in the shadows of the political bunfights over policy. This is a big problem. There are currently three renewable projects slated for placement on Australia's karst: Arrowsmith WA, The Nullarbor WA side, and Kentbruck Victoria, as well as a massive drawdown of water in the karst aquifer underlaying the Wiso basin in the NT. There are no state laws that protect karst, let alone any at the federal level.

EPA approves Environmental Scoping Document	July 2025
Proponent submits first draft Environmental Review Document to the EPA	December 2026
EPA provides comment on first draft Environmental Review Document	February 2027
(6 weeks from receipt of ERD)	
Proponent submits revised draft Environmental Review Document	June 2027
EPA authorises release of Environmental Review Document	July 2027
for public review (2 weeks from EPA approval of ERD)	
Proponent releases Environmental Review Document	August 2027
for public review for 10 weeks	
Close of public review period	October 2027
EPA provides Summary of Submissions	November 2027
(3-6 weeks from close of public review period)	
Proponent provides Response to Submissions	January 2028
EPA reviews the Response to Submissions	March 2028
(4-8 weeks from receipt of Response to Submissions)	
EPA prepares draft assessment report and completes assessment	May 2028
EPA finalises Assessment report	June 2028
(including two-week consultation on draft conditions)	
and gives report to Minister (6 weeks from completion of assessment)	

Key assessment milestones timeline as outlined in the WA EPA Scoping Document Indicative timeline:

The EPBC Act does not protect karst, as it is not one of the Matters of National Environmental Significance. Individual caves are protected for contents: bugs, bats, bones, speleothems, and in relation to show caves, often for their aesthetic beauty if in a National Park or a Reserve, but generally not on private land. Bits of caves are recognised for national cultural heritage importance, and a couple have made it to World Heritage status, but the rest can be dug up, blown up, used as rubbish dumps or now, face surface area destruction by energy developments.

The Kentbruck development in south-western Victoria is a case in point. If it doesn't go ahead, it will be because of bats and brolgas, not because it is on karst. Admittedly, this karst is in some places 100 m below the surface but in other areas it is within one metre of it. Despite this, in none of the surface impacts from windmill foundations or cable trenching, does the dirt rate much of a discussion. The Kentbruck developers, Neoen, did get out the backhoe and dig 16 test holes to examine the soil profile, reaching a depth of five metres in most cases, with 'refusal' being encountered at one metre due to dense cemented limestone in others1. In this case, and in the case of the Nullarbor, dealing with the dirt is an engineering problem and nought else.

Members of the ASF should not be surprised at this. Generally, the public reaction to caves is one of fear, or danger, the latter usually sparked by the latest human drama surrounding an accident. Show caves are incredibly important in changing public opinion, but we as a national organisation need change if we have any hope of protecting what karst Australia has. We must seize the current political policy moment to push for karst to be included in any new EPBC Act and its regulations. We need a seat at the table.

As cavers, we have both an image problem and a lobbying problem. We must use our past four decades of fighting karst battles, to obtain legislative change. If not, those past battles will reflect lost opportunities and past glories. Write to your member of parliament urging them to include within the EBPC Act protection for our karst landscapes and the unique values they hold.

[1] See: Kentbruck Green Power Hub EES Technical Report. Appendix I. Environmental Site Investigation. Appendix B: Bore Logs.



A septic drainage trench dug in karst on private property within 100 meters of known caves. Other options for septic disposal are available, why not enforced? Note the hole at the bottom of the trench. Photo by Clare Buswell

A test pit dug to 1.2 m by Neoen Green Power Hub consultants, AECOM. 2024. Source: Kentbruck Green Power Hub EES Technical Report. Appendix I. *Environmental Site Investigation*. Appendix C: Plate photos

# International Cave Rescue Conference Report 2024

**Brian Evans** 



The participants gathering at registration. I wore my (bright) green NSW VRA rescue uniform. - Courtesy of a kind South African delegate who shared this with me.

About 10 nations had some people attending the International Cave Rescue Conference. It was pleasing to see six young caver-rescuers from South Africa and five from China (via Hong Kong). Likewise, there was a representative from Indonesia and a few from Brazil. There was a strong representation from the local area, including about 12 from the various paid rescue services of Spain: police rescue from Cantabria; the Basque country and the UME, an arm of the military, whose responsibility is for national-level emergencies, but they train in caves, as well as the more likely scenarios...

As always, what I'm writing here is my impression of what I learned at the International Cave Rescue Conference - I may not have everything right! I'm happy to talk more, or share whatever resources I have.

# Summary/Highlights

- Good discussion and a start to understanding cave rescue in various countries: Spain, China (via Hong Kong), South Africa, UK, Brazil, NZ
- Meeting caving contacts from: Indonesia, Czechia, Hungary, Japan
- Watching a cave rescue competition (!!!) team demonstrate their stuff.
- What looks like a far safer and more effective chemical for deobstruction.
- Some nice caving and prehistoric art! And a couple of via ferratas!

# **Irritations**

The only European nations represented were: Spain, in large numbers, and with many paid emergency services attending as well; Hungary, with one, the ICRC commissioner; Czechia, with one; and the UK, with one, although he was not officially representing BCRA - he is a local 6 months of the year!

Opening remarks - Courtesy that same generous South African photographer.

Although we were reassured that ECRA member nations all had other important things on at that time, or had illnesses, etc. it sure looked like a boycott to me! Particularly since the date for it had apparently been published two years ago...

### **EsoCan**

The Cantabrian (local state) cave rescue service. A bit like us: cavers who volunteer to help in cave rescues. They work closely with police, fire service and the UME, a "military" emergency service who are called to national level emergencies. They also provide training in caving.

Many members from out of state. Some photos of their gear store.



This is what happens when the locals invite two kiwis, four South Africans and an Aussie to their gear store: we immediately truss up a kiwi and threaten to abandon him - Courtesy that same generous South African photographer



It was a small store-room but packed with caving and rescue gear.

Photo by Brian Evans

# **Cave Rescue organisation in other nations**

In Spain, casualties pay for their rescue. Rescue services are contracted out, at present to Red Cross. There have been issues in the past where paid rescuers have gone on strike for the season because of low pay, and then cavers cannot cave!

In Brazil, there is a strong national organisation from within the cave clubs, and they are progressively building capability in states. Their training has been mostly provided by SSF (France). They were pushing for attendees to the UIS / ICS there, next year. The caving looks attractive!

NZ, many of us know quite well. Volunteer-based, and via clubs, but embedded in LandSAR, with a little government funding and a support network, a little like SES, but for search and rescue, not for storms, floods etc.

The following nations' information I only gleaned through conversations: Hungary - like Slovenia reported previously; South Africa - there were six young members from Johannesburg attending. I think Joburg is the only organised rescue group; they train and have incidents. Organised similarly to most states in Oz; Hong Kong - also about six young people - most of their caving on mainland China, with lots of options. Capable cavers and at least one makes a living out of it. I really didn't get much about rescue from them.

You'll have noticed that I didn't learn much about rescue organisation from a bundle of countries; I did, however, make a lot of contacts, and maybe find some very useful information...

# Technical Techniques

All seemed to be using what most of Australia's cavers do: the so called French Technique. The UK has large numbers of volunteers and therefore tends to do less with rope and more with pass+carry.

### **Anchors**

The Spanish seemed to use Terriers/Spits as their bolt of choice for rescue (Bo tells me the French do, too). In regular cave rigging for the popular cave I did, there were glue-in P hangers, and lots of 10 mm wedge anchors of various flavours (In fact, a veritable forest of them in some places). 6 mm concrete screws were apparently the choice for exploration.

EsoCan had a very compact and robust-looking cordless drill by Worx.

I don't think I saw a natural point used in the rigging.



A very compact rotary hammer - Photo by Brian Evans



A selection of temporary and permanent anchors.

Photo by Brian Evans

### **Stretchers**

Nests were the only thing I saw, although there was discussion of a Swiss fibreglass one; the Neil-Robertson <a href="https://www.ferno.com/product/">https://www.ferno.com/product/</a> as very good for tight spaces (although cotton canvas and what looks like sisal ropes make it look unlikely!), and the Kiwis are now very happy with their Aspiring-made Nest lookalike with ongoing maintenance, and less than ½ the price of the Nest <a href="https://www.facebook.com/">https://www.facebook.com/</a> They also have a Slix50 for tight spaces.

https://www.prosafetyservices.



Placing the cover for the stretcher behind the casualty's knees was a thing! Apart from meaning that someone else doesn't need to carry it out, this makes the casualty FAR more comfortable, in both vertical and horizontal orientations. The mask would provide great face protection for the casualty, but I suspect it would fog up dreadfully.

# De obstruction

Very interesting! Unfortunately, 1 missed the demonstration of PenRock, and only got 2nd hand info and videos. It appears that this stuff will break big rocks, but without the velocity! No fly rock! The chemical burns more vigorously under pressure - when the pressure is released, the burn rate slows, producing less gas so not "exploding". Able to be transported without security and with almost zero licencing in Spain. Worth pursuing. Actually, I now have much better information: PenRock did not respond to my emails, however, a similar product: AutoStem is available in Australia. I'm working on getting a demo from them for caver rescuers in Australia...maybe the rescue workshop in February?



Observing the PenRock at work Photo by John (Oz) Patterson, NZ



This chemical expands at around 300m/s compared to about 2000m/s for gunpowder (caps). Photo by John (Oz) Patterson, NZ

## **Trog suits**

I noticed that two other manufacturers make unproofed cordura suits: Rodcle and Malcon, as well as MTDE.

# Cave rescue competition!

Who'd have thought? But of course, if we have national Road Crash Rescue and Surf Lifesaving competitions, why would there not be an international cave rescue championship?

Espeleosoccoro sin fronteras <u>link (you'll need a FB login)</u> performed for us . These guys had won the championships at some point.

I do mean "performed"! All rope ascents were treated as sprints, with "no hands" displays and lots of showmanship! They were extremely well-practiced, strong and quick. Their communication was loud, clear and effective.

I assume that there is a standard course? What we saw was a lift in horizontal stretcher orientation to horizontal tyrolean. Feet first to a tyrolean junction. 90° turn. Feet first along a second. Reversed to 90° turn, but keeping head to corner this time so that the casualty moves feet first again. Then lower to ground. Horizontal lift again to half height. Change to vertical stretcher orientation. Some more fiddling, and then lower in vertical orientation.

Some interesting aspects of their techniques...

- 1. The lift and haul ropes were rigged from ground to head or foot, at both ends of the course.
- 2. This means that they were rigged through pulleys at each change in direction.
- 3. More importantly, it meant that the lift was on two ropes, with two counterweights, who did not leave the ground, as they each only had half the weight.
- 4. Rather than swivel pulleys on the tyrolean rope, they were using the pulley on a krab (e.g. Petzl Rollclip). Rather than a cord and Munter hitch to connect that to the stretcher, they had a fixed rope slings, and relied on the haul ropes to take the weight while pulleys were transferred to a new line.
- 5. They had also developed a fancy harness for the Nest. Like the Shunt on rope harness used in NSW and other places, and unlike the commercial STEF harness, it allowed the stretcher to go to completely vertical. The advantage was that it was a one-handed operation to return the stretcher to horizontal orientation. I'll let you look at the pix to see the disadvantage.
- 6.One used a ropewalking technique. Most had their foot loop tied to their foot, and an elastic band holding it at their knee, too. I think all used Pantins or equivalent.

Most of the above can be seen as very useful for a well-practiced team and a "course" like this. I think only point 3 might have broader application in our circumstances.

The pretty uniforms and showmanship were interesting, though.

# **ICRC** plenary

The ICRC is a commission of the UIS. It has no funding and just a few volunteers. Its <u>website</u>. There is a meeting at the International Congress of Speleology each four years. The next is 2025 in Brazil. In theory, there is a conference specifically for Cave Rescue each four years, offset to fall between the ICS, but the last was 2015. ICRC does not currently have contact info for a few nations that have been members in the past.

It is looking for volunteers to do various things... It is also looking for photos and updates from member countries. Anyone feel like that job?

They're looking for a proposal to host the next ICRC in 2027.

A few of us talked about running a smaller scale Asia-Pacific ICRC meeting.



The team, and they put on a show! This was the introduction, complete with over-the-top introductions! - Photo by Brian Evans



At the top of the first lift, the counterweight transfers the casualty to the first tyrolean. Another rescuer is waiting to transfer her to yet another tyrolean - Photo by Brian Evans



In this pic, you can see the couterweights on the floor, against the wall on the right, and at the extreme left. Each counterbalance rope is threaded through the whole system from head or foot to the appropriate counterweight - Photo by Brian Evans

There was discussion about UIS negotiating a caver insurance scheme to get a better deal than nations usually can. This was for all cavers, not specifically caver-rescuers.

There was discussion about promoting MoUs like what we have with NZ, to try to smooth the path when nations want to call on cavers from other nations to help.

There was also a fair bit of discussion AGAINST the idea of standardising rescue techniques but rather to promote working together and handovers to allow teams to support each other effectively while maintaining the skills that their team has evolved with. Also encouragement to share what we each know, test or practice.

There was no real outcome regarding interaction with ECRA, other than that it would be wise if the ICRC ran adjacent in time and place with an ECRA conference. Both organisations have similar goals.

# **Projects worth Pursuing**

- The PenRock "Stone fracturing with expansive gases" system looks very interesting.
- There's a very nice face mask in the pix that I think will be worth trying.
- Opening our Australian and Kiwi CR workshops more widely in the Asia Pacific region seems smart
- It's worth better investigating the Aspiring stretcher
- We should try to get an Aussie to these things every time they happen...
- I got access to very good comms information from ECRA that I'll research and circulate. Our diversity of systems, and inadequacy of available units in some regions is a problem, but gaining supply remains the issue.

 There were a few from various countries that indicated that they might visit Oz. It would be a privilege to return the hospitality, and rather nice to learn more from them while showing off our stuff.

# Field trips

The local caves are renowned for their prehistoric cave art, from 30 to 20 000 years ago. Like Lascaux in France, Altamira and Covalanas have amazing examples, and often deep in the cave. I visited the replica cave at Altamira (no visits to the art site, but they've done an excellent job of reproducing the site in plastic on the surface - it seemed very real, apart from the level floor and lighting) and Cullalvera but missed Covalanas 'cos I got into a real cave.

Coventosa had some enormous passage, a rather pleasant river section, and large room of big, grey stalagmites - the Hall of Ghosts. A pleasant sporting cave with a few pitches and lots of cow's tail traverses. The Andalusian team that showed me through were excellent. They added on a scenic tour through a mountain pass, some glaciated limestone and a classic waterfall. Looks like a great place to cave, and many caves to be visited.

I also managed to join a bundle of South Africans, a Kiwi and Spaniard on a couple of via ferrata on the day after the conference. One went through a canyon with lots of zip lines and bridges, but also some very pleasant climbing, often using natural features like caves. The other was more the expected, up-a-cliff type. Nice. I was not expecting to be able to do these without a guide and a big fee, but €10 got me the lanyards and another €6 the harness, as I'd not brought my own. In Europe, it seems these are mostly built to attract tourists, rather than by an exclusive private operator - more like a bush walking track or mtb trail.



What a pleasant, invigorating activity. Out on the via ferrata Callejomadero with five South Africans, two Kiwis and a Frenchman - Courtesy another kind, young South African

## **European Cave Rescue Association, ECRA**

This formed about a decade ago with a view to exchanging cave rescue information between countries. It's focussed in Europe, but allows countries outside Europe to join without voting rights (that's OK, they charge half as much, and there's nothing much to vote on) and boasts membership from >30 organisations in >25 nations.

The organisation has been meeting annually, on a budget (but not when you factor travel to Europe in!) since 2007. While its main focus has been information interchange and promoting collaboration, there have been several major cave rescues in that time. These have involved teams from various nations getting together and working for one goal. (Think Reisending, 2014 and Morca 2023).

Membership obviously includes organisations that do cave rescue from most European countries, but also the US, Canada, Russia, UK, Israel.

The organisation quickly established that it does not DO or manage rescues, that remains the prerogative and responsibilitry of the nation where the incident has happened. However, it does offer specialist advice and can request cave rescuers from other nations to attend and offer their services to the host country. With both of those major rescues proving successful international collaborations the organisation has been effective, but remains focussed primarily on supporting cave rescue teams to do their job effectively on their own patches.

The organisation takes care NOT to mandate or even approve particular techniques or protocols, but does provide a vehicle for people to share what they have learned, and what works for them. In fact, their general secretary made a point of saying to me that, "what methods you use should depend entirely on your local conditions and traditions". I took this to mean that we should respect the knowledge and understanding of local caver rescuers – and let them use the methods that they have practised and established to work in their environments. That's not to say that we should not spread ideas and alternate strategies, but that they should be presented as an option that locals might consider...

Here's a few web links: <a href="https://caverescue.eu/">https://caverescue.eu/</a>

https://www.facebook.com/ECRA.rescue

EQUIPMENT: https://caverescue.eu/documents/

NEWS: https://caverescue.eu/news/



ECRA's 2024 conference "family photo" at Mostar, Herzegovina -Courtesy ECRA, XOX, accessed 31/7/25

## Australia a member?

I proposed to the ASF executive that Australia become a member, at least for a trial period and they approved. We were accepted in October 2024.

For this, we gain the following:

- access to ECRA's research and reports
- access to a broader network of caver rescuers and their potential support in discussions with government, coroners, etc.
- invitation to their annual conference (although I don't think we're going to see Aussies attending this annually! I will be attending in Poland this year (I've not asked for ASF support). Perhaps some others will attend every few years? There is considerable benefit for the leaders in Australian cave rescue to discuss cave rescue stuff in this way.
- current news on what is happening on the cave rescue front

We've contributed to their cave communiucations catalogue.

I'm not sure how our membership will work out, but, at present, ECRA is doing a far better job of promoting collaboration between cave rescue organisations than the International Cave Rescue Commission via the UIS. I propose we try to support and get support from both, and evaluate their effectiveness regularly.

PS (27/7/25) I had a message from the ECRA president:

"Brian, do you know those people below, do you know something about this event?

# Subject: URGENT – Missing Solo Caver (XXX) – Immediate Help Needed

Dear Team,

I'm writing with deep concern regarding my friend XXX, who went caving alone today somewhere in North Macedonia.

Before entering the cave, he told me clearly that he would send me a message within 6 hours of entering, and that if I didn't hear from him, I should treat it as an emergency and contact rescue services. That time has now passed, and I have not received any message.

The last message I received from him was at approximately 2:30 AM (Australia time) — which is 6:30 PM North Macedonia time. Based on that, he should have contacted me again by 12:30 AM Macedonian time, but I have heard nothing.

He shared with me this approximate location where he was going caving: XXX

I've tried calling emergency numbers from Australia, but I haven't been able to get through. I'm very worried for his safety.

If there is any way you can assist, either by alerting mountain or cave rescue teams, or advising me what else I can do. I would be incredibly grateful.

YYY"

A flurry of messages to Aussie cave rescue people and some internet research led to a message to NZ. We were able to confirm that it was a real person, who could well be in Macedonia doing such things. ECRA advised the local mountain rescue who sent a team out, and found him: "The guy was found, he is alive, got lost and stayed..."

I'm not sure of the details of what happened yet, but an international network of caver rescuers with relationships with each other probably made a big difference to this guy!



The (mostly!) youthful team heading off for a post-conference day on the local via ferratas - Courtesy of a kind South African delegate who shared this with me.



The performance begins with a lift in horizontal orientation. - Photo by Brian Evans



Post-Penrock fracturing at the de-obstruction workshop -Photo by John Patterson



Drilling in preparation for a PenRock charge - Courtesy of a kind South African delegate who shared this with me

## **Buchan Headwaters Karst**

## **Peter Ackroyd**

Author's note: this article was written many years ago and has languished unpublished in a desk drawer until now.

## Introduction

Most people have heard of the limestone deposits in and around Buchan, Victoria, laid down in shallow seas during the Devonian period. However, located in the Buchan Headwaters Wilderness Zone 50 km to the north there are older limestone deposits laid down during the Silurian period, about 415 million years ago.

Three smallish remnants have survived the 250 millionyear period of erosion following the Palaeozoic era by having the fortune to be included in a graben (a downthrown block between two parallel fault lines).

### The Buchan Headwaters

The earliest recorded visit by cavers to this region was in 1975 when a small party hiked in to the easternmost deposit on Limestone Creek. They noted "two small cave-like entrances" (Franz, 1975).

The next recorded visit was in near drought conditions in April 1998 when Dick Clarke and the author walked in from the Wombargo Track to spent three nights camped on the Buchan River (Clarke, 1998). The two western deposits were the main target and the closest, on a ridge above Cave Creek, was explored to reveal "Chasm Cave" and other karst features. Chasm Cave was mapped.

An attempt was made to head further west to reach the third limestone deposit. After scrub-bashing across a few gully crossings and with night rapidly approaching it was decided that, as the march back to camp was now 6 km and 600 m of elevation away, discretion was the better part of valour.

The eastern-most deposit, on Limestone Creek, was visited the next day and the two caves there were explored and mapped. They were given the names "Wombat Grand Prix" and "Block Cave".

## **Documentation Trip**

In early June 1998 Roger Taylor and the author packed into the Buchan River camp to carry out recording and tagging tasks on the known caves and to explore the third limestone deposit. Unfortunately, this coincided with the breaking of the drought and after about 60 mm of rain fell the Buchan River was transformed from a mostly dry, cobbled riverbed to a frothing torrent that we considered a little too risky to cross.

We suffered two nights of this. Wet to the skin we admitted defeat and dragged ourselves the 700 m back up to the Wombargo Track, where we'd left the vehicle at the locked gate, and left.

Six months later we set off from Melbourne mid-week on 25 November 1998 to complete the mission. Leaving the vehicle at the gate just off the Wombargo Track, we tramped down to the Buchan River, just south of its confluence with Reedy Creek, to set up camp at 9:00 pm.

In the morning, we crossed the now much more manageable Buchan River and cranked our way up the 600 m rise to the ridge-top then headed west to reach Chasm Cave 5 km later.

Carrying out a careful survey, and because the drought had broken, we saw something not obvious on the earlier visit: a stream sink on the edge of the limestone outcrop. Following the stream bed down the gully for 200 m or so revealed water coming in from the north. Chasing this stream up for 50 m we reached a rising emerging from a pile of boulders at the base of a steephead.

All this was in the same Silurian limestone deposit as Chasm Cave. Along with the already known limestone deposits and their karst features, we had seen enough to determine this region deserved its own area identifier "BH".



Roger fording the Buchan River on the way to Chasm Cave -Photo by Peter Ackroyd, 26 Nov 1998

Roger set to tagging Chasm Cave as BH-1 while I climbed down some old poles that appeared to have been placed about 20 years before our visit, probably before the area had been proclaimed a wilderness zone. Inside I took some photos and noted a steeply dipping dyke in the roof which had probably controlled the structure of this cave.

Roger joined me and we both noticed an entire area of the roof, nearest the entrance, had been stripped of stalactites, some up to 50 mm in diameter. Again, this appeared to be a couple of decades before our visit. Further inside the cave the decoration was still intact.

Back on the surface, Roger commenced installing a BH-2 tag on a rift with a small cave 60 m or so southwest of BH-1, while I carried out a compass and pace survey of the immediate limestone outcrop, which had some nice karren features and a small bluff near the top.

A draughting hole 15 m south-west of BH-2 was tagged BH-3, then the stream sink was duly numbered BH-4. At the time of our visit the flow was about 1 L/s and it sank into a gravel bed over a distance of 10 m a few metres north of BH-2. We then carried out a survey traverse to the rising of the stream at the steephead, numbered BH-5.

After surveying, tagging, photo-tagging and GPS-ing these features the time was 7:00 pm and the atmosphere was cooling rapidly. Scrub bashing back to the track we trudged back to our camp on the Buchan River, arriving a tad after dark.



Roger entering Chasm Cave (BH-1) via 20-year-old scaling poles - Photo by Peter Ackroyd, 26 Nov 1998

The following day was a rest day — a leisurely walk to the known caves in the limestone deposit near the lower part of Limestone Creek. During the drought in April, Dick and I had simply walked down the dry bed of the upper Buchan River. This time Roger and I were forced high onto the ridges to scrub bash our way the 4 or 5 kilometres to the deposit.

After a pleasant lunch on lower Limestone Creek, we set off in light rain for the caves. Upon reaching them the weather cleared and we spent a couple of happy hours on the smallish Silurian limestone outcrop. The snow gums were in full flower and the grass cover in its prime.

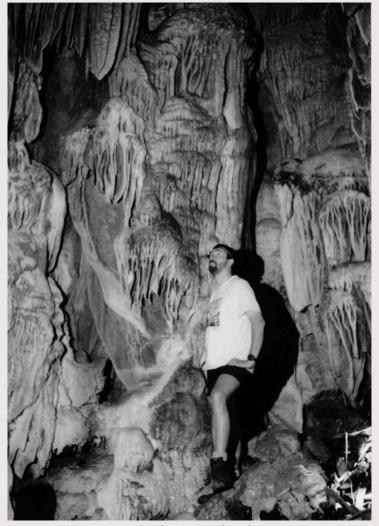
We set about documenting and GPS-ing the two caves, Block Cave (BH-6) and Wombat Grand Prix (BH-7). Despite a careful search, we did not find the spring mentioned in Franz (1975). Presumably it is intermittent only.

A quick trip inside Wombat Grand Prix allowed a couple of check compass bearings to be made to validate the accuracy of the survey made in April. We noticed that this cave had also suffered stalactite breakage. Again, it was some time ago as indicated by the considerable growth of straws on some of the stumps.

Afterwards, lying in the sun under the snow gums watching a soaring eagle proved very enticing but we still had the return journey to make. Shouldering packs we headed back onto the scrubby ridges, returning to camp by 7:00 pm.



Steeply dipping dyke in roof of Chasm Cave (BH-1) - Photo by Peter Ackroyd, 26 Nov 1998



Roger in Chasm Cave (BH-1) -Photo by Peter Ackroyd, 26 Nov 1998

We just had time to cook our meal before the rain came down in earnest sending us scurrying for our tents.

The following day we planned to tramp to the third and farthest limestone deposit, well to the west of our camp. We crossed the Buchan River, which was somewhat higher due to the 10 mm of overnight rain, and walked up the 600 m straight rise to reach the saddle near Chasm Cave by mid-morning. Cutting into the scrub we walked past BH-4, noting that the stream sink was now taking twice the flow compared to two days ago.

Following a compass bearing, we scrub-bashed our way west to reach the saddle Dick and I had reached in April. Below us, only a few metres away, we observed a lyre bird on its mound going through a wide repertoire of songs and dances. After ten minutes or so the bird seemed to sense us and disappeared into the scrub.

Continuing down a scree slope into a gully then pushing up the opposite side, we came across a narrow outcrop of limestone. A cursory search revealed no significant karst features but did allow us to find several splendid banksias and a magnificent stand of leopard orchids.

Crossing the saddle at the top of the ridge, we found we were still on limestone but this quickly petered out to the more common sandstone and quartzite country rock. It appears that this westernmost limestone deposit has been badly fractured by the folding and faulting events after the Silurian period and so is unlikely to host any significant karst features.

By now we were reasonably close to Reedy Creek Chasm so we continued to bush bash to the southwest until we reached it. Due to the overnight rain, rushing water filled the entire width of the chasm making progress, either upstream or down, somewhat difficult.

Stripping to the bare essentials, we were able to follow the chasm upstream for a short distance until steep walls and fast, deep water made progress risky.

We realised we were currently only 120 m elevation above our campsite but to return to it we had to climb, then drop down, two more scree covered gullies before rising to 1220 m then descend half that height to get back to camp. After an 18 km round trip we finally reached our tents at 8:30 pm.

The next day was Sunday 29 November and time to go home to Melbourne. All we had to do was climb the steepish 700 metres out of the valley to the car at the locked gate.

A stop-off for home-made cakes at Buchan Roadhouse and a leisurely drive home rounded out a fine trip to a new cave area in some beautiful country. If we'd had any more fun it would've probably have been illegal.

### References

Clarke, Dick (1998), Tea and Pog. Nargun, 31(2): 28-31.

Franz, Brian (1975), Trip Report—Upper Buchan. Nargun, 8(4): 9-11.



Peter trying to get that perfect shot in Reedy Creek Chasm -Photo by Roger Taylor, 28 Nov 1998

## **Velvetworm Caves**

## **Trowutta - Sumac Karst Tasmania**

Article and Images by Adrian Slee, Forest Practice Authority



Figure 1: Crawl space in Velvetworm Cave

## Introduction

The Trowutta-Sumac (T-S) karst covers 380 sq kilometres of rugged forested hill country stretching from Nabageena in the north to the Horton River valley in the south. Approximately half the area is located on State Forest while the remainder is divided between conservation reserve and small areas of agricultural land north of the Arthur River. This karst area is the most notable karst system in the Precambrian dolomite of northwest Tasmania. Unlike many other Tasmanian dolomite and limestone karst areas, large caves in the order of hundreds of meters to kilometres long have never been discovered in the region. Caves in the T-S Karst are relatively rare especially considering the hundreds of sinkholes that pockmark the area and the conspicuous lack of surface streams. Up until recent years the Trowutta Arch north of the Arthur River, the Julius River Caves and Lake Chisolm (a large sinkhole lake) were considered to be the most significant karst landforms in the area (Sharples 1996). However, recent work has documented further enclaves of significant karst landforms in the middle Lamprey Creek valley (Slee 2019, Darby 2023), and at Howitzer Hill (Slee and McIntosh 2023). Dolomite units with humanly enterable caves are not widespread in the T-S karst but locally highly cavernous terrain is present. The Velvetworm Caves (named after velvetworms present in one of the caves) are the most recent caves discovered and documented within the T-S karst. They are found within a bluff of Black River dolomite associated with a large stream riser. Like other recently documented karst phenomena in the area (Lamprey Creek, Howitzer Hill), the Velvetworm Caves are located within an isolated pinnacle of high-grade dolomite that emerges from beneath silicified dolostone. This report documents the larger caves present at the site and explains the likely hydrology of the area.

### Methods

The site was surveyed by a group of FPA staff and foresters over two days in March 2025 (Figure 1), in sunny dry weather following a long period of low rainfall. Mapping was undertaken in the field by using Avenza mapper on tablets to record the location of the features, and a Leica Disto X310 and compass to survey the caves. The cave maps are low to moderate grade equivalent to 3/4 (ASF 1997). To protect the site, we chose to use a non-geographic name for the location and to not publish any locational data, in line with ASF guidelines and to protect both abiotic and biologic values of the caves and the outcrop in which they occur.

## **Cave Descriptions**

At least 12 small caves are located on the main dolomite outcrop that covers an area of 0.50 ha while a further small cave lies in an isolated outcrop 150 m away from the main outcrop. The main outcrop rises to 20 m above the valley floor. The surface topography of the outcrop is rugged with past cave collapse indicated by a pair of rifts 7-8 m deep and 40 m long. Large conical sinkholes and rundkarren formation is common on the upper surface of the outcrop. Most of the caves are negotiable for less than 10 m. This report details the four most significant caves at the site.

Foresters First (Figure 2): It was so named as it was the first wild unexplored cave that two of the party had ever visited. This cave lies at the eastern end of a significant cover collapse feature forming two deep rifts in the dolomite. The cave has an entrance that descends for 7 m at 38° to a large well decorated chamber 4-5 m wide, 7 m long and 6 m high. Two tight passages are present leading to the east and several metres out of sight while a low side passage leading to two small side entrances extends about 4 m to the west just within the entrance. The cave has significant decoration in the form of stalactites, cave cauliflower formations and cave shawls (see picture below).

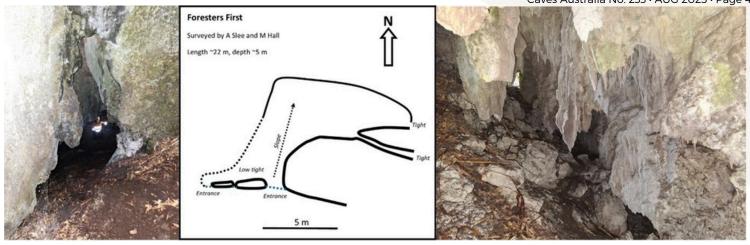


Figure 2. Left - View into Foresters First, Right - view towards entrance showing decorated cave wall.

Velvetworm Cave (Figure 3): This cave features a large lower passage containing a stream riser and deep mud and an upper dry passage a couple of metres higher up slope and separated by a steep wall of dolomite. The lower passage features a large entrance overhang leading to 11 m of passage floored by a deep bog. This passage tightens to a 1 m wide by 1 m high lead that was not explored due to the extremely muddy nature of the entrance. The upper passage forms a rift entrance 2 m above and 3 m to the east of the lower passage. A tight 11 m long rift leads to a low squeeze into a chamber 4.6 m long by 4.5 m wide with a second small

entrance and several low impenetrable passages leading from it. A second very tight lower-level passage exists under the main rift, and this is assumed to lead to the main lower entrance. The cave has a significant draught. The cave gets its name from velvetworms of unknown species being present along with slaters and abundant spiders. As with other caves at the site no cave crickets were noted, although these are generally ubiquitous in most Tasmanian karst areas.

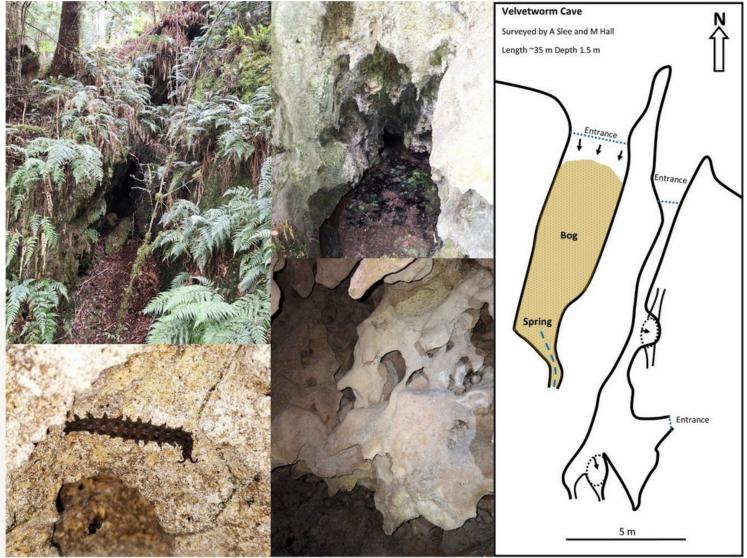


Figure 3: Clockwise from top left, upper entrance, lower entrance, cave map, roof pendants, large finger long velvetworm of unknown species.

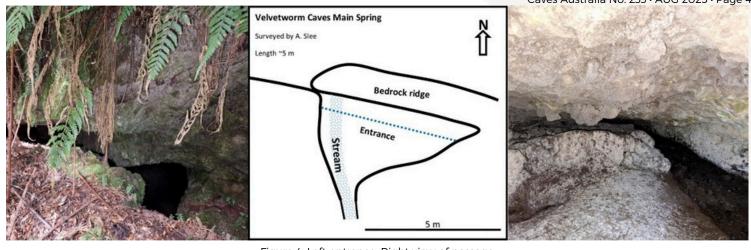


Figure 4: Left entrance, Right view of passage

**Velvetworm Caves Main Spring (Figure 4):** A Low ~5 m wide entrance at the base of a cliff face behind a rockfall, this entrance leads to a very low passage with stream extending 5 m out of sight. This passage looks unlikely to be negotiable for any distance. During high flows the passage is likely to flood.

**Dead Hicky Cave (Figure 5):** Large partially roofed entrance chamber 7.6 m x 4 m by 4 m high. A low passage extends c. 5 m north of the chamber. Two larger passages extend from a central easterly trending rift. The western passage is approximately 15 m long with an aven 7 m high. It ends in a very small passage that extends a couple of meters out of sight. The eastern passage is narrow upward sloping and approximately 10 m long. It leads to a small daylight hole but was not fully explored. The cave was named after a prominently displayed dead cave spider (*Hickmania troglodytes*) on a ledge.

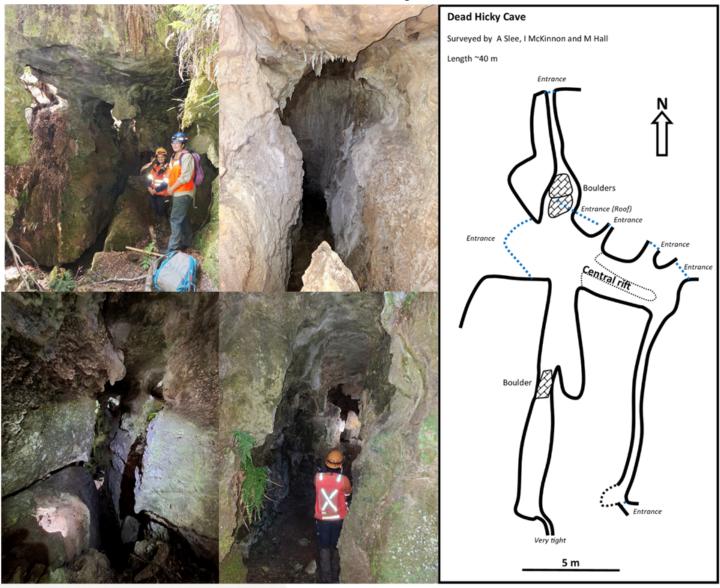


Figure 5: Clockwise from top left, entrance chamber, back of western passage, cave map, looking into western passage, central rift.



Figure 6: Large anabranching stream having flowed from multiple springs rising from the Velvetworm Caves.

## Hydrology

dolomite bluffs. Downstream of the caves the streams coalesce into a single wide anabranching stream (Figure flowed significantly at the time documentation (in late March after a dry summer). Flows indicated that this stream could be classified as a small class 2 stream in the stream classification used by the forestry industry and defined in the Forest Practices Code (FPA 2020), in which case we could expect that the catchment of the caves most likely covers an area of at least 100 ha and could conceivably approach several hundred hectares. No known stream sinks are recorded in the area. However, the immediate hillslopes above the caves contain a mixture of large bowl-shaped sinkholes as well as areas of more active steeper-sided sinkholes that could almost be defined as polygonal karst.

## **Cave Development**

The Velvetworm Caves feature 12 documented entrances within a comparatively small dolomite bluff having an area of less than 0.50 ha and include numerous smaller solution tunnels and fissures. The main bluff has evidence of roof collapse into larger chambers in the vicinity of Foresters First and in the form of an unroofed stream gully immediately north of the risers in Velvetworm and Velvetworm Main Spring caves. Like elsewhere in the T-S karst abundant sinkholes within the vicinity of the caves attest to the likely presence of a significant karst aquifer. However, there appears to be no negotiable master stream cave, even though the volume of water exiting the system points to a substantial karstic aquifer that must extend some distance under the less soluble largely silicified caprocks in the area. A master stream cave could conceivably be obscured by breakdown around its stream risers. However, the small scale and number of the active stream passages suggests this is probably not the case.

Rather the impurities within the dolostone bedrock and The caves are associated with a series of springs in the high degree of silicification means that the dolomite beds allowing significant karst development are discontinuous lenses and therefore karst development, of while very pervasive in the relatively pure carbonate dolomite lenses, has limited potential to develop into master stream passages characteristic of other Tasmanian karst, in which faults and fold axes may play a role in cave development. The result of the patchy distribution of high-grade dolomite lenses is that the karst is a complex 'sponge' network of random larger cavernous voids joined by seepages or narrow solution passages. Consequently, the scattered sinkholes show no sign of lineations associated with the presence of single well-defined drainage pathways (stream caves).

> The observations of cave development at the Velvetworm Caves corresponds to observations of the karst hydrology at Howitzer Hill (Slee and McIntosh 2023) where a substantial karstic aquifer estimated at <500 m long is present.

## Acknowledgements

Ground survey and documentation of the caves and nearby sinkhole terrain was undertaken with the help of Sustainable Timbers staff Melissa Hall, Codey Kershaw, Stephanie Haag, Adam Hyland and FPA Earth Science staff member Indigo McKinnon.

### References

Darby, P., 2023. Lamprey Creek Trip Report, Speleopod, 92: 19-35

Forest Practices Authority, 2020. Forest Practices Code. pp. 62-63

Sharples, C., 1996. A reconnaissance of Landforms and Geological Sites of Geoconservation Significance in the Circular Head Forest District. Volume 2 – Description. A report to Forestry Tasmania. pp. 38-39

Slee, A., 2019. A reconnaissance survey of the Trowutta-Sumac Karst. Forest Practices Authority, Scientific Report 25, 25/11/2019, 49pp.

Slee, A and McIntosh, P., 2023. Drainage derangement at Howitzer Hill in the Trowutta-Sumac Karst, north-west Tasmania. Helictite, 47:13-19

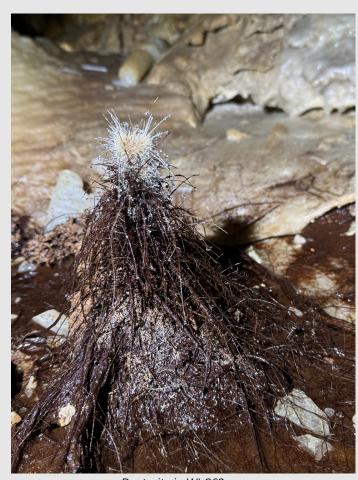
## **CLinc in 2025.**

## Text and photos by John Tonai-Moore

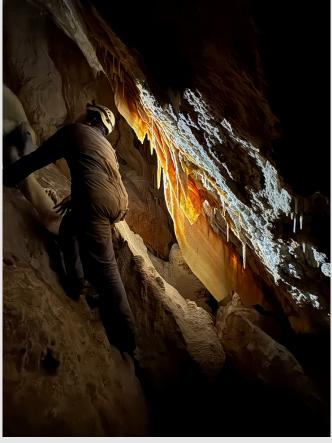
January was a write-off for the club except for me attending the conference in Buchan. It seems our members were all off having fun doing other things after the Christmas break. Our monthly trips commenced in February and have continued each month with our June trip scheduled for this coming weekend.

All our trips in this first half of the year have been to our local caves situated along the Leeuwin Naturalist Ridge between Augusta and Margaret River. The area is divided into five sections: AU (Augusta), WI (Witchcliffe), CO (Cowaramup), MR (Margaret River) and YA (Yallingup). We have quite a range of caves on the ridge. We have some big dolines and some tight squeezes. Our vertical entry caves are not very deep but some of the solution pipes are challenging due to their small diameter. We will often have a tight squeeze followed by a large, cavernous chamber. We don't get very muddy in many of our caves due to a drying climate with reducing rainfall. Many of our streamway caves are slowly drying and some of the streamway's never flow anymore.

Due to the Aeolian limestone that makes up many of our caves we have some spectacular decorations. The cover picture on the latest *Caves Australia* taken by Marcos Silverio is one of our many caves with incredible decoration. We do protect the most spectacular caves with locked gates, limited trips and limited numbers of cavers on each trip.



Rootmite in WI-062



Lovely shawl in WI-115



Arlo squeezing into WI-115



Lauren checking water flow in CO-01

## Foul Air in Caves, Can Be Life Threatening

Text and photos by Garry K. Smith

My interest in 'foul air' goes back to well before 1993 when I wrote an article on this subject. A number of indepth studies and articles followed. So more than 30 years later I feel compelled to once again highlight the dangers of 'foul air' as new generations of speleologists explore the underground. Foul air, sometimes called "bad air", can be life-threatening and cause death, if the warning signs are not heeded.

Where is foul air likely to occur in caves and how can one determine a dangerous level? This article should answer many of the questions on this subject and provide information to assist in identifying this unseen danger.

### **Definition**

Foul air is typically defined as any atmosphere which has a noticeable abnormal physiological effect on humans. In limestone caves, 'foul air' can generally be described as containing greater than 0.5% carbon dioxide (CO<sub>2</sub>) and/or less than 18% oxygen (O<sub>2</sub>) by volume. As a comparison, normal air (above ground) contains approximately 0.04% CO<sub>2</sub> and 21% O<sub>2</sub> by volume (Smith 1996, 1997a, 1999a,b). However, there are some isolated caves which could contain atmospheres influenced by other gases such as methane, ammonia, hydrogen sulphide and carbon monoxide, but these gases are very rarely found in limestone caves (Smith 1998a).

## CO<sub>2</sub> properties and effect on humans

To the novice caver, the first encounter with foul air is often a frightening experience. Typically there is no smell or visual sign and the first physiological effects are increased pulse and breathing rates. concentrations of CO<sub>2</sub> lead to physiological signs such as clumsiness, severe headaches, feeling hot and sweaty, loss of energy, dizziness and even death (Smith 1996, 1997a-d). Experienced foul air cavers can notice a dry acidic taste in their mouth, however the average caver may not notice this effect. Note, that at high altitudes (i.e. caves in high mountains) the physiological effects are increased.

Prolonged breathing of air containing around 2% CO<sub>2</sub> or greater will disturb the body's function by causing the tissue fluids to become too acidic. The body then releases other chemicals to try and counteract the acidity. Thus some of the symptoms, such as feeling weak and lethargic may last for hours or days after exiting the cave.

An elevated  $CO_2$  concentration, as opposed to depleted  $O_2$ , is usually the most life-threatening foul air scenario found within limestone caves.  $CO_2$  is a colourless, odourless and non-combustible gas. It is a heavy gas and tends to accumulate at the bottom of deep caves in areas with minimal air flow (Fig. 1). However, it can still be found in some shallow caves with a vertical range of less than 10 metres (Smith 1999b). In general, cave passages containing very active stream-ways do not contain foul air as the water flow dissipates the  $CO_2$  and replenishes the  $O_2$  (James and Dyson 1981).

 $\mathrm{CO_2}$  is the body's primary regulator of the breathing function. There are exceptions to this generalisation which may occur in people suffering from chronic obstructive pulmonary disease (COPD) where a reduction in  $\mathrm{O_2}$  concentration has become their body's primary breathing regulator (Smith 2003). However, for the overwhelming majority of humans, elevated  $\mathrm{CO_2}$  concentration is the body's primary breathing regulator and a lack of  $\mathrm{O_2}$  is the secondary regulator. For more indepth information on this topic refer to the paper, Smith 2003.

## Why is CO<sub>2</sub> so dangerous?

It all has to do with red cell haemoglobin in the blood, which transports  $O_2$  and  $CO_2$  around our body. The exchange of the two gases takes place in the lungs by diffusion across the walls of the air sacs (alveoli). Oxygen from inspired air diffuses across the lining of the air sacs and enters the circulation, while  $CO_2$  moves in the opposite direction. The gases are transported between cells and the lung by the blood circulation. Diffusion occurs because a gas in high concentration will move to an area of relatively low concentration, until an equilibrium is reached. When breathing good air, this enables  $CO_2$  in the body at a higher concentration to diffuse to the inhaled air, before being exhaled. (Smith 1993, 1998b, 1999b).

In simplified terms, if the inhaled air, (foul air) contains a relatively high concentration of  $CO_2$  the haemoglobin is unable to get rid of the body's waste  $CO_2$ , thus the haemoglobin is not free to take on fresh  $O_2$ . The result is asphyxiation and death.

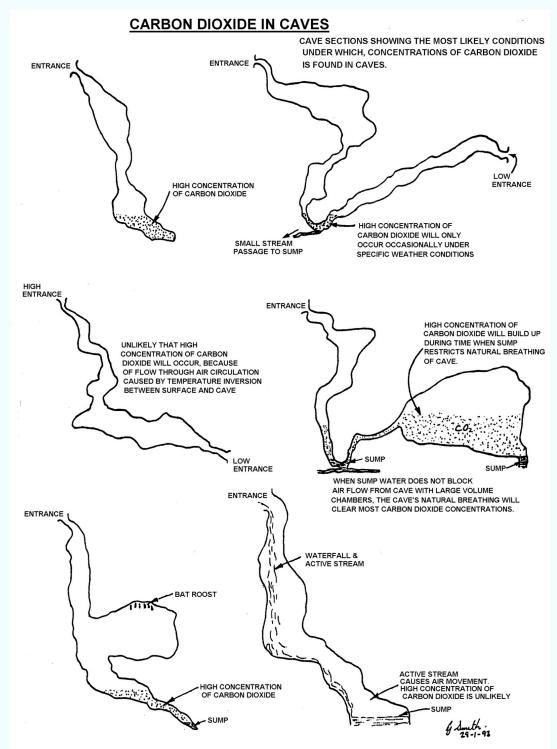


Fig 1. Likely location of foul air in caves. Reproduced from the 21st ASF Biennial Conference Proceedings p.39

## CO<sub>2</sub> versus O<sub>2</sub>

You're probably asking at this stage why an elevated concentration of CO<sub>2</sub> is more likely to be the dangerous atmosphere in caves as opposed to a low concentration of O2. It all comes back to the concentrations usually encountered in cave atmospheres. Human tolerance between individuals can vary, but if we take the generally accepted tolerance of a healthy human, an atmosphere containing greater than 7% CO2 or less than 10% O<sub>2</sub> are considered to be the thresholds at which humans will die. This can be either just one of the above gas concentrations despite the other gas being within acceptable limits. For example a person could survive many hours in an atmosphere with 4% CO<sub>2</sub> and 12% O<sub>2</sub>. On the other hand, an atmosphere of 8% CO<sub>2</sub> and 18% O<sub>2</sub> could result in suffocation and death within a few minutes.

A cave's atmosphere directly correlates with how the  $CO_2$  entered the cave. There are three basic methods in which  $CO_2$  gets into a cave (Halbert 1982, Smith 1996). The types of 'foul air' are detailed in more depth, later in this article.

## How CO<sub>2</sub> gets into caves

Elevated concentration of  $CO_2$  can be due to one or more of the following mechanisms: carried by ground water into the cave and released from solution during deposition of secondary deposits creating speleothems, a by-product of micro-organism metabolism, respiration by fauna such as bats, humans or respiration from tree roots in caves. In volcanic areas magmatic  $CO_2$  may be dissolved in water deep within the earth's crust and transported into caves.

In summary if a metabolic process is introducing  $CO_2$  along with the reduction of  $O_2$  (typically 1:1), then a critical elevated concentration of  $CO_2$  is reached before a critical reduced concentration of  $O_2$ . On the other hand, if  $CO_2$  is being introduction to a cave atmosphere, while displacing both  $O_2$  and nitrogen ( $N_2$ ) equally, then a dangerous  $CO_2$  is reached well before the  $O_2$  drops to a dangerous concentration. This is why  $CO_2$  concentration is typically the most life-threatening.

### How can we detect foul air?

It must be stressed here that the majority of Australian caves and indeed around the world, DO NOT contain foul air. However as shown earlier, an elevated concentration of  $CO_2$  is an indication of a reduced  $O_2$  concentration. If sophisticated gas measuring equipment is not readily available, then a 'Naked Flame Test' will indicate air quality to some degree. This test is actually measuring the  $O_2$  concentrations required to support combustion of various materials – i.e. allow a naked flame to burn (Figs. 2 and 3).



Fig 2. The first sign that reduced  $O_2$  is present and most likely elevated  $CO_2$  is when the cigarette lighter flame is elongated and separated from the lighter jet

The 'naked flame test' can be undertaken by igniting a match or butane cigarette lighter or carrying a lit candle into suspected foul air. If the flame is present. extinguished, foul Extensive air experimentation by the author, in controlled atmospheres, shows that matches and candles extinguish when the O<sub>2</sub> concentration drops below 15% and a butane lighter when O2 is reduced to 14.25% (Smith 1996, 1997a,b,c). A video taken during these experiments can be viewed at

https://www.youtube.com/watch?v=8nSdTRHw3os



Fig 3. Cindy Li performing a party trick demonstrating the foul air interface in Moores Cave, Timor. When the cigarette lighter flame is lit in good air the flame extends directly from the lighter jet. As the lit cigarette lighter is then lowered into a layer of foul air, the flame remains burning in air which can just support combustion. Keep lowering the cigarette lighter and the flame will extinguish.

Where possible a butane cigarette lighter should be used to reduce unpleasant fumes emitted from matches burnt by people testing air quality in the confines of a cave. However, the 'flame test' is a rough guide and does not tell you the actual concentration of the CO<sub>2</sub> other than it is elevated.

The cheapest and most reliable measurement system on the market is the Dräger-Tube gas analyser (Fig. 4). It uses disposable single use tubes containing chemical reagent crystals, that change colour to accurately measure CO<sub>2</sub> concentrations. These instruments are extensively used in mines where naked flames would cause explosions. Various tubes are available to measure concentrations of different gases. This instrument has been used by the author on many trips into caves containing 'foul air'. One particular cave atmosphere was measured at 6.5% CO<sub>2</sub>. Fifteen Minutes at this concentration was almost unbearable for a group of experienced cavers, with most experiencing severe headaches and all noticeably affected by lack of energy, gasping for breath and heart rates of around 148 bpm and above, while at rest. A rescue in these conditions would be extremely difficult without breathing apparatus.

## Types of foul air in caves

Foul Air can be categorised in three main types (Halbert 1982).

- 1. Foul Air Type 1", is produced when  $CO_2$  is introduced into the cave atmosphere from ground water. This occurs because  $CO_2$  is absorbed by the ground water as it passes through surface soil containing high concentrations of the gas, due to the decay of vegetation and respiration from plant roots. The resulting weak carbonic acid percolates through the rock strata and enters the cave system, usually taking part in the calcite deposition cycle (creation of speleothems) before the  $CO_2$  is liberated to the cave atmosphere. In this instance it takes the addition of five percent  $CO_2$  to reduce the  $O_2$  level by one percent.
- 2.In "Foul Air Type 2" the  $CO_2$  is a by-product of organic and micro-organism metabolism or respiration by fauna such as bats, humans or tree roots. In this instance the oxygen concentration is reduced in proportion to the increase in  $CO_2$ . The  $N_2$  concentration stays constant.
- 3. "Foul Air Type 3", is a cave atmosphere which has resulted from the introduction of other gasses, such as methane and nitrogen and the non-respiratory uptake of O<sub>2</sub> as well as CO<sub>2</sub> stripping by water. Another example is "stink damp" so named because it often contains hydrogen sulphide and the O<sub>2</sub> is significantly more depleted than in "Type 2". Foul air consisting strictly of "Type 3" is rare in Australian caves, although some samples collected at Bungonia do suggest a few caves contain atmospheres partly influenced by this mechanism (James 1977, Osborne 1990).

## How do the gases affect humans? Effect of CO<sub>2</sub> on humans

As each person's body has a slightly different reaction and tolerance to stressful situations the following symptoms are general (Table 1), however nobody is immune to the dangers of  $CO_2$ .

Exposure of between 1 and 2% CO<sub>2</sub>, for some hours will result in acidosis, even if there is no lack of oxygen. This acid-based disturbance will occur in the human body when the increase in partial pressure of CO<sub>2</sub> (pCO<sub>2</sub>) is greater than 44 mm Hg. Acidemia will result and secondary mechanisms are initiated by the body that attempt to prevent drastic changes in pH and try to return the pH toward normal. Although this response begins early, the maximum effect takes several days.

Prolonged breathing of air containing around 2% or greater will disturb body function by causing the tissue fluids to become too acidic. This will result in loss of energy and feeling run-down even after leaving the cave. It may take the person up to several days in a good environment for the body metabolism to return to normal.

The "Laboratory Safety Manual (1992)", quotes 0.5% CO<sub>2</sub> as the 'Threshold Limit Value Time Waited Average' (TLVTWA). This is the concentration to which a person may be exposed, 8 hours a day, 5 days a week, without harm. The manual also quotes 5% CO<sub>2</sub> and above as being 'Immediately Dangerous To Life and Health' (IDLH).

## Effect of O<sub>2</sub> deficiency on humans

If we consider an atmosphere consisting of just  $N_2$  and  $O_2$ , where the  $O_2$  is at a lower concentration than the normal atmosphere, the human body would be affected in the manner shown in Table 2.

Table 1. Generally accepted physiological eff	ffects of CO₂ at various concentrations.
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Concentration	Comments
0.04%	Nothing happens as this is the normal carbon dioxide concentration in air.
0.5%	Lung ventilation increases by 5 percent. This is the maximum safe working level recommended for an 8 hour working day in industry (Australian Standard).
2.0%	Lung ventilation increases by 50 percent, headache after several hours exposure.  Accumulation of carbon dioxide in the body after prolonged breathing of air containing around 2% or greater will disturb body function by causing the tissue fluids to become too acidic. This will result in loss of energy and feeling run-down even after leaving the cave. It may take the person up to several days in a good environment for the body metabolism to return to normal.
3.0%	Lung ventilation increases by 100 percent, panting after exertion. Symptoms may <u>include:</u> headaches, dizziness and possible vision disturbance such as speckled stars.
5 - 10%	Violent panting and fatigue to the point of exhaustion merely from respiration & severe headache. Prolonged exposure at 5% could result in irreversible effects to health. Prolonged exposure at > 6% could result in unconsciousness and death.
10 - 15%	Intolerable panting, severe headaches and rapid exhaustion. Exposure for a few minutes will result in unconsciousness and suffocation without warning.
25% to 30%	Extremely high concentrations will cause coma and convulsions within one minute of exposure. Certain death.

Table 2. Generally accepted physiological effects of reduced O2 concentrations.

O2% by volume.	Symptoms(at sea level)
reduced from 21 to 14%	First perceptible signs with increased rate and volume of breathing, accelerated pulse rate and diminished ability to maintain attention.
between 14 to 10%	Consciousness continues, but judgment becomes faulty. Rapid fatigue following exertion. Emotions effected, in particularly ill temper is easily aroused.
10 to 6%	Can cause nausea and vomiting. Loss of ability to perform any vigorous movement or even move at all. Often the victim may not be aware that anything is wrong until collapsing and being unable to walk or crawl. This is followed by unconsciousness and death. Even if resuscitation is possible, there may be permanent brain damage.
below 6%	Gasping breath. Convulsive movements may occur. Breathing stops, but heart may continue beating for a few minutes - ultimately death.

## Cave rescues in foul air

The ASF Australian Cave Rescue Commission (ACRC), along with other groups such as the NSW Cave Rescue Squad, regularly train at areas affected by foul air such as Bungonia Caves, NSW. Their members are well aware of the effects and hazards of foul air. Generally speaking experienced cavers who frequent these caves and others containing foul air, are aware of this hazard. The real problem is inexperienced cavers who don't realise when they are in foul air, then get into difficulty. So, if you come across inexperienced cavers in known foul air caves, take the time to explain the signs and symptoms to those cavers. You may avert a rescue or save a life.

## **ASF Safety Guidelines**

The Australian Speleological Federation (ASF) has adopted safety guidelines relating to foul air. These can be found on the ASF website. It is recommended that speleologists take the time to read these guidelines and adhere to them. In particular Appendix 3: Toxic (foul) air.

## **Summary**

If sophisticated measuring equipment is not available, the best advice is to carry out a "Naked Flame Test" when you or a member of your group experiences the first signs of laboured breathing, headaches, clumsiness, loss of energy or any of the other signs associated with an elevated  $CO_2$  concentration. The naked flame test is actually measuring the  $O_2$  concentration, however reduced  $O_2$  typically indicates elevate  $CO_2$ .

Ideally cavers should use a cigarette lighter flame. This will reduce the amount of unpleasant fumes and smoke emitted from matches burnt by people experimenting in the confines of a cave. The best advice is, "If in doubt, get out", in an orderly manner.

NOTE- that in mines, sewers, buildings and other areas where flammable gases are likely to occur, the naked flame test **should not** be attempted. There are only a hand-full of limestone caves around the world where it is possible that explosive gas mixtures exist - none are known in Australia.

Laboratory tests have proven that combustion of a match, candle or butane cigarette lighter will cease at about 14.25% to 15% concentration of oxygen (Smith 1996). Twenty one percent (21%) being the oxygen concentration in normal atmosphere. Bear in mind that humans on average breath out air containing 15% oxygen and this is enough to revive a person using mouth to mouth resuscitation. In fact humans can survive in an atmosphere containing as low as 10% oxygen, so when the flame test just fails it is still measuring an atmosphere containing enough oxygen to survive.

The real danger is the  $CO_2$  concentration which is the primary trigger for the human body to increase the breathing rate. Prolonged exposure to a concentration of just 5 or 6% may be enough to cause suffocation. In the majority of cases, if a person has any of the symptoms of elevated  $CO_2$  concentration, a simple naked flame test will fail to ignite. This is a sure sign of foul air and it is time to get out of that area of the cave or completely out of the cave. Accurate measurement of  $CO_2$  and  $O_2$  concentrations in 'foul air' can be achieved by using a Dräger-Tube Gas Analyser with the appropriate tubes or one of the many other gas analysers on the market. These readings can be used to more accurately assess the possible danger of the cave atmosphere.

Carbon dioxide when treated with respect is no worse than the other dangers in caves. Despite the possible dangers, caving is still safer than driving a motor vehicle, which most of us take for granted.



Fig 4 Dräger-Tube gas analyser is showing by the change in tube colour to purple, that there is a 4% CO2 concentration in Moores Cave, Timor, NSW

## References

James. J, 1977, Carbon Dioxide in the Cave Atmosphere. Trans British Cave Research Association, 4(4): 417-429.

James. J, and Dyson, J, 1981,  $CO_2$  in Caves Caving International Magazine, 13: 54-59.

Halbert. E.J.M, 1982, Evaluation of Carbon Dioxide and oxygen data in atmospheres using the Gibbs Triangle and Cave Air Index. *Helictite*, 20 (2): 60-68,

Osborne R. A. L, 1990, Carbon Dioxide in Tourist Caves - A Review in Cave Management in Australia No.5, pp. 43-47

Smith, G.K, 1993, Caves, Carbon Dioxide & You. *Australian Caver*, 133: 20-23

Smith G.K, 1996, Naked Flame Tests for, and Human Tolerance to, Foul Air in Caves. *Helictite*, 34(2): 39-47.

Smith, G.K, 1997a, Naked Flame Tests for  $CO_2$  in Limestone Caves & The Effect of  $CO_2$  and  $O_2$  on Humans, Proceedings of the 21st Biennial Conference of the Australian Speleological Federation Inc. pp. 40-52.

Smith, G.K, 1997b, Caves, Carbon Dioxide & You. Australian Speleological Federation Inc., Proceedings of the 21st Biennial Conference. pp.35-39.

Smith, G.K, 1997c, Unseen Danger Of Foul Air & The Flame Test. *Australian Caver.* 141: 13-16.

Smith. G.K, 1997d, "Unseen Hazards Of Cave Photography". 'Underground Photographer' Spring 1997, Issue 5. P. 15-17.

Smith G.K., 1998a, Foul Air at Bungonia, *Under Bungonia*, in Bauer, J. & Bauer, P. (Eds) pp. 84-92,

Smith G.K, 1998b, Non Toxic "Foul Air" Can Kill. Rescue Australia, pp.11,19,20,65

Smith, G.K, 1999a, Glossary of Caving Terms. Caving Queensland: Australian Speleological Federation's, 22nd Biennial Conference Proceedings, pp. 61-83.

Smith, G.K, 1999b, Foul Air in Limestone Caves And Its Effect On Cavers. Caving Queensland: Australian Speleological Federation's, 22nd Biennial Conference Proceedings. pp. 48-58.

Smith G. K, 2003, Caving for "Pink Puffers" and "Blue Bloaters", Proceedings of 24th ASF Biennial Conference, Bunbury WA. pp.164-173.

## **International Day of Caves and Karst Sep 13**

Sil lannello

The UIS General Assembly in Brazil has officially endorsed the celebration of the first-ever UIS International Day of Caves and Karst, to be held on 13 September 2025.



