

The Journal of the Australian Speleological Federation Inc.

CAVES

AUSTRALIA

NO. 231 FEB 2025

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CONFERENCE

STOP THE PRESS

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COVER: FATHERS CAVE, BUCHAN - NADINE MURESAN



A long drop -Midnight Hole - Tas - Photo by Garry K Smith

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**AUSTRALIAN
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Cave Rescue event, Buchan - Photo by Nadine Muresan



Bogdan demonstrating how to do a pick off
Photo by Marcos Silverio

Editor's Note



Nadine wearing a bit too much colour at the 80's Cavers Dinner - Photo by Glen Pez

Welcome to 2025! While the year has only just begun, it already promises to be an extraordinary one for caving. With exciting events such as conferences, trips to New Zealand and significant discoveries in the southern region of Tasmania, we are certainly in for an exciting year. In addition to these major events, I also aim to focus on other areas across Australia. I would greatly appreciate hearing from all clubs about any adventurous stories, completed mapping projects, exploration endeavours, or simply enjoyable trips that have taken place.

As mentioned during the conference and reiterated by Andrew below, we would like to express our sincere gratitude to Sarah, our former president, for her leadership, guidance and dedication throughout her tenure. We would also like to extend our best wishes to our new president, Andrew—best of luck in filling such significant shoes.

I am eagerly looking forward to what this year will bring and hope that everyone has exciting plans on the horizon. Please do share any updates; I look forward to hearing from you.

Until next time, let's go CAVING!

Nadine Muresan

President's Report

This January was the usual ASF smorgasbord with the Council meeting and subsequent Conference in Buchan, Vic. So for my first report, here is a summary of the 'ASF Silly Season.'

The Council meeting was held online (via Zoom) on 05 January and had a great turnout, with nearly every club represented with limited proxies. We have accepted a new provisional club, Cave Rescue Victoria, to focus on all things rescue. Sil Iannello was appointed to represent Australia as a delegate for the UIS Conference in Brazil later this year.

The Council also adopted the brand name Caves Australia with a majority vote. The Executive will be working over the next few months on how we execute this process with input from the Council. The finer details of the Council Meeting will be released in the Annual Report as well as the Council meeting minutes in the coming weeks. Stay tuned.

The Victorian Speleological Association (VSA) put on a great show for the 33rd Biennial Conference, "Caving in the Moonlight" held in Buchan, Vic. This brought over 130 people from across Australia together for a week of conferencing and of course caving. My hat goes off to Nadine and her incredible team for a well-balanced program. The caves, the talks, the presentations, the food and the people made for a memorable experience. Thank You!!

A highlight for me was the cavers' dinner and the presentation of awards. I'm always humbled by the incredible talent we have in our volunteer community and the recipients were beyond deserving of recognition. For a full recap of the awards see page 13.

Another noteworthy event was the 'Get to know the ASF' night. The ASF is only as strong as its volunteers. So if you have any interest in contributing to the Federation (no matter how big or small), please reach out. For more information see Janice's article on page 15 of this issue.



Andrew in Dalleys Cave - Photo by Ian McKay

The Nullarbor was again at the forefront of cavers' minds in the New Year with the Department of Climate Change, Energy, the Environment and Water (DCEEW) opening up the Western Green Energy proposal for public comment via the EPBC Act's 'controlled action' processes. This was a short window for submission and I would like to thank the Conservation Commission for educating and guiding our membership through this process. The ASF, Commissioners and many individuals have made submissions. Thank you!

I'm very happy to report that the ASF has formally engaged a consultant, Anne McConnell, to produce documentation for the National Heritage Listing of the Nullarbor. This project is officially up and running! And finally I'd like to give a huge thanks to Sarah Gilbert for her strong work and incredible communication during her time on the ASF Executive, especially the last four years as President. The ASF is continuing to grow and Sarah rose to the challenge. I've got massive shoes to fill, but the Executive is in good shape as we continue to work towards our collective goals. Sarah has kindly agreed to stick around for a bit as a Non-Executive Vice President. Thanks again Sarah!

I had an absolute blast getting to know some new people at the conference and catching up with old friends. I'm looking forward to the next two years as President. And as always reach out and say hello, or better yet - let's go caving!

Andrew Stempel



The Australian Speleological Federation (ASF) in conjunction with Victorian Speleological Association (VSA) recently hosted its biennial conference in the small Victorian town of Buchan, drawing approximately 135 caving enthusiasts from across the country. Held from January 9th to January 20th, the event, aptly named Caving in the Moonlight, paid tribute to Frank Moon, a pioneering figure in the caving community and a key discoverer of many of Buchan's caves. "Moon was passionate about the Buchan caves, and for him, it wasn't just a matter of work but a way of life," said Dr. Robert Haldane, reflecting on the legacy of one of the region's most influential caving figures.



Presentations - Photo by Nadine Muresan

Throughout the two-week conference, attendees engaged in a wide range of activities, with the heart of the event focused on presentations from fellow cavers. These talks covered everything from personal projects to the scientific exploration of caves, furthering the understanding of the sport and the natural wonders it preserves. The event also featured guided caving expeditions, made possible by the generosity of Parks Victoria, who allowed access to show caves after hours. Special thanks were given to Phil McGuinn, Danny Mitton and Tom Aberdeen for their expert leadership during these outings.



Buttery Factory Evening - Photo by Nadine Muresan

One of the major highlights of the conference was the exclusive opportunity to explore some of Buchan's lesser-known caves. Graymont provided access to Dalleys Cave, with Josh Van Dyk leading the way, while Rimstone Co-Op opened the gates to Scrubby Creek Cave. These behind-the-scenes cave explorations offered a rare glimpse into the less visited beauty of the region.



Helpful team of deriggers - Photo by Nadine Muresan



Wayne Revell in Slocombes Cave (BA1) Buchan - Photo by Garry K Smith

The event was further enriched by competitions, with sponsors such as Mont, Climbing Anchors, Spelean and Bogong providing valuable support. The conference also attracted local attention, with Buchan's mayor, John White, attending the opening ceremony to express his admiration for the caving community and for those who venture beyond the tourist routes. The East Gippsland Shire generously sponsored the event, reinforcing its commitment to supporting local tourism and adventure activities.

A key event at the conference was a Cave Rescue training session held at Wilsons Cave, led by Bogdan Muresan, the chair of Cave Rescue Victoria. This important session focused on the crucial skills needed to safely extract individuals from caves in emergency situations. Attendees were given hands-on experience, learning techniques that emphasized the significance of preparedness and teamwork in cave rescues. The event underscored the ongoing commitment to safety within the caving community and highlighted the vital role of rescue operations in ensuring that all cavers can explore the underground world safely.

Adding to the local flair, the Buchan Heritage Group hosted a memorable event at the Old Butter Factory, showcasing original town photographs and a makers' market. Cavers were delighted by the prospect of tasting what was hailed as the best coleslaw in the area, underscoring the strong community ties that the event fostered.



Stephen Fordyce demonstrating cave diving in pool at Buchan - Photo by Garry K Smith



Hanging up in Wilsons Cave - Photo by Grace Mason



The amazing food! - Photo by Nadine Muresan



SRT Competition Wall - Photo by Marika Kahle



Bogdan Muresan informing the group of the areas for cave rescue
- Photo by Marcos Silverio



Bogdan Muresan grading the mapping salon-
Photo by Nadine Muresan

Organizers expressed their sincere gratitude to the Buchan community for their hospitality, particularly the Buchan Caves Hotel and the Buchan Valley Roadhouse, both of which played essential roles in making the conference a success. In fact, many attendees voted this year's gathering as one of the best yet, a testament to the collaborative spirit of both the caving community and the Buchan locals.

On a personal note, it was truly a pleasure to witness so many enthusiastic cavers enjoying their time in Buchan. I consider it a privilege to have chaired this event, and I am deeply grateful for the remarkable support from our families, friends and the VSA. To the upcoming organisers, please be assured that we will offer our support, regardless of the location or timing. I wish you all the best of luck!



Having fun whilst trying to win BIG Prizes! -
Photo by Nadine Muresan



Focus Rob ...Focus - Photo by Nadine Muresan



Following Dave Wools-Cobb's advice and
CAVING SOFTLY - Selfie



Grace pushing through the squeeze -
photographer unknown



Group photo at the Cavers' dinner - Photo by Nadine Muresan

A HUGE THANK YOU SPONSORS

East Gippsland Shire Council

A MASSIVE Thank you to Jeanette and East Gippsland Shire Council for their generous donation to help this conference.



Spelean - Blue Water Ropes & Petzl

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Bogong

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MONT Adventure Equipment

This sponsorship was huge! Thank you so much for supporting the cavers from around Australia!



CAVING IN THE MOONLIGHT PHOTOGRAPHY WINNERS

Entrance

Marcos Silverio - Yallingup



Life

Janice March - Possum Poo Fungi



Cave

Garry K Smith - Huge passage in Skocjan Cave



Caver

Jack Henderson - Survey Man



CAVING IN THE MOONLIGHT PHOTOGRAPHY WINNERS

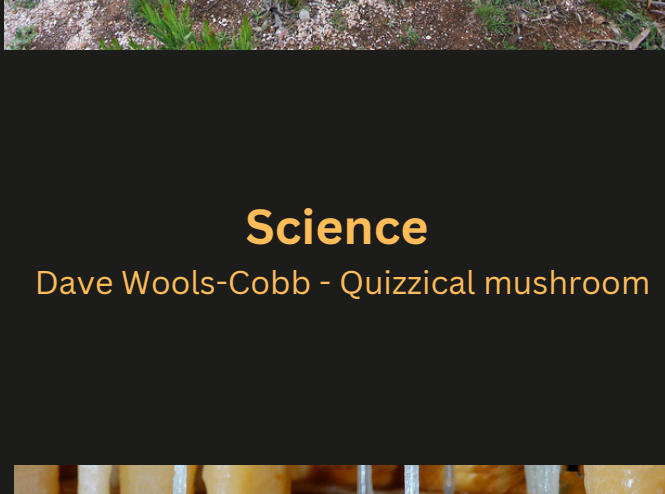
Formations

Dave Wools-Cobb - Crystal mystery



Humor

Garry K Smith - There is a cave down here



Science

Dave Wools-Cobb - Quizzical mushroom



Manipulated

Garry K Smith - Exploring wonderland

STOP THE PRESS!!!

Stephen Fordyce



El Dorado - Photo by Alex Motyka

An 8-person team from Southern Tasmanian Caverneers (STC) had a MAJOR breakthrough in Niggly Cave on Valentines Day (14th Feb, 2025). After eight years of project work and four years of focus in this area, the downstream terminal rockpile was passed, and the team bagged, surveyed and sketched 1.2 km of gigantic streamway cave ("El Dorado") across four days and three nights underground at -350 m. Finally, we won a game of "Mastercave or Bust", and suddenly all the recent bust trips seem totally worth it! More detail in a future *Caves Australia*.

A highly memorable trip with Ciara Smart, Henry Garratt, Kynan Bonnice, Bogdan Mureşan, Alex Motyka, Eleanor March, Ashlee Bastiaansen, building on the efforts of many others, over the decades.



The gang before entering - Selfie



Deciding how to survey the next section - Photo by Alex Motyka

ASF Awards 2025

Andrew Stempel

Edie Smith Award - For outstanding service to Australian speleology over a long period of time. At this presentation two Edie Smith Awards were made to members of the Australian speleological community

Graham Pilkington for:

His lifelong cave exploration in South Australia at Corra-Lynn Caves and on the Nullarbor karst; service to the Cave Exploration Group of South Australia as a committee member and as CEGSA's Records Keeper and Coordinator for the Nullarbor and other South Australian karst areas for many years; the development of the OzKarst database, that is used Australia-wide for storing karst documentation by clubs; and his contribution to Australian speleology as a member of the ASF Executive over a number of years.



Janine McKinnon for:

Her service to the Southern Tasmanian Caverneers, holding various committee roles including President, Editor of *Speleo Speil* and Training Officer; training new members in caving techniques including SRT and cave rescue; exploration of caves and cave diving in Tasmania including Exit Cave, Khazad-Dum, Sesame, Cauldron Pot and The Letterbox; and to the Australian speleological community as a member of the ASF Executive during which time Janine updated many ASF Codes and Guidelines.



Awards of Distinction - The Jeff Butt Award of Distinction for Cave Exploration for recognition of those who have made an especially notable contribution to speleology in the field of exploration.

Mark Sefton for: Encouraging the systematic exploration of the Bullita Karst in Judburra/Gregory National Park in the Northern Territory for over twenty years and leading the Judburra/Gregory Special Interest Group from its inauguration in 2006 until 2023; leading and co-instigating the second major Cave Exploration Group of South Australia-led expedition-style trip in 1991 to Old Homestead Cave that led to the cave becoming the longest in Australia at that time; and guiding a reinvigoration of CEGSA during the early 2000s and being an active member of the CEGSA committee in leadership roles and encouraging exploration over a long period of time. This award was presented to Mark at a CEGSA dinner prior to the conference as Mark was unable to attend the dinner.



An **Award of Distinction** for recognition of those who have made an especially notable contribution to speleology was made to **Deborah Hunter** for rescue preparedness in Tasmania, including the rewriting of the Minimum Impact Cave Rescue Code for the ASF in 2019 and the development of cave rescue plan templates; and for her commitment to the conservation of caves and karst in Northern Tasmania.



Certificates of Merit



Marilyn Scott

For valuable service to Metropolitan Speleological Society via her work on their committee, holding various positions and attracting new members to caving. Also for initiating the NSW Cave Leader Training Program to assist in the development of future NSW cave leaders.

A presentation of a Certificate of Merit that should have been made 25 years ago was presented after the conference to:

David Martin

As Business Manager for *Helictite* from 1984 to 2000 and as survey methods coordinator during the formative years of the Jenolan Caves Survey, including software development.



Succession Planning for ASF volunteers

Janice March

At the recent ASF conference held at Buchan, I introduced some of the many volunteer caving club members who have stepped up to perform vital roles within the hierarchy of the ASF. Our new President Andrew Stempel from FUSSI and other Exec members were busy meeting conference delegates. It was wonderful to be with interstate cavers face-to-face and hear how passionate they are about their local projects and club activities. There are so many amazing cavers to get to know in our caving community!

Executive committee members assist the President to run the many functions of the Federation behind the scenes. There are three Vice Presidents, a Senior Vice President, a Treasurer, a General Secretary, a Membership Secretary, an Executive Secretary and a few non-Exec VPs (for ASF knowledge) who meet via Zoom every two months to make progress on various ASF matters.

Among other things, in the past year our focus has been on:

- Contracting a consultant to coordinate a National Heritage listing application for the Nullarbor, recently announced as Anne McConnell
- Canvassing members' ideas about the new ASF brand name Caves Australia (passed at the January ASF Council Meeting)
- Applying for a large project grant from the Ian Potter Foundation (not successful)
- Talking to new clubs wanting to join the ASF
- Hearing from several busy commissioners, allocating funding
- Learning about intellectual property, indigenous relations, and databases
- Writing a new anti-harassment policy, updating bylaws and codes
- Getting the accounts in order for the auditor

There are also 13 ASF commissions each run by a volunteer called a Commissioner who with a small team have responsibilities for running critical functions of the Federation such as Conservation, Rescue, Publications, Library, Grants, and our newest one-the Science Commission. These commissions work fairly autonomously and regularly report to the Executive about problems and progress being made in their areas of responsibility.

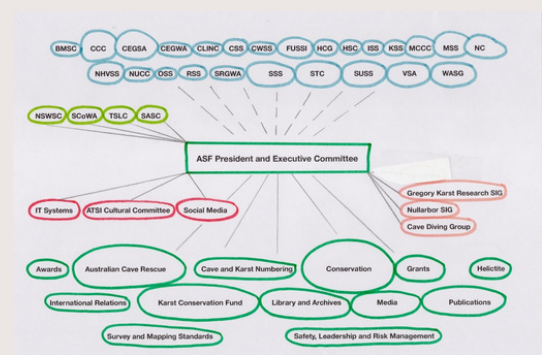
The ASF has been working through a 2019-2024 business plan and a list of organisational risks to prioritise tasks. We would like to reduce the risk of loss of key people and to do this we have written position descriptions for nearly every volunteer role within the ASF and the next step is to fill a few vacancies and find understudies for all positions. All the current volunteers mentioned that they've learnt lots, met loads of interesting people, and made significant progress over the years in their areas of influence within the ASF.

No volunteer wants to keep doing their role for an indefinite amount of time. Volunteers fit their roles into their busy lives and cannot be expected to do them forever, even though it would be easier for the rest of us if they did! Therefore we (the Exec) would ideally like each volunteer to be supported in their role by a small team and to train up an understudy (or at least write copious notes about how to do the role if the proverbial bus takes them out).

So please let someone on the Exec team know your availability and areas of interest by sending an email to asf.info@gmail.com or fill out the new Volunteer Now form on the footer of the ASF website

<https://caves.org.au/volunteer-now/>

We need you and your club mates too, so please ask around your club for talented people with skills or interests in the multiple commissions the ASF has to offer. For more options look up the website for a list of commissions.



Australian Cave Animal of the Year—A change of Direction

Cathie Plowman

A new Australian Cave Animal promotional campaign was launched at the recent ASF conference at Buchan.

We're no longer going to have a Cave Animal of the Year with new products every year and then these not being available when the 'year' is over. We've changed course and will have an ongoing promotional effort for Australian Cave Animals. This is aimed at giving longevity to the program, covering costs and trying to increase the range and distribution of the products.

The products will be sold just above or at cost price. We want to get these products 'out and about'.

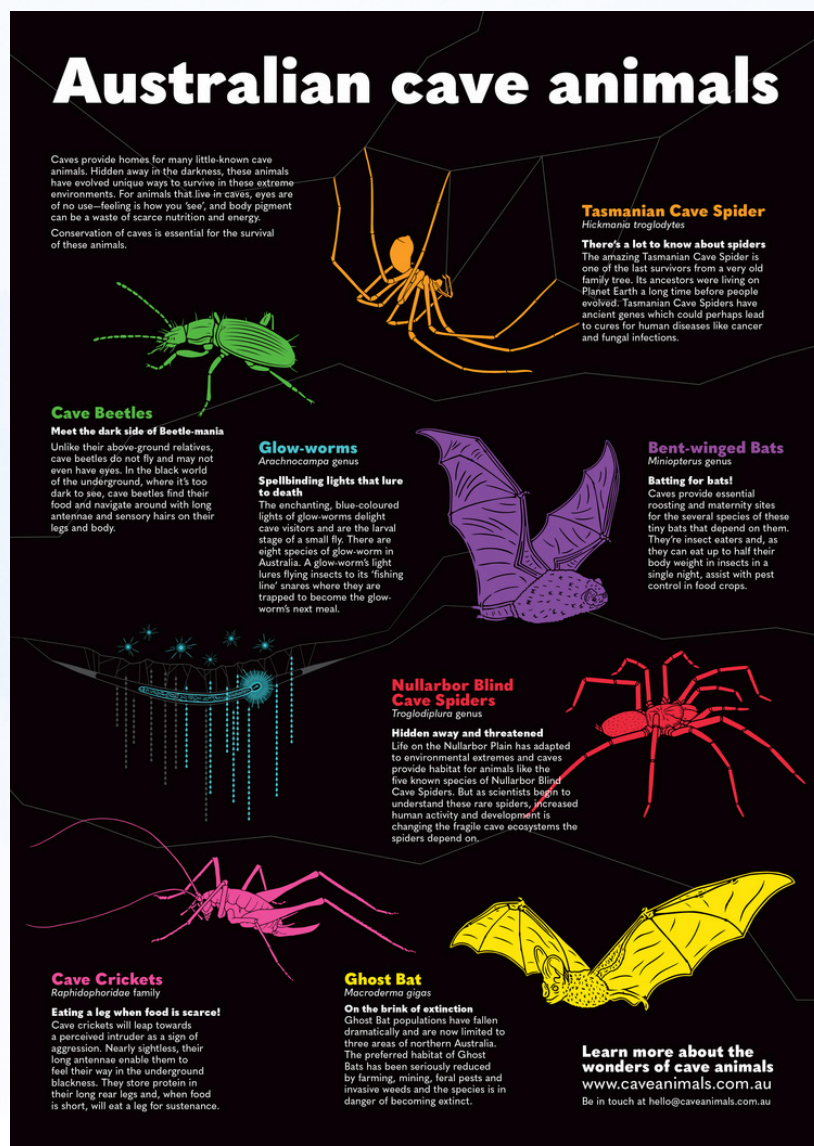
Our new and colourful poster, featuring illustrations of seven Australian cave animals, is now available for **\$2.00 each** plus the cost of pack and post.

You can support the effort by buying the posters, displaying them, and giving them to friends and colleagues. They'll make delightful presents for the young people in your life and inspire them to learn more about caves and cave animals.

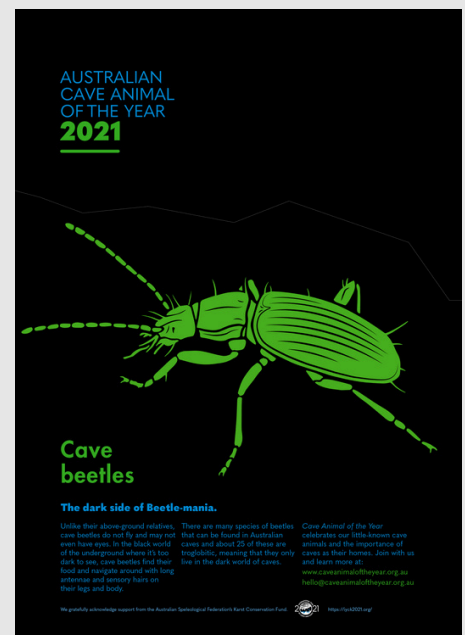
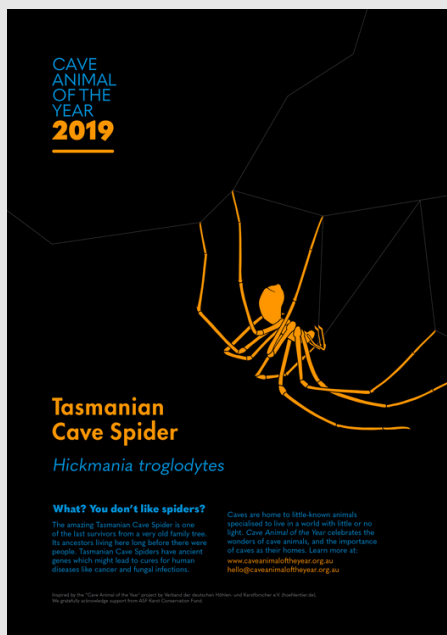
Perhaps you could encourage a retail outlet to sell the posters and help grow the love for cave animals.

The Cave Animal of the Year website will soon be altered to a new Cave Animals website.

Thanks to everyone who has supported the previous Cave Animal of the Year effort, and I hope that you will enjoy and help grow the new efforts. Our email address will be changing soon, but for now you can be in touch and order posters at: hello@caveanimaloftheyear.org.au



LIMITED EDITION REPRINT!

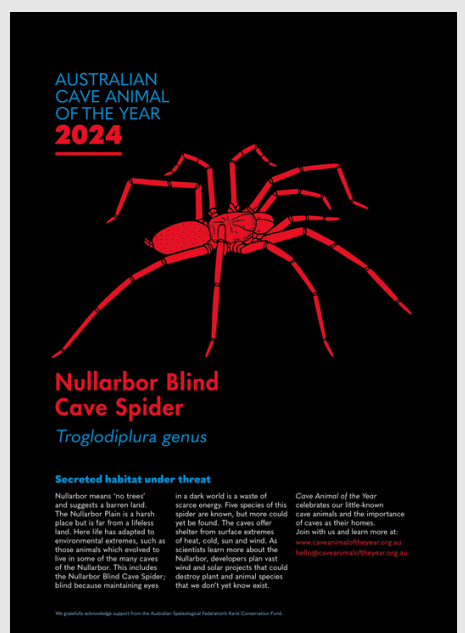


At the request of the cavers attending the Buchan conference, Cathie has agreed to produce a limited edition reprint, available exclusively in a set of only 25 copies.

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 asf.cavesaustralia@gmail.com.

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



Promote Friends of the ASF to your network

Janice March

The Friends of the ASF group has had a soft start in 2024 with five people joining and receiving their copies of *Caves Australia* and *The Cricket* in return for the nominal fee of \$20. One of the ASF's aims is to promote the value of the cave and karst environment and our advocacy and influence can be extended by having a much larger group of Friends who have values similar to our own. We should be able to find Friends in other volunteer-based not-for-profit environmental organisations and interest groups such as bushwalking clubs, so please spread the word to your network of contacts.

There is also the potential for former cavers or your mates overseas to join the Friends of ASF so they can keep abreast of current Australian speleological topics.

Maybe you know your local karst managers or landowners who would surely be interested in reading *Caves Australia* and *The Cricket* four times a year, but they are not club members, so they don't receive it. Now they can become Friends of the ASF to show their support of our organisation and all the good work it does to safeguard caves and karst around Australia.

A green button can be found on the ASF website membership page or <https://caves.org.au/membership/asf-friends-information/> is the link to subscribe as a Friend of the ASF.



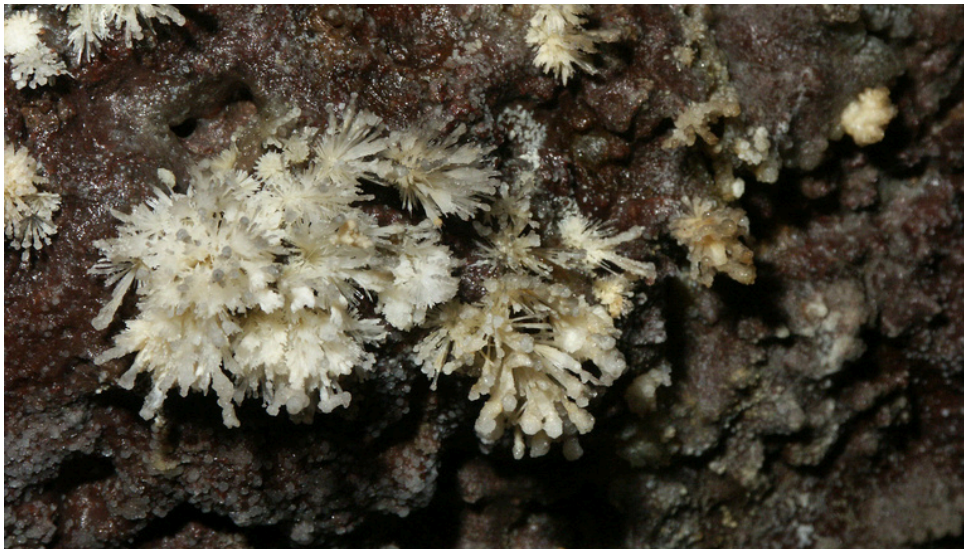


Fig 1. Opal-A anthodites, Mount Hamilton Lava Cave; field of view ~6 cm. Photo Ken Grimes

Speleothems in non-carbonate caves and overhangs

Text and photos by Garry K. Smith, except where noted otherwise

Non-carbonate caves and overhangs that have formed in sandstone, conglomerate, granite, basalt or other host rocks, may contain speleothems, however they are usually less common and smaller in size than those in carbonate (e.g. limestone or dolomite) caves. There are certainly exceptions to this generalisation of size. Non-carbonate cave speleothems can be created from a variety of minerals deposited in the shapes and forms of stalactites, stalagmites, flowstone etc., that we typically see in limestone caves.

For simplicity in this article, secondary deposits (speleothems) that occur in true caves have not been segregated from secondary deposits on cliffs and overhangs, as the chemistry is the same. Hence the term 'speleothem' in this article encompasses the secondary deposits that resemble the shapes and forms found in caves as well as under overhangs and on cliffs.

As this subject is very broad, a comprehensive article would be near impossible to detail in this publication, hence only a few examples of the most prominent speleothem types and their composition are provided.

Caves can form in non-carbonate rock by a range of geomorphic processes. The main types are: lava caves, boulder caves, fissure caves, piping caves and sea caves. However, within this article these cave types are not discussed individually, but are lumped together in caves within host rock types. More information about non-carbonate caves can be found in the Springer publication *'Australian Caves and Karst Systems'* (Smith 2023, Middleton et al. 2023, Webb 2023).

Basaltic Lava Caves

Lava caves, also called lava tubes, are common worldwide. In Australia they have formed in north and south-eastern Queensland, and western Victoria due to past lava flows from volcanoes. Their resulting tunnels range in size from less than a metre to greater than 18 m in height and width. Most have a length of less than 200 m but there are exceptions, such as the Bayliss Cave at Undara which is 1350 m in length (Middleton et al. 2023). There are a range of speleothems that have formed in these caves ranging from opal-A anthodites, allophane stalactites (Finlayson and Webb 1985), gypsum crusts, gypsum coralloids, calcite stalactites (Webb 1985) and taranakite moonmilk (Smith 2024a) to name a few.

A clear glassy opal called hyalite was identified in Holy Jump Lava Cave, Queensland (4BM-1) (Webb 1979) and opal-A anthodites have been documented in Mount Hamilton Lava Cave, Victoria (Fig. 1) (Webb 1985). Stalactites composed of allophane, an amorphous aluminosilicate clay mineral, were recorded in Church Cave, Victoria, by Finlayson and Webb (1985).

In basalt lava caves of western Victoria, small opaline coralloids and stalactites have been found on the walls and ceiling of Skipton Cave and Mt Hamilton Cave (Webb and Finlayson 1987).



Fig 2. An unidentified speleothem, most likely created by microbial activity in Church Cave, a lava tube at Byaduk, Vic. Photo by Reto Zollinger



Fig 3. Lava stalagmite, not considered a speleothem by definition. Theatre Cave, Byaduk Vic

Microbes are ubiquitous in cave environments and can be responsible for much of the authigenic mineral formation/precipitation found in lava caves (Northup et al., 2011). Speleothems that have been mediated by microbial activity causing deposition and influencing morphology are known as biospeleothems (Aubrecht et al. 2008, López-Martínez et al. 2016). An unidentified speleothem found in Church Cave, Byaduk, Vic is most likely an example (Fig 2). The mushroom shaped mineral clusters in Figure 2 range in size from 2 mm to 12 mm diameter as individual discs, but can be several cm when combined. The deposit covers an area of about one square metre (Reto Zollinger pers. comm.).

Lava stalactites, stalagmites, columns, coralloids and extruded lava “hands” etc., are also found in lava caves, however these lava forms are not considered true speleothems as they stop growing when the lava stops flowing and are not secondary mineral deposits (Fig. 3).

Quartzite, quartz sandstone and conglomerate caves, overhangs and cliffs

Caves and overhangs in sandstone and conglomerate are quite common on the east coast of Australia, in particular within the Hawkesbury sandstones that cover a large area stretching from Wollongong to west of Newcastle and include the Blue Mountains west of Sydney, NSW. The most common speleothems found in sandstone and conglomerate caves are siliceous, ferruginous (goethite) and calcareous (calcium carbonate). Each of these are briefly described below, however these speleothem types can also occur in other caves e.g. basalt, granite, etc.

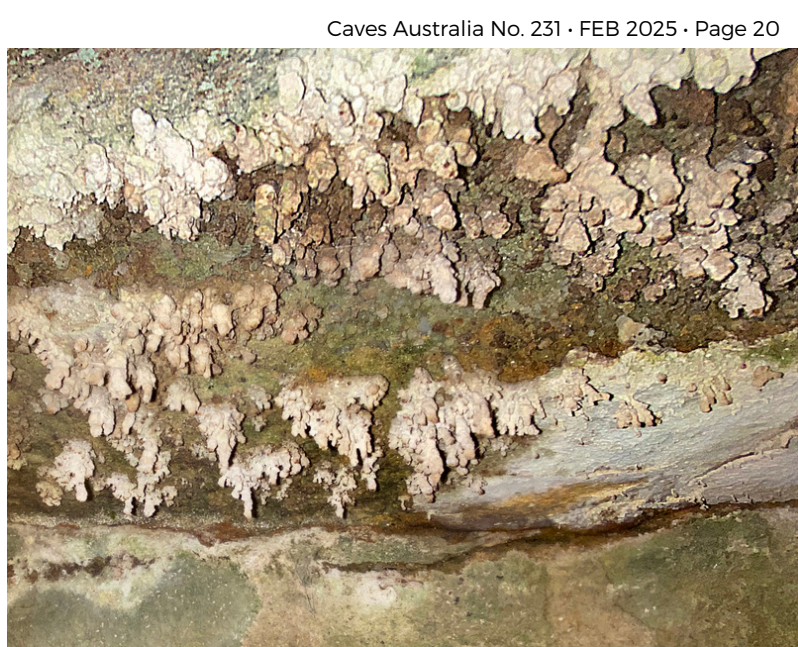


Fig 4. Opal-A coralline speleothems in Cathedral of Ferns Canyon, Blue Mountains, NSW

Siliceous speleothems

Silica-rich speleothems can be found in sandstone, conglomerate, granite and volcanic caves.

Ground water can dissolve a small quantity of silica from the surrounding host rock. In locations where the ground water can seep into caves or overhangs, evaporation causes silica to precipitate as opal-A (amorphous silica) or less commonly chalcedony (dense cryptocrystalline silica). Typically, small coralloid speleothems (Figs. 4,5) form and occasionally stalactites and flowstone are created. Stalactites are usually composed of amorphous silica (opal-A) and flowstone is typically composed of interlayered opal and chalcedony (Wray 1999). These speleothems are physically robust and range in colour from transparent or white through to orange and almost black, depending on the chemical composition and proportion of included organic matter (Wray 1995, 1997, 1999).



Fig. 5. Irregular branching Opal-A coralloid stalactites (45 mm long) in Cathedral of Ferns Canyon, Blue Mountains, NSW



Fig. 6. Opal-A stalactites and coralline speleothems Gap Creek, Browns Falls, Watagan Mountains, NSW. The largest stalactites are about 60 mm long

Three main stalactite forms are found. 1. Irregular branching coralline stalactites from less than 1mm to over 75 mm in length, with branches from 0.25 mm to over 12 mm in diameter. 2. Stalactites that are conical and taper from the base to the tip. They have no central drip-water hole, and have typical lengths of 1 mm to 50 mm and diameters from 0.5 mm to about 5 mm. 3. Coralline 'popcorn' is the most widespread stalactite form. It is highly irregular and highly porous, with a range in size from around 5 mm to 50 mm in diameter (Wray 1995, 1997, 1999).

Grey-brown opal coralloids and stalactites, up to 50 mm in length, occur in Slaven Cave near Bathurst in central NSW (Smith 2024c). The cave is in sandstone strata and has most likely been created by collapse into a void created by dissolution of underlying soluble rock strata. Siliceous speleothems are commonly found in overhang caves and canyons within the Blue Mountains west of Sydney including the Watagan Mountains west of Newcastle, NSW (Fig. 6).

Goethite (iron-rich) speleothems

Hawkesbury sandstones and other quartz sandstones around Australia often contain iron-rich minerals. Groundwater can leach iron from the iron-rich minerals and create speleothems of iron oxides/hydroxides (goethite). These speleothems are relatively common and can often be seen as orange or red stalactites and flowstone under overhangs and on cliffs (Figs. 7, 8). The colour of goethite can also be black, brown, yellowish-brown, reddish-brown, or yellow. When sectioned these speleothems can have a range of colours across each growth layer (Fig. 9).

Goethite is a mineral with the chemical formula $\text{Fe}^{3+}\text{O}(\text{OH})$, which in words is iron oxy-hydroxide or ferric oxy-hydroxide (ferric iron is Fe^{3+} ; ferrous iron is Fe^{2+}).



Fig. 7. Goethite (iron oxides/hydroxides) stalactites and flowstone at Horseshoe Falls, Hazelbrook, NSW

Iron occurs in solution as both ferric (Fe^{3+}) and ferrous iron (Fe^{2+}). At pH values typical of normal groundwater (pH 6-8), ferrous iron is virtually insoluble unless the groundwater is reducing, i.e. has very low dissolved oxygen content. Groundwater that has been in contact with organic material often has very low oxygen content (the oxygen is used up by reaction with organic carbon to form CO_2) and can contain quite high levels of dissolved ferrous iron. When this groundwater seeps out of a sandstone face and comes into contact with the atmosphere, the oxygen in the atmosphere reacts with the dissolved ferrous iron to form ferric iron, which then immediately precipitates as ferric hydroxide (ferrihydrite), ferric oxyhydroxide (goethite) or ferric oxide (haematite). Often ferrihydrite forms first and then crystallizes into goethite or haematite over time. Evaporation and/or degassing of CO_2 are not necessary for goethite precipitation.



Fig. 8. Goethite stalactites and stalagmite. Note, outside of stalactite is completely dry but solution continues flowing through central drip-water hole. Horseshoe Falls, Hazelbrook, NSW



Fig. 9. Cross section viewed from below broken goethite stalactites on the ceiling of an overhang cave at Horseshoe Falls near Hazelbrook, NSW. Note the colour range across growth layers of ferric oxyhydroxide

The source of the iron is dissolution of iron-rich minerals in the sandstone. The Hawkesbury sandstones contain both siderite (iron carbonate) cement and goethite (as brown banding) (Vernon 2021) hence goethite speleothems are commonly found in this strata (Fig. 10). Some can grow to several meters or more in height (Figs. 11, 12).

Ken Pickering (1972a, b) describes limonite stalactites up to 30 cm long and a column 109 cm high in the Blue Mountains sandstone caves, created by deposition of iron from seepage water as ferric hydroxide, probably mediated by iron bacteria. However, the term limonite is "used as a field-term for unidentified massive hydroxides and oxides of iron, with no visible crystals, and a yellow-brown streak. 'Limonite' is most commonly the mineral species goethite, but can also consist of varying proportions of lepidocrocite, hematite and/or maghemite, along with impurities of other minerals such as quartz and clays" (<https://www.mindat.org/>).

Bright orange rootsicles, coated in iron oxides/hydroxides, bacteria and algae, occur at the entrance to a small overhang cave in the Watagan Mountains, NSW (Fig. 13) (Smith 2022b). The dark orange bacteria feel slimy and cover parts of the harder goethite. Iron bacteria (also known as iron-oxidizing bacteria) feed on iron-rich water and create an orange or rust coloured slime. Groundwater is low in oxygen, and this limits the growth of these bacteria. However, when groundwater rises to the surface via cracks in the rock, the oxygen in the air acts like a fertiliser for the



Fig. 10. A 2 m high sandstone overhang containing many goethite formations in a creek bed, Mount Coricudgy area. Photo by Marilyn Scott

bacteria and they can grow quickly, forming a rust-coloured slippery slime on surfaces while underneath may become a hard and cemented iron-rich deposit (Figs. 14, 15).

In still or stagnant water, the bacteria can create a film on the surface of the water that has a rainbow sheen that looks like an oil film (Figs. 15, 16).

Calcium carbonate speleothems

There are numerous occurrences of calcium carbonate speleothems in quartz sandstone and conglomerate caves that have been created by dissolution of calcite cement in the overlying strata (Wray 1995, Smith 2007, 2015).

Quartz sandstones may contain a small amount of calcium carbonate, that can be leached by groundwater from the sandstone in the same manner as dissolution occurs in carbonate rocks like limestone, i.e. the same chemistry as in limestone caves occurs here.

Water which has absorbed carbon dioxide (CO_2) to form a weak carbonic acid will dissolve calcium carbonate. Rainwater absorbs CO_2 as it falls through the Earth's atmosphere. Extra CO_2 is absorbed by the water as it seeps through the surface soil containing an elevated CO_2 concentration (up to about 7%) caused by rotting vegetation, e.g. bacteria and fungi breaking down the organic matter in the soil.

Calcium carbonate usually precipitates from solution as calcite rather than the other polymorphs (aragonite and vaterite). Deposition occurs as carbon dioxide (CO_2) diffuses from solution. Stalactites, stalagmites and flowstone speleothems of calcite are quite commonly found in non-carbonate caves, particularly in the Hawkesbury quartz sandstone.



Fig. 11. Goethite stalactites, some greater than 2 m in length at Numantia Falls near Sassafras Creek, Faulconbridge, NSW



Fig. 12. A 3 m tall goethite stalagmite at Numantia Falls near Sassafras Creek, Faulconbridge, NSW

Lovering (1951) reported that excellent examples of calcite formations occur in a sandstone rock shelter (overhang) on Palona Brook in the Royal National Park near Sydney NSW, measuring 7.5 m deep by 7.5 m high. Here large, curved stalactites, stalagmites and columns of calcite measuring up to 3 m in height are found (Figs. 17, 18). The water bearing dissolved calcium carbonate is coming from a horizontal fissure at the back of the cave about 7.5 metres above the floor level. It is believed that the source of calcite is a layer of Hawkesbury sandstone that contains an unusually high concentration of calcareous cement. This is being leached out and precipitated as stalactites and stalagmites (Lovering 1951).

Another example is in Jewboy Cave (I6B-3), a stream erosion cave located near Seahampton to the west of Newcastle NSW. This sandstone and conglomerate cave contains calcite flowstone and a number of stalactites and columns up to 0.7 m high (Fig. 19) (Smith 2015, 2022a).

Sea caves formed in sandstone and conglomerate rock can also contain calcite speleothems. One example is Ghosties No. 2 South Cave located south of Catherine Hill Bay, NSW. Well-formed calcite flowstone and shawls up to a metre in length are found at the back of the sea cave (Fig. 20). Some of the flowstone has a thin coating of green algae growing on the calcite surfaces that are exposed to the small amount of light reaching the back of the cave (Smith 2024b).

Potassium Alum

Occasionally unexpected minerals are found in sandstone caves. An example is potassium alum crusts found in the 'Cave of Hands', in the Grampians, Victoria (Hough and Segnit 1986). The speleothem occurs as a white efflorescence on the walls of a shallow rock shelter. Analysis of the salts that have formed a crystalline crust about 1 mm thick reveals potassium alum.

Granite cave speleothems

Granite is an igneous rock, created when molten magma cools deep inside the earth, under high pressure. It is a combination of several different minerals, occurring in varying proportions. The three main components of granite are feldspar, quartz and mica. The inclusion of other minerals provides a wide variety of granite colours.

Speleothems such as flowstone, stalactites, stalagmites and coralline forms can occur in granite caves (Webb and Finlayson 1984, 1987). Siliceous speleothems are common. At Girraween National Park, south-east Queensland, coralline speleothems of amorphous silica (opal-A) and allophane flowstone are present in granite caves on the walls and floor (Finlayson 1982; Webb and Finlayson 1984).

Other speleothems

Speleothems may form from other minerals, such as gypsum, salt, etc., leached from the surrounding rock strata.

Acknowledgements

Thank you to Cathi Humphrey-Hood for sourcing several reference papers as well as facilitating the analysis of a small piece of stalagmite sampled from beneath a waterfall near Faulconbridge in the Blue Mountains, NSW. Also thank you to John Webb for proof reading this article and providing a concise and detailed explanation of how goethite deposits are created. The following photographers kindly supplied extra images for this article: Reto Zollinger, Marilyn Scott, Justin Wilkinson, Ross Ellis and the late Ken Grimes.

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Fig 13. Daniel next to a small waterfall in the Watagan Mountains NSW. The goethite stalagmite, stalactites and rootsicles are hard iron rich deposits, however some are coated in a slimy red/brown iron-oxidizing bacteria



Fig 14. Iron-oxidizing bacteria has created a small rim dam and flowstone at a seepage point, Numantia Falls, Faulconbridge, NSW



Fig 15. Iron rich flowstone with deposition aided by iron-oxidizing bacteria. Numantia Falls, Faulconbridge, NSW

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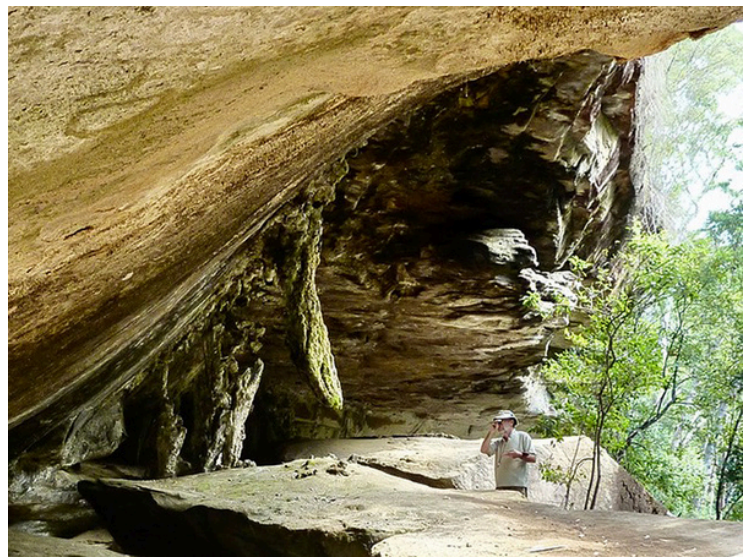
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Fig 16. Iron-oxidizing bacteria, indicated by a rainbow sheen on the speleothem surface is aiding deposition of iron. Clarinda Falls, Faulconbridge, NSW



Fig 17. A 3m long curved calcite stalactite at Palona Brook in the Royal NP. Photo by Justin Wilkinson



Figs 18. Curved calcite stalactites and columns at Palona Brook cave, Royal NP. Photos by Ross Ellis



Fig 19. The author in a sandstone/conglomerate cave next to calcite speleothems up to 1 m tall. Jewboy Cave, Stockrington, NSW



Fig 20. Calcite flowstone (≈1 m long) in Ghosties No 2 South, a sandstone sea cave south of Catherine Hill Bay NSW

Fathers Cave (3M-???)

Tom Elms



Tom Elms in the entrance pitch - Photo by Nadine Muresan

At the end of March 2024, the dig application for the doline referred to as 'Fence Post Pot' was submitted to Parks Vic, by Tom Aberdeen on behalf of Bogdan M. and Tom E. The dig was approved in late August of 2024 and work commenced shortly thereafter. In the morning of Friday 30th August, work commenced at the surface of the doline. The team initially consisted of Tom E, Warren E, Bogdan M, Nadine M, Edmund M, and Arantxa G.

The dig was focused on an area in the doline where soil appeared to be sinking, which was exposing some limestone boulders. Initially, large amounts of loose soil and small rocks between the size of tennis balls and basketballs were removed by hand and placed in piles close to the hole. As the hole began to get deeper and wider, a clear direction was established when soil began to fall into a larger airspace below, and a solid cave wall was revealed. By midday on Friday, roughly 1 m³ of rock and soil had been excavated to expose several boulders weighing more than 50 kg. The team returned in the afternoon on Friday with a tripod and pulley system to help move these larger boulders from the hole. By the end of Friday, at least four boulders weighing between 50 and 100 kg had been removed and placed at the surface which created enough room to see an airspace dropping at least two metres. Access to the airspace was blocked by a huge boulder wedged between two walls. The space beside the rock was made bigger using micro-shaving and was successfully passed by Tom on Friday night. The boulder was made very unstable in the process of micro-shaving and was lifted out on Saturday by Bogdan, Edmund and Warren and is estimated to have weighed more than 200 kg.



How it started...yep there is a cave I just know it - Photo by Nadine Muresan



Edmund doing his part, he fits into smaller sections - Photo by Nadine Muresan



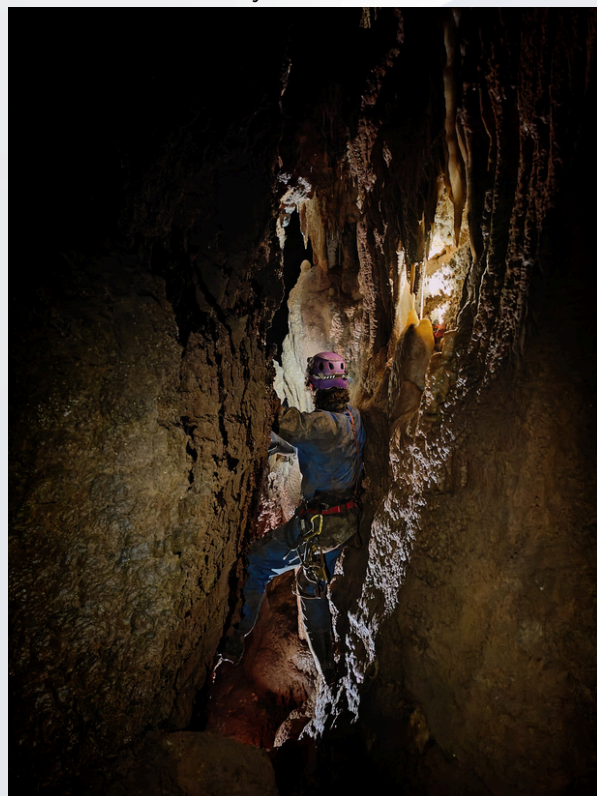
Nice fossil, tiny hole - Photo by Nadine Muresan

Upon passing the initial rockfall close to the surface, the first pitch was found after a short crawl under a low ceiling. This pitch was between 6 and 8 m deep and revealed a large chamber with the entire north-facing wall covered in flowstone. Several leads were explored on Sunday morning which revealed areas of significant decoration including cave coral, flowstone and stalactites. Multiple bones were also identified, including a near-complete skeleton that was later identified as belonging to a brushtail possum. Two further pitches were discovered by downclimbing through an obvious lead in the main chamber. The first pitch was initially blocked by a large boulder in an area of very unstable collapse. Nadine and Tom returned on 27th September and removed the rock to expose a pitch estimated to be 15-20 m deep. At the base of this pitch is a large puddle of water, which drains into another small chamber approximately a five metre downclimb below. The water disappears into a narrow rift that is too small to pass, however a lead exists high in the rift. No draft was noticed at the bottom, and the air was somewhat stale. The second pitch was entered by Bogdan and Tom on 28th September and is located behind some very clean decorations. The walls of this pitch are covered with flowstone and are between 8 and 10 m deep. There are no leads at the base of the pitch, however the floor is filled with a pile of bones belonging to at least 20 small mammals. One of the more complete skeletons was identified as another brushtail possum.

A survey has been started, but at the time of writing, there is no accurate measure of length or depth. At the time of writing, the estimated denivelation is estimated to be in the range of 50 m. Recent exploration has revealed that the main chamber contains a significant number of invertebrate fossils in the rocks and walls including coral, sea worms and snails. The name 'Father's Cave' was chosen to celebrate the shared work between the two pairs of fathers and sons who worked to excavate the cave on the Father's Day weekend.



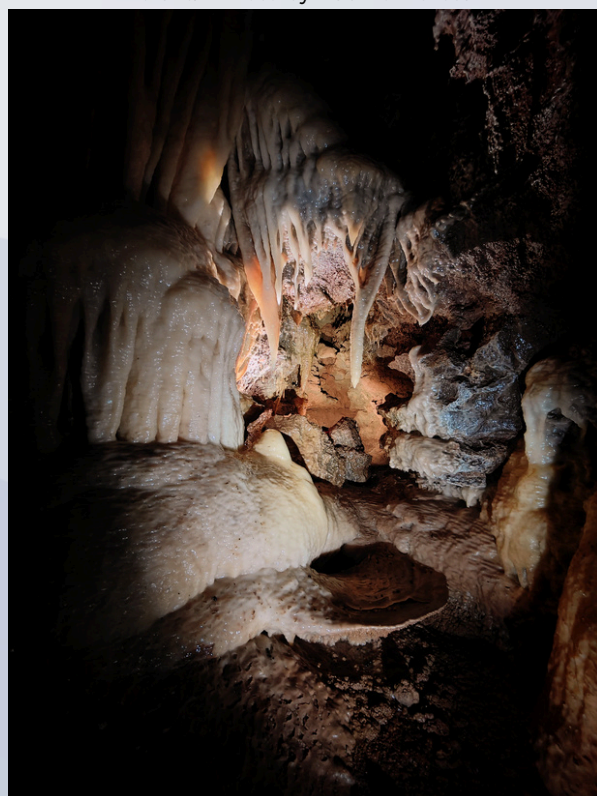
Grace in the entrance...yep that will go! -
Photo by Nadine Muresan



Hold it! - Photo by Nadine Muresan



Nadine Muresan got in a damn photo! - Photo by Tom Elms



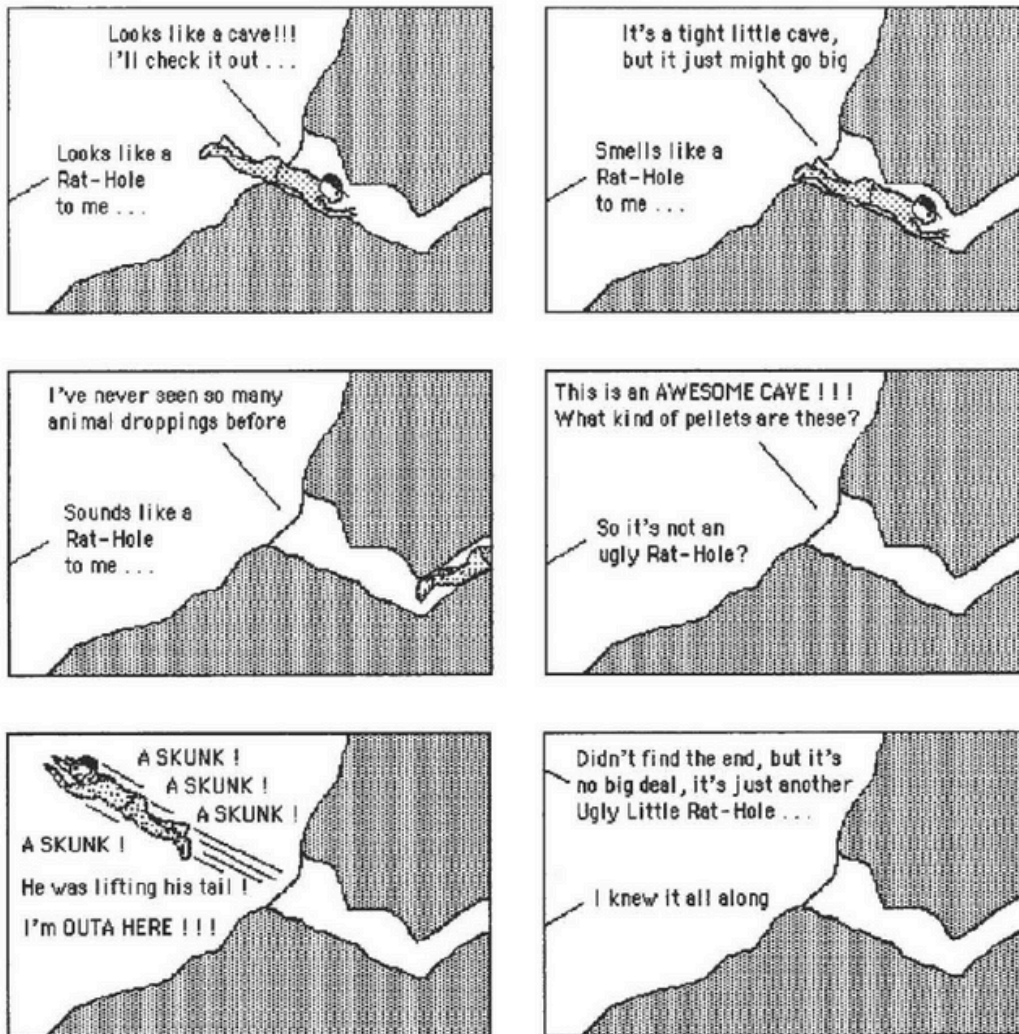
Pretty details - Photo by Nadine Muresan

ONLY A CAVER

David Herron

Only A Caver

by David Herron : (#13) April 2000



Croatia

Brian Evans

Hot on the heels of training with the Slovenians, we crossed the border to Zagreb. I'd made contact with Dinko Novosel, president of ECRA (European Cave Rescue Association), by sending an email to the Italian Cave Rescue service. I didn't know people there, but I was aware that Italy produced a very useful manual for cave rescue, and published it in English:

(<http://www.soccorsospeleo.it/en/press-area/publications/caving-rescue-techniques/>), so I figured they might be able to share what they'd learned more easily.

However, the Italians decided it was better for Dinko to talk with me, so they didn't respond to me, but forwarded my request to him. I got a response out of the blue inviting me to visit Croatia. This was quite late before the trip, and I had to estimate whether I could learn more by visiting the British Cave Rescue Council or meeting people and an organisation that I knew nothing about previously...

I think it was the right thing to do, although I do look forward to meeting the Brits at some point in the future...

We arrived in Zagreb late on an autumn afternoon, found our accommodation and arranged to meet Dinko.

It was hosing rain, but he'd planned an evening of showing us the sights of Zagreb, while talking with me about how cave rescue worked in Croatia, what the European Cave Rescue Association was about, and why Australia should also be a member.

We walked through the deluge to a pavement cafe for beer and conversation. Then walked around the streets of Zagreb looking at the fine historic sites, followed by dinner in a restaurant serving a Croatian specialty, Štrukle (and more beer). Then across to his car to drive out to the suburbs where he knew of an excellent micro-brewery for more beer and conversation. "No Brian. You cannot put your hand in your pocket. You have travelled here. The Croatian way is that we must 'look after you' while you were with us." His team kept that up for four days!



Figure 1: Wearing uniforms made it easier to find each other :-)

On the second day, Dinko had organised Darko, another member of Croatian Mountain Rescue, to pick me up, take me up a gondola on the edge of town to see their ski patrol rooms at a suburban ski hill; and take me to a meeting of the HGSS Hrvatska Gorska Služba Spašavanja = Croatian Mountain Rescue Service: <https://www.hgss.hr/en/>
Hrvatska = Croatia

I gave a brief presentation on cave rescue in Oz and had a lot of conversations, particularly with the cavers amongst them. It was another late night with plenty of beer!

On the third, another HGSS member, Ana, picked us up in an HGSS vehicle and took us to Plitvice Lakes where we walked, talked and saw lots of magnificent karst before late lunch at another place of Croatian specialties then returned to Zagreb for evening – whereupon she went out on a bush search callout!

On our last morning, we met again with Dinko and he filled in answers to the questions I'd come up with over the previous few days!

So what did I learn?

Dinko is the president of the European Cave Rescue Association (<https://caverescue.eu/about-ecra/>) so he was most keen to promote its activities and encourage our membership – membership is open to those that are not in Europe! He also answered my questions as to how cave rescue works in Croatia, and gave me answers as to way that many other European states are organised, too. He's also a significant player in the HGSS.

HGSS, the Croatian Mountain Rescue Service, provides rescue services for:

- caves
- ski patrol
- alpine rescue
- ski lift/gondola rescue
- vertical rescue
- bush search and rescue
- and even flood rescue

HGSS = Hrvatska Gorska Služba Spašavanja

They are an agency of volunteers but have some paid staff who provide support for the volunteers. Paid staff can also be volunteers but cannot hold executive roles. The volunteers are the people who meet with government.

They have a budget of €2-3 million !!!! This is nationally, of course, but the country covers about 55,000 km² (about $\frac{3}{4}$ that of Tasmania), and contains approximately 4.3 million people (a few more than Queensland!)

They do a “big” cave rescue about once every five years, and about two others each year.

The Mountain Rescue service has existed as a volunteer organisation for more than 40 years. (In fact, their website <https://www.hgss.hr/en/about-us/> says 70 years!) I didn't ask the history of how caves also became involved but suspect that it's because it was the same volunteers!

There are 25 “stations” across the country. There are more than a thousand volunteers. Rescues, as in Australia, are not charged to the persons being rescued. Also like in Australia, they have the stated aim of preventing accidents by education and advice.

They are very proud of their combined service and figure that cave rescue does well from it. They have an enormous budget and there's always plenty of money for cave specific stuff/services within it.

They feel that non-caver rescuers benefit enormously from cross training in caves.

Individual members make themselves available in whatever areas, disciplines and time slots they feel they can. If they are on the roster, however, they're on and ready to respond.



Figure 2: HGSS also provides ski patrol services.(photo: HGSS)



Figure 3: ...and bush search, as well as caves, cave diving and vertical rescue. (photo: HGSS)



Figure 4: ...and flood rescue services... (photo: HGSS)

Zagreb station

My visit here was very interesting. It's a new establishment for them, and located in a gondola bottom station that's been replaced, so it's a large facility, with several levels.

The meeting I attended was beautifully relaxed and respectful (as far as I could tell without knowing the language!) even though they were having passionate and serious discussions – they were discussing sacking their long-term and much-respected volunteer president because he was standing for election as a mayor, and representing a political party. This was seen as very unacceptable because, even though he was very good for HGSS, they needed to be completely apolitical.

I gave the presentation I'd prepared for the International Cave Rescue Commission which showed something of caving and cave rescue in Oz and it was well received. They seemed to clearly understand how big Australia is in comparison, and also the long (and expensive) journey to get here. Many go to South Africa to cave, but no one indicated that they'd be likely to cave in Oz anytime soon. That's a shame, I'd love to help Australia show them the beautiful hospitality they showed me.

There were also reports on the various searches and rescues members had been involved in during the previous week. They meet like this weekly, for this station!

The meeting room was on the bottom floor, with a storeroom for gear.

Communication systems

They have a Sybet Spellcom system coming shortly. Otherwise they use a phone system. For further info on this, see my report in *Caves Australia* 230.



Figure 5: On the main level, there's a climbing wall, open to the public at some times.



Figure 6: ...ropes rigged for SRT practice.

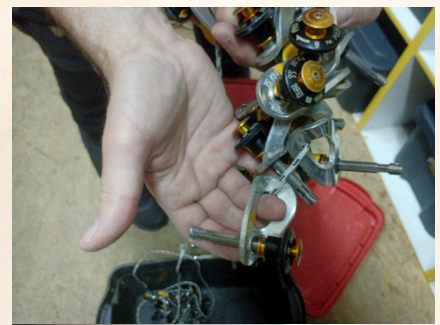
Figure 7: and parking for the five (!) station vehicles. There's also a library, offices and bar - I didn't photograph them.



Figure 9: The perfect meeting? Dogs, beer! And even better, it's Europe, but while there's plenty of smokers, they went outside to smoke :-)



Figure 8: Doing what I do best: talking!



Caving in Croatia

The caving clubs are financially supported by the government as a sporting organisation (like a footy club gets support through the Australian Sports Commission). They are also allocated exploration areas each year, and paid for the exploration and survey work they do.

There's also the interestingly formal process of becoming a caver: with formal training, written tests and rigorous assessments and learning periods.

There's an enormous amount of karst (about 50% of the land area), and it offers 1000 m deep caves and locations from the Adriatic coast to glaciated mountains.

ECRA

Dinko provided me with a lot of information about ECRA.

"The purpose of ECRA is to promote the exchange of knowledge and experience in the field of cave rescue. This means that ECRA is a community of European cave rescuers, which exchange knowledge and techniques to realize a quick, safe and comfortable transport from a patient out of the cave." (from: <https://caverescue.eu/about-ecra/>)

- It is NOT an organisation that mandates particular approaches or 'runs' rescues.
- It includes many countries outside Europe, including USA, Canada, China, Brazil, Russia, Israel ...
- Its purpose is to encourage information interchange, and to do that, it runs annual conferences and collates and publishes information about cave rescue techniques. See: <https://caverescue.eu/documents/>
- Please join! Non-European countries join as associate members and have the same access to information and gatherings, but do not have the right to vote.



Figure 10: Rather than sleeping bags, for rescuer or casualty, they use the pied d'elephant (hip-length bag) and down jacket combo



Figure 11: On the very top floor, some random storage, a practice space for a band (comprised of some members) and a load test rig!

He went on to tell me quite a lot about two big rescues, each from >1000 m: Morca (2023) in Turkey, and Reisending (2014) in Germany.

- Both were multi-national efforts, with caver rescuers coming from many other countries and being coordinated to achieve successful, multi-day rescues.
- In both, the country in which the cave was located was reluctant to seek help from other nations, but the local caver rescuers asked international colleagues anyway, and they were permitted to bring their expertise into the cave.
- In both, it was critical to get a doctor, with appropriate resources, to the casualty ASAP rather than start the extraction. In this way, the casualty was shown to be likely to survive and media became interested, so that authorities were forced to support the rescue efforts.
- Underground, nations mostly fielded a team (or maybe more) with responsibility for a particular section or role.
- Communication between teams with different languages was not a particular challenge – “we’re Europeans, understanding different languages is what we do.”
- He also described frustrations with some teams who proved unable to achieve the tasks they’d taken on.
- Morca, 2023 - Deepest rescue in world - 8 hrs from civilisation - was in a remote location, with... organisation challenges but with Turkey government supportive. Military managed the camp. It seems ECRA provided the resources. An Italian managed the operations. National rescue organisations carried their own expenses.
- Slovenian cave rescue that is certified by EU - Governments are reluctant to call other nations for support - “why does the service we fund need help?” Of course, from the rescuers' point of view, they want to co-operate, be professional colleagues - so the Slovenians don't get called by government, and can't respond independently, because of their EU certified status . This is a shame - they're good.

He described evolutions in techniques:

- The basic “French techniques” with counterbalances and tyroleans remain the main approach. (* he also described other schools of thought that ECRA acknowledges. I've described them below)

- The Italians have now evolved an approach for long rescues where smaller teams spend much longer in the cave. They have two teams of six in the cave independently working alternate 10 hours on - 10 off shifts and carrying all of their own gear. Gear is recycled and the casualty moves through each section as it is ready. Teams stay in for 40-60 hours and are then replaced. The team then gets sustained recovery time on the surface. (I imagined a model like this might be the way we would need for a many-day rescue from deep in the Junee. It would require medical/casualty care teams to also do long stays in the cave, in addition to the rigger/rescuers.)
- To reduce worker numbers, they no longer use a controller on lifts. One or two people can move the casualty at any time. (Presumably only while on roped sections)
- The Croatians have adopted this and say, e.g., with a 400 m deep cave, the traditional, siege-like approach would need 55 rescuers while they would keep the casualty moving with only 12 rescuers.

Other schools of thought

He also mentioned that some nations have different strategies:

- The Brits have enormous numbers of rescuers, and typically very wet and cold caves. They rotate operators on 6 hour shifts. This works well for them.
- A few nations prefer twin rope techniques.

General approach

ECRA does not mandate approaches, and has avoided joining with ICAR (International Commission on Alpine Rescue) because it does.

“We share and communicate people's approaches and techniques, but each nation/region has unique conditions, skills, histories that make their choice of particular strategies also unique.

We do not force our organisation on an incident, or insist on anything. We wait until we are asked.

Our goal is to provide free and respectful information sharing. We're proud to have non-Euro members, and, at this stage, can only count Australia, NZ, Brazil as important caving nations that have not joined.”

A huge thank you to Dinko and his mates at HGSS. Their hospitality was fabulous, and I learned so much about how cave rescue and caving is organised in Croatia. The Australian Cave Rescue Commission has joined ECRA, but more on that in CA 232.



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