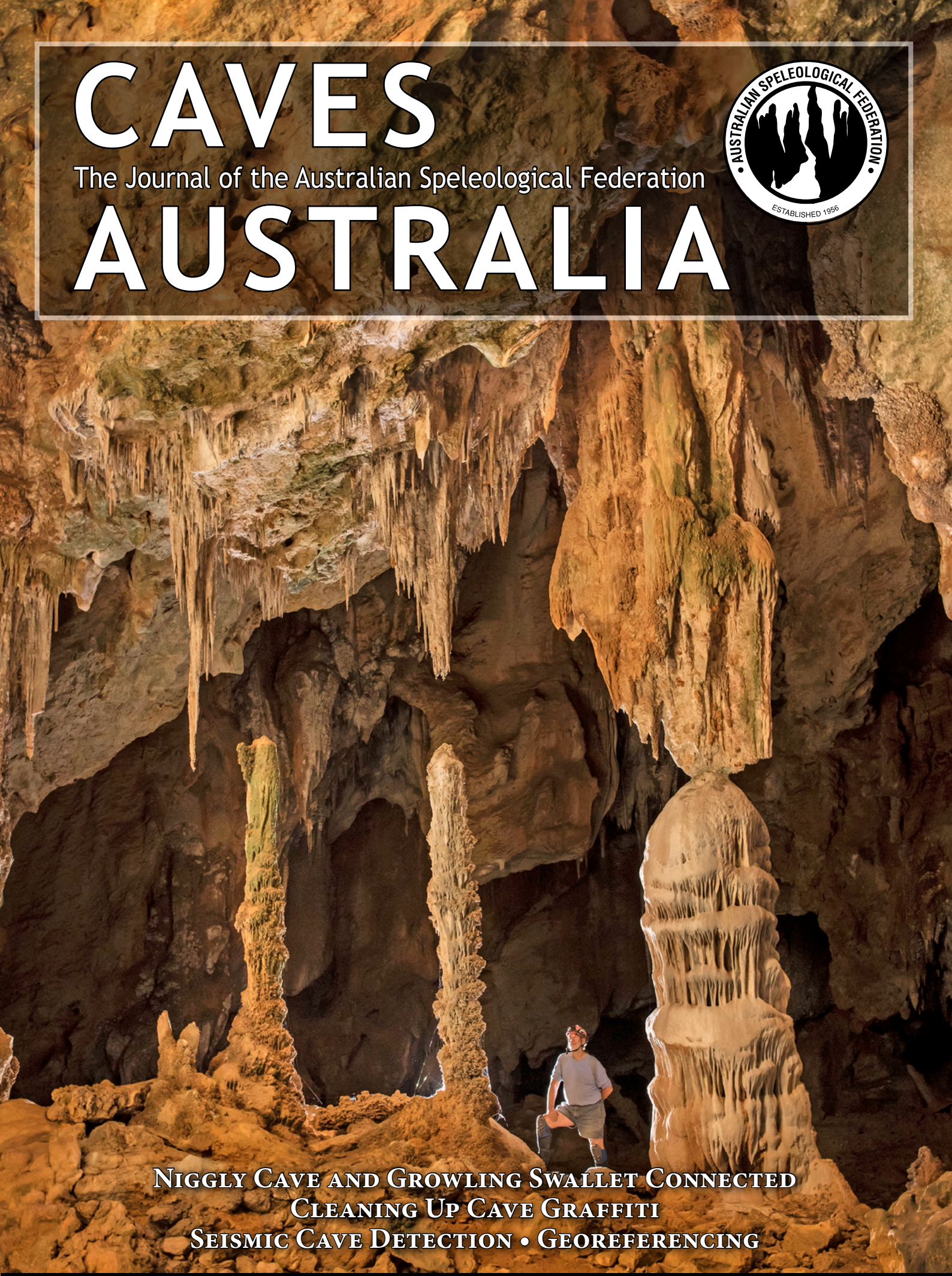
CAVES AUSTRALIA

The Journal of the Australian Speleological Federation



Niggly Cave and Growling Swallet Connected
Cleaning Up Cave Graffiti
Seismic Cave Detection • Georeferencing

No. 209 • SEPTEMBER 2019

COMING EVENTS

This list covers events of interest to anyone seriously interested in caves and karst. The list is just that: if you want further information the contact details for each event are included in the list for you to contact directly. The relevant websites and details of other international and regional events may be listed on the UIS/IUS website www.uis-speleo.org/ or on the ASF website http:// www.caves.org.au. For international events, the Chair of International Commission (Tim Moulds) timothy.moulds@yahoo.com.au may have extra information.
This calendar comes to us courtesy of George Veni, President of the IUS.

September-November 2019

2-8 September
13th Balkan Cavers' Camp, (Antalya, Turkey), http://bsuturkey.com/index.html

7-10 September
TransKarst 2019: The 3rd Asian Trans-Disciplinary Conference, (Bohol, Philippines), http://www.transkarst2019.com/

11-13 September
ArmConference 2019: Caves as Natural and Cultural Monuments, (Yerevan, Armenia), http://armconference2019.com/

18-22 September
25th International Cave Bear Symposium, (Paklenica National Park, Croatia), nadja.kavcik@univie.ac.at

22-25 September
Geological Society of America Convention, (Phoenix, Arizona, USA), http://www.geosociety.org/GSA/Events/Annual_Meeting/GSA/Events/gsa2019.aspx

23-26 September
13th EuroSpeleo Forum, (Sofia, Bulgaria), https://esf2019.speleo-bg.org.

23-27 September
46th IAH Congress "Groundwater Management and Governance Coping with Water Scarcity" (Topic 7: Karst Hydrogeology), (Malaga, Spain), http://www.iah2019.org/topics-and-sessions/

4-6 October
6th Texas Hydro-Geo Workshop, (Boerne, Texas, USA), https://hydrogeo-workshop.org/

7-9 October
Sustainable Management of Show Caves, (Bristol, Skocjan Caves Park, Slovenia), https://izrk-sci-mtg.zrc-sazu.si/en/

7-11 October
National Cave and Karst Management Symposium, (Bristol, Virginia, USA), http://nckms.org/2019-symposium

15-17 November
13th European Cave Rescue Meeting, (Istanbul, Turkey), https://caverescue.eu/13th-european-cave-rescue-meeting/

23-29 July 2021
18th International Congress of Speleology, (Lyon, France), http://uis2021.speleos.fr/

2020 and beyond

19-23 February 2020
International Congress: 80th Anniversary of the Cuban Speleological Society, (Caibarién, Villa Clara, Cuba), congreso80aniv.sec@gmail.com

20-24 April 2020
16th Multidisciplinary Conference on the Engineering and Environmental Impacts of Karst, (San Juan, Puerto Rico), www.sinkholeconference.com

2-8 May 2020
23rd Conference of the Australasian Cave & Karst Management Association , (Jenolan Caves, NSW, Australia), scott.melton@jenolancaves.org.au

12-15 May 2020
9th International Workshop on Ice Caves (IWIC-IX) & the 12th Scientific Conference Research, Utilization and Protection of Caves, (Liptovský Mikuláš, Slovakia), http://www.ssj.sk/en/akcia/18-12th-scientific-conference-research-protection-and-utilization-of-caves

13-14 May 2020
US Geological Survey Karst Interest Group Meeting, (Nashville, Tennessee), akclark@usgs.gov

18-22 May 2020
UNESCOkarst 2020: Conservation of Fragile Karst Resources, (Bowling Green, Kentucky, USA), https://unescokarst2020.com/

29 August-5 September 2020
19th International Symposium on Vulcanospeleology, (Catania, Italy), http://www.19isvetna.com/

22-24 June 2021
EuroKarst 2021: The European Congress on Karst Hydrogeology and Carbonate Reservoirs, (Málaga, Spain), http://www.eurokarst.org/

The Darkness Beneath

ASF Conference Proceedings now online

THE 31st ASF conference proceedings have just gone 'live' on the ASF website

This link will download a 22.8 MB zip file:
http://tinyurl.com/yxzm2vxg

The proceedings are the lasting record of the conference and the input of the presenters for their contributions is greatly appreciated.

My sincere thanks to my friend and professional graphic designer Julie Hawkins of In Graphic Detail, Hobart, for her work on the formatting of the proceedings and to ASF webmaster Colin Tyrrell for his kind support. — *Cathie Plowman*

CAVES AUSTRALIA

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Editor:
Alan Jackson
Email: alan.jackson@lmrs.com.au

Production and Advertising Manager:
Alan Jackson
Email: alan.jackson@lmrs.com.au

Proofreading:
Susan White
Greg Middleton
Ian Curtis

ASF: asf.caves.info@gmail.com
For all ASF publications:
asf.caves.sales@gmail.com
Editorial contributions are welcome!
For contributor guidelines, contact the Production Manager.

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Change of address
Notify us immediately of any address changes to ensure delivery of your *Caves Australia.*

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ASF

Contents

Cover: Graham Pilkington in Bandilgnan Cave large chamber. Photo by Alan Pryke

ASF Executive

WANTED
ARTICLES FOR *CAVES AUSTRALIA!*

Whether caving, cave diving or generally just caving, *Caves Australia* readers are interested in YOUR story. It is only with YOUR contribution that we can produce a quality magazine for all to enjoy. For writing and style guidelines, contact the Editor or Production Manager.

EDITORIAL

THIS ISSUE sees a nice range of topics covered, illustrating the diversity of activities undertaken by ASF's members — conservation, experimental science and innovation, exploration, mapping and even a bit of administration/member engagement. Something for everyone, hopefully.

On the administration/member engagement front I like what I'm seeing.

The Executive and numerous other volunteers are currently working hard to make themselves and the entire organisation more open and accountable.

Most of us are pretty good at laying the boot in when we think things aren't up to scratch and while I encourage having a good (but hopefully constructive) whinge every now and again I must also point out the value in sharing some praise and the odd compliment when things are done well.

Too much stick and not enough carrot might make matters worse in the long run.

There's not much in the cupboard for the December issue at this point in time, so get the creative juices flowing and churn me out some copy, please. ***— Alan Jackson***

Vale Lloyd Mill

LONG TERM VSA member, ex-president and committee member, Rimstone member and ex-ASF Treasurer passed away on Thursday 15th March at Bupa in Coburg, Victoria.

Lloyd was a stalwart of the Victorian caving community for the past 50 years and will be sadly missed by the Victorian speleological community. A more detailed obituary will be prepared for publication.

— Susan White

President's Report

WHAT A busy few months it has been. It was particularly good to see half of the Executive actively out and about on various expeditions around the country in July.

I personally had the pleasure of a couple of weeks caving in the East Kimberley on an Illawara Speleological Society-led trip mapping and exploring karst.

Despite the adventures, the ASF Executive continues to work hard towards achieving objectives in the ASF Strategic Plan.

One of these objectives was the implementation of a satisfaction survey amongst membership which was completed earlier this year.

Many of you took the time to provide feedback and input — please see the article in this edition for results from the survey.

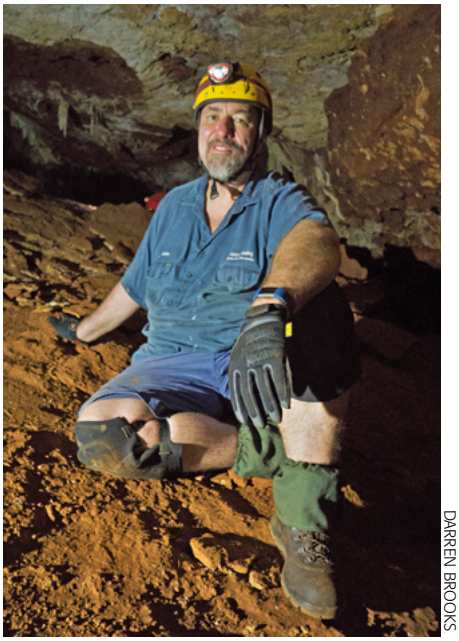
There will be another survey coming out in January 2020 for you to have your say, so we look forward to more feedback then.

For old hands planning to attend the ASF Council meeting on 4th January, please note a change of venue to the Bankstown Sports Club.

For our newer ASF members who may not be aware, the ASF Council meeting is the Annual General Meeting of the ASF and each club sends a representative or appoints a proxy.

Each club has a number of votes depending on the size of the club. Elections are also held for half the Executive. We welcome new faces, ideas and input.

All ASF members are welcome to attend.



DARREN BROOKS

On a lighter note, I learnt some valuable lessons on my recent trip up north:

- Never let the President install cave tags if you want them to remain in place longer than a few hours.
- Using a smartphone out in the field is a good thing when loaded up with the right apps and maps — even if not in a coverage area.
- Getting up at 5:30 am is not a sleep in, apparently.
- You never know who you may meet and the knowledge they love to impart.

Looking forward to seeing you all out and about caving. *— Cheers, Johnno*

Niggly Cave and Growling Swallet Connected

(and Australian cave depth record extended… a bit)

Alan Jackson
STC

THE LURE of the Junee-Florentine 'master cave' and the dream of filling in the gaps and thus joining the known pieces has been driving Tasmanian cavers for decades.

Significant progress has been made in the last twelve months over a number of multi-day trips and the result is a slightly deeper deepest cave in Australia and a much longer and connected Growling Swallet-Niggly Cave system.

Neither Growling Swallet nor Niggly Cave had grown much in the decades since their main periods of expansion (1980s and 1990s respectively).

Growling twitched a bit when the familiar Eberhard name added almost 500 m in the Living Fossils extension to Growling in 2013-14. It twitched a bit more when Andreas Klocker managed to cobble together enough souls foolhardy enough to drag dive gear for a few pokes in the Dreamtime Sump in 2013-14, resulting in another ~500 m of (mostly) underwater passage (refer to Fordyce (2018) for background on this phase and the project in general). This twitch was enough to redirect efforts to the Niggly side.

It took until mid-2016 before things really started happening in Niggly. On a trip in July of that year a way down to the main stream, and ultimately an upstream sump, was discovered off the western end of the Mt Niggly basal chamber; the main stream continuation from the 1990s, Mother of God, is downstream to the east.

This was a significant development and predictions of a quick and easy underwater connection were prematurely bandied about. The subsequently collected survey data hinted otherwise but it was the best lead available so a dive was planned.

Getting diving gear to the bottom of Niggly is no easy feat. Just the walk up the hill from the road to the entrance is a major pain in the butt.

STEFAN EBERHARD

Base camp in Mt Niggly Chamber

The hundreds of metres of snaggy tight meanders of Tigertooth Passage in the upper levels are probably the most brutal obstacle but the finale is over 250 m of vertical shafts. It was clear that camping would be required and pretty much all subsequent push trips (diving and non-diving) have involved at least one night underground and up to three.

The new sump, DIY (Dig It Yourself) Sump was passed after two attempts by Sandy Varin and Stephen Fordyce. Leads in

the dry chamber (Business Class Lounge) beyond the sump looked desperate and it was practically written off.

The survey indicated it was almost certainly heading for Porcupine Pot (and maybe the Living Fossils/Coelacanth area in Growling) and not the target Dreamtime Sump. Efforts were redirected to finding the elusive Dreamtime Sump resurgence.

Anecdotal evidence from the original Growling-Niggly dye trace from the 1990s and a more recent Bunyips Lair-Niggly dye trace suggested the junction we sought was located somewhere between the Mt Niggly area and the start of Mother of God.

Some targeted dye tracing confirmed this and a team of particularly foolhardy cavers tasked themselves with pushing rock fall 'passage' at stream level in that area (Ninja Streamway). By all accounts every metre won in this section was hard work with even a few 'Was the water level this high when we came in?' moments.

In December 2018 a determined multi-day push in this area was rewarded with a breakthrough beyond the flood-prone rock fall into solid stream passage terminating in a delightful-looking sump (Pool of Promise) heading in precisely the right direction for a Dreamtime connection and a bonus of wide open upper fossil passages to explore.

The bonus silver lining was the realisation of a simple bypass to the horrid Ninja Streamway once the survey data was entered back at camp which required only a modicum of digging.

The bypass transformed what would have been a truly horrendous dive trip commute into a walk in the park (for the non-divers, at least). That the bypass also involved a highly entertaining tyrolean beside a waterfall was just icing on the already silver-lined cake.

So the stage was set and expectations were high but the mega-bushfires and associated road closures over summer and autumn prevented a prompt return. The big day finally came on the evening of 23 May 2019.

Diver Stephen Fordyce was poked into the Pool of Promise and he returned over an hour and a half later with a grin; a ~200 m dive (with a short bit of dry passage) had been negotiated to locate the end of the line from his 2014 Dreamtime dive.

By connecting the two systems a bit of housekeeping was required on the 'longest and deepest caves' list. By taking the Niggly entrance as the highest point in the system and combining it with the deepest point in the Growling system (the bottom of the Dreamtime Sump), a few metres were added to the previous recorded depth for Niggly.

STEFAN EBERHARD

Mt Niggly from Base Camp

It was all a bit academic and wanky; the main win was the physical connection (albeit via an underwater conduit, which is not much use to 'normal' cavers).

As with all cave survey data sets, there are multiple ways you can interpret them depending on your desired outcome (lies, damn lies and statistics). The final number decided upon by those that delight in crunching the numbers is a total system depth of 397.7 m.

Yep, despite our best efforts we couldn't bring ourselves to fudge the data to breach the 400 m mark. It's all plus or minus significant error etc., and a bit of a pissing competition, but that's life.

A pre-prepared and distributed media release outlining the connection attempt and hopeful depth record had been distributed before the trip, instigated by the combined needs of Fraser Johnston's voracious desire to get material and free advertising for his *Tartarus* Tasmania caving documentary and Stephen Fordyce's insatiable ego.

The result was spectacular, with enthusiastic coverage at local and national levels (TV and print). It was nice to see a cave diving story that didn't involve drownings or rescues for once, although I'm sure the events in Thailand played a major part in why this story was seized upon so eagerly.

As usual, it confirmed to all those who knew the facts behind the story just how hopeless the media are at interpreting even a short and carefully-worded media release.

My personal favourite was a local news-

STEFAN EBERHARD

Stephen Fordyce commencing the connection dive in the Pool of Promise

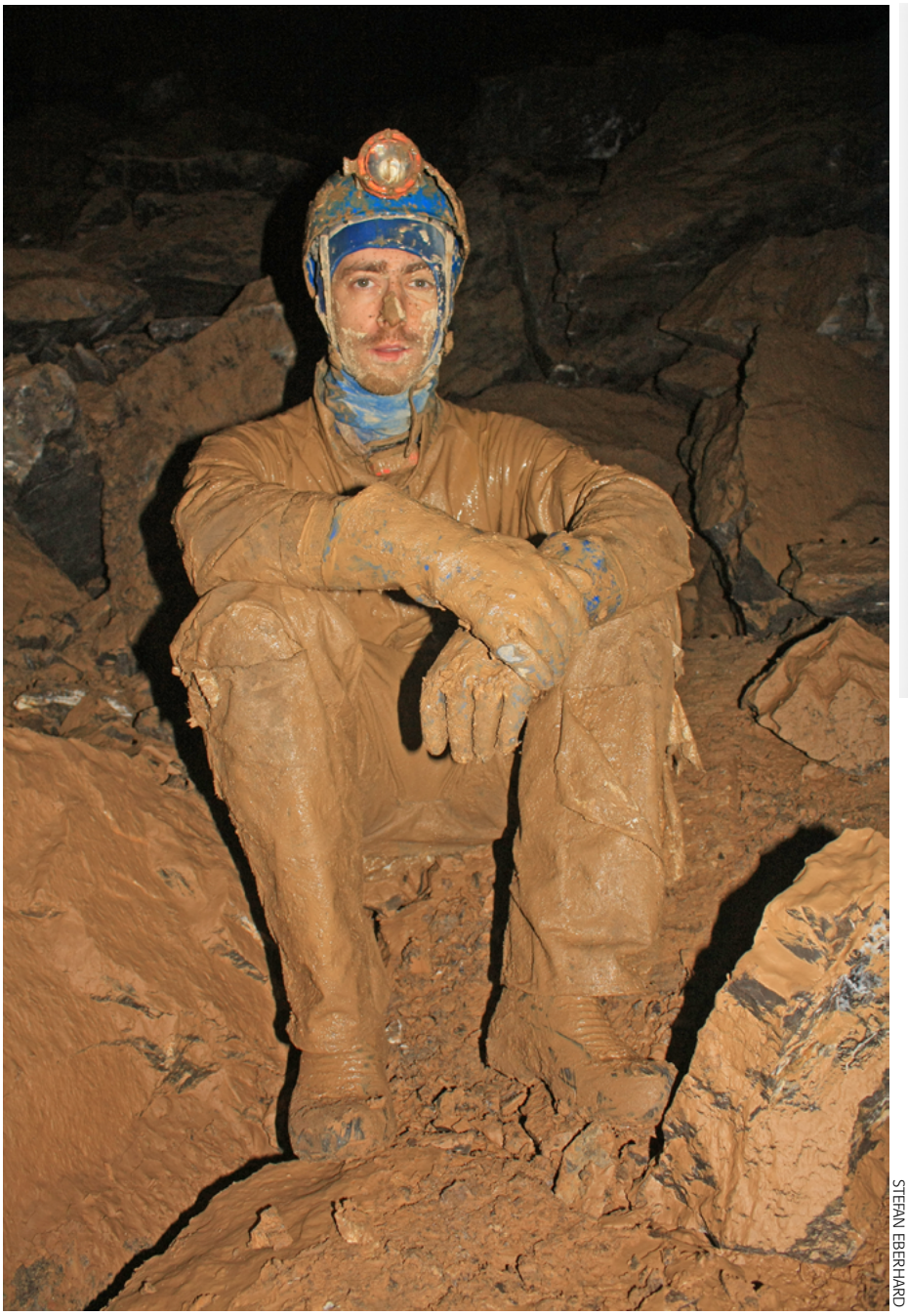
reader proudly reading from the autocue how the trip had received financial support from *National Geographic* while the picture behind her face showed Steve wearing his *Australian Geographic* t-shirt. Thanks, by the way, to *Australian Geographic* for their support.

While the connection and the depth record were cool, it hasn't all just been about the divers (despite what they'll tell you). In the process of looking for sumps we've managed to make some spectacular dry breakthroughs.

A dry connection between Growling and Niggly isn't entirely off the cards. During the connection dive trip, and on two subsequent trips, a few kilometres of new dry passage have been explored to the south and west of 'old' Niggly.

Also, since the gear was in the cave anyway for the connection attempt, another look at the DIY Sump/Business Class Lounge area has provided a breakthrough in the Porcupine Pot direction too. The show isn't over yet.

Prior to 2013 Growling and Niggly were considered about 13 and 3 km long respectively. As of the end of July 2019 the combined system is in excess of 23.5 km. This rivals Exit Cave for title of Tasmania's longest cave.



STEFAN EBERHARD

Personal hygiene can be a casualty of cave exploration — Gabriel Kinzler after a successful day of pushing

The Junee-Florentine karst area still has a lot of secrets to give; the down side is what it takes from those who wish to receive — mostly cartilage, blood, sweat and tears and even some friendships.

It has been a massive team effort over multiple years and there are too many names to list individually (I'd only cock it up and miss someone off). If you've been on one or many of the trips since ~2014 then well done, cheers and thanks, but don't pat yourself on the back and retire just yet as there are still more leads to survey and tanks to cart.

REFERENCE

Fordyce, S. 2018 JF36 Growling Swallet: The Niggly Connection Project Phase 1. *Caves Australia* 203: 17-20.

ASF Satisfaction Survey

Sarah Gilbert
ASF

EARLIER this year the ASF sent out two satisfaction surveys to find out what you, our members, think of our organisation; what we do well and areas where we can improve.

These results will be used to help sharpen and prioritise activities identified in the Strategic Plan and the forthcoming Business Plan.

These results will also form a baseline on which future questionnaires will be prepared.

A big thank you to those who took the time to fill this out, your feedback has been very useful especially from the free text questions.

Below is a summary of the results covering the main themes that were highlighted. Detailed specifics have been omitted here for brevity and confidentiality; however, a detailed report has been circulated amongst the executive including all your comments.

If you missed out this time, or are surprised by any inclusions/omissions in the results, there will be another opportunity to give feedback via a follow-up survey early next year. You can, of course, email us at any time.

The good news is that overall ASF members are 'Satisfied' with the organisation, although there are some who clearly are not. Everyone provided feedback which was both positive and suggestions of areas that need improving (summarised by category in Figure 1).

Positive feedback reflected the recent conference and the sense of community it creates. *Caves Australia* was ranked highly along with general communication by some responders, as well as advocacy for caving and the karst environment.

Communication featured often both in positive feedback and also as an area that needs improvement, where it was mentioned in the context of organisation transparency and engagement directly with members.

The ASF is engaging with some members via email, but not all members feel they receive enough information.

Broadening our modes of communication and increasing engagement with members are areas that have also been identified in the Strategic Plan.

One of the largest areas for improvement was access to information and cave data, as well as access and digitisation of the library itself.

These included suggestions for increased access to cave maps and cave location information, as well as information of how to access permits and state-specific requirements.

Members are increasingly seeking information outside of their own club and the ASF is well placed to facilitate and encourage this while still being mindful of copyright and intellectual property considerations.

Relocation, cataloguing and digitisation of the library to make information available to members online is already underway, along with setting up a forum to develop the next-generation of an Australia-wide karst database.

Recruitment of younger members was also ranked highly, along with the need for increased engagement by the ASF with its

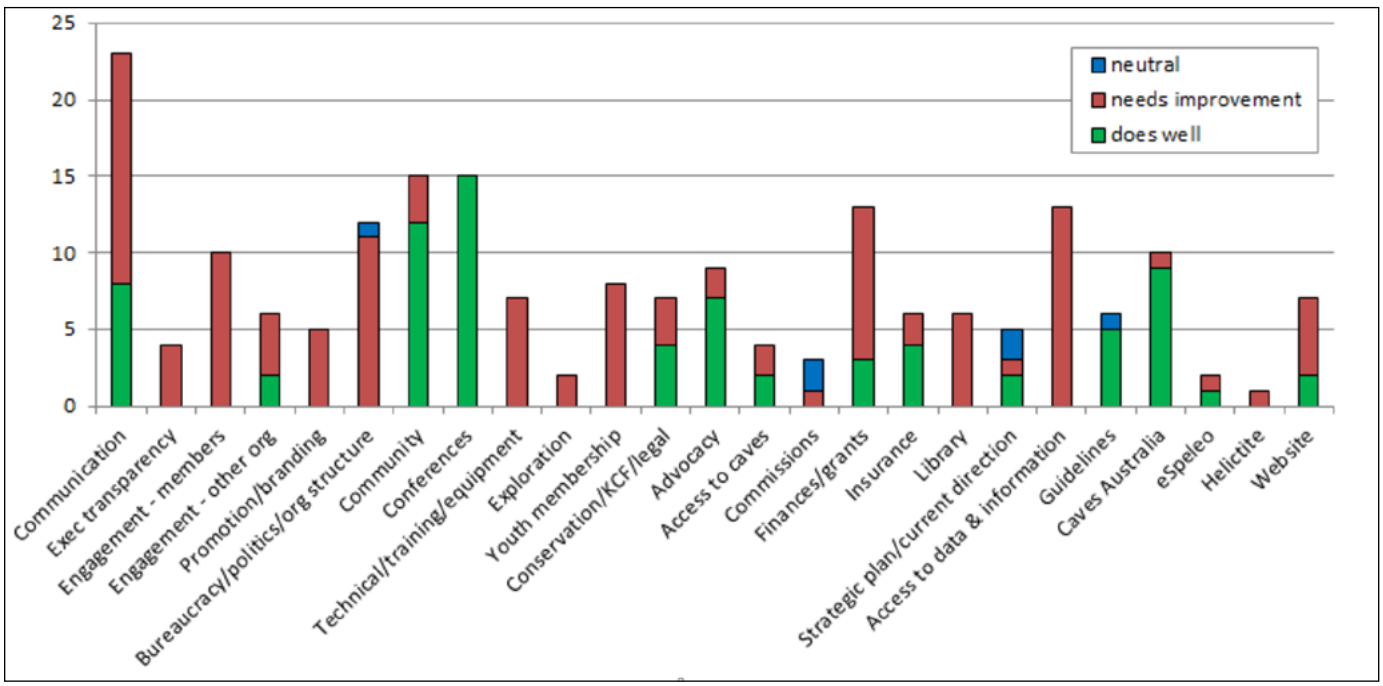


Figure 1: Summary of all feedback from free text questions in broad categories.

existing members and other organisations, and to encourage a broader section of members to become involved with the ASF.

There were also comments relating to the need to review the organisational structure, transparency and finances, which are also being addressed within the Strategic Plan.

Recent progress and changes were reflected favourably in many comments, e.g. 'I think that working in the direction we seem to be going now is definitely a GOOD THING!'

The majority of members who use social media are on Facebook, followed by YouTube.

However, there was a significant number of responders who do not use any form of social media, and to whom emails are the primary communication source.

The ASF will continue to develop our Facebook presence to engage with existing members as well as attracting new members, while still maintaining a broad range of communication and information streams.

The gender diversity questions seem to have taken some people by surprise. The gender breakdown of the responses is interesting though.

The numbers of responders who have never considered the issue or think the balance of it about right, are very similar between males (68 per cent) and females (71 per cent). However, no female responders avoided these questions (gave blank answers) but many males did especially relating to potential barriers.

The majority of female respondents do not consider gender an issue or have not experienced any negative impacts of it themselves; but more females could think of potential barriers that may apply to others and in general, and not surprisingly, show they are more aware of the potential for gender-related issue than males.

Overall there are more active male cavers than females in many, but not all clubs, and this is reflected in the male (70 per cent) and female (23 per cent) survey response rate.

This is not necessarily something specific to caving and is similar across many community sports and recreation groups.

This survey shows that although the majority of long term active female cavers are those who have either overcome or who have not experienced any barriers themselves, there are, or have been, significant barriers to females taking up and/or continuing caving, as there are more male than female cavers overall.

This is something that all cavers should be aware of, especially in terms of recruiting and maintaining new and younger members, and we encourage you to discuss this further within your club.

If you have any ideas or areas of expertise that would help develop and promote caving in Australia, or if you simply want to get more involved in (your) ASF, don't hesitate to contact one of our Commissioners or Executives. The ASF relies on the valuable time of our volunteers, and the more people who are involved the more productive and dynamic we will be.

Social media boosts interest in ASF

Sil Iannello
VSA

THE NAME 'Facebook' might be overwhelming to some; however, the online world of social media has many advantages for the Australian Speleological Federation (ASF).

The recent launch of an ASF Facebook page and group page in April 2019 has received an overwhelming response from cavers and non-cavers in Australia and globally, allowing us to access a wider audience and streamline communication for all things cave-related.

The ASF developed its Facebook page to keep followers up to date with official announcements, ASF news, and information regarding ASF cave clubs.

This page is a practical addition to the official ASF website, allowing members of the public to like, follow and share content.

For those who want to feel even more connected to the caving community, ASF created a Facebook Group which allows people to join as members, post their thoughts and interact through discussion threads.

The purpose of the group is to provide a forum for all things caving including upcoming events and trips, cave news, science reports, photos and videos, gear reviews and even cave politics.

It is intended as a way for us all to connect, communicate and share experiences and information across the country.

Since launching, the ASF Facebook group has attracted 210 members, most of whom are interested in keeping informed about cave information within Australia and discovering how they can actively get involved with a state club.

A feature that members will enjoy is the quick and easy access to details of ASF state clubs.

There are 24 caving clubs or speleological societies in states and territories across Australia and the ASF Facebook group highlights each one, as well as providing links to each club's website or Facebook page.

Facebook's handy statistics function shows that videos generate the most reactions and views amongst the ASF group. It also shows us that Wednesday and Thursday nights are when the group is most active.

If you would like to join as a member of the ASF Facebook group, all you need is a Facebook account.

It's easy to set up and start enjoying the world of social media.

Follow the ASF Facebook page at: www.facebook.com/asfcavers/

Join the ASF Facebook Group at: www.facebook.com/groups/ASFgroup/

Andrew Philip Spate, AM

Tony Culberg, OAM

WELL KNOWN Australian caving, ASF and ACKMA identity, Andy Spate, received an AM (Member of the Order of Australia) 'for significant service to conservation, particularly to caves and karsts' on the Queen's Birthday 2019 Honours List.

Below is the supporting documentation for his nomination for an award. Further details can be found at https://honours.pmc.gov.au/honours/awards/2004454

Andy Spate has spent a lifetime involved with, first cave surveying, then recreational caving, then speleology and finally karst management. Karst is the technical name for limestone environments. He has published widely on caves and karst generally and on karst management specifically.

After graduating in 1972 with a Bachelor degree in Applied Science he started work with CSIRO, in the Division of Land Use Research.

After nine years with CSIRO he moved, in 1981, to the NSW Parks & Wildlife Service (NPWS), as the first karst professional managing protected areas. This was the first such appointment in the Southern Hemisphere. NSW National Parks include a number of limestone areas such as Yarrangobilly and Cooleman Plain in the south and Ashford in the north.

His involvement with speleology included being, in the late 1960s, a Vice President of the Australian Speleological Federation (ASF), which is a Registered Environmental Organisation.

After his term as VP expired he was the Convener of ASF's Conservation Commission, which was involved in various battles to protect limestone areas from careless exploitation.

ASF sponsored a conference on cave tourism management in Tasmania in 1976 and Andy's interest in this aspect of speleology was sparked.

He attended similar conferences in 1981, in WA, in 1983 in Waitomo NZ, another in 1985 and convened one in NSW in 1987. Arising from this last conference a new organisation was formed, now known as the Australasian Cave and Karst Management Association (ACKMA). Andy was elected as VP and has served as President, Secretary, Vice President and ordinary committee member ever since.

KIRSTY DIXON

Andrew Spate at Mundrabilla, 2010

In 2001 Andy retired from NSW NPWS and set up his own business, Optimal Karst Management. This business has been involved in:

- Writing and designing interpretative material for tourist cave areas
- Re-lighting various tourist caves
- Training of cave guides
- Writing and reviewing World Heritage and UNESCO Global Geopark nominations

He helped draft a nomination for a World Heritage Area in South Korea, as well as a nomination for a UNESCO Global Geopark. Both were successful. Within Australia he has been involved with many submissions to various government departments on karst management.

This work has also been outside Australia. He has worked in Malaysia, specifically Mulu Caves World Heritage Area, in Vietnam, Papua New Guinea, Soth Korea and New Zealand.

He has designed, written and delivered numerous four-day training sessions for cave guides, the most recent being at Chillagoe caves, inland from Cairns, in late 2017.

Locally, involved in CSIRO's Science in Schools program in primary and high schools to promote STEM subjects (Science, Technology, Engineering and Mathematics).

As a result of Andy's over 60 years of involvement with land use management, specifically karst, all Australians have a better experience when they choose to visit a National Park or a tourist cave.

Graffiti Removal in Main Cave at Timor NSW

7th–10th June 2019

Garry K Smith
NHVSS

GARRY K SMITH

Graffiti vandalism in Main Cave, Timor

ONE OF OUR members alerted me that a large amount of spray paint graffiti vandalism had appeared on the walls of Main Cave, Timor, during 2018.

This led me to think about what could be done to remove it. As trip leader for the upcoming Timor and Crawney Pass caves trip scheduled over the June long weekend, I thought this would be the perfect opportunity.

In the week before the trip I emailed participants the usual information on the trip objectives, but I also included a request that everyone bring along a wire brush to be used for the removal of graffiti. I am sure some participants were quite puzzled by this request.

In all we had 18 participants who took part in all or part of the planned activities during the long weekend; however, our numbers had dwindled to seven to go caving by Monday, the last day of the weekend.

NHVSS members are very lucky to have access to a well-equipped privately owned, multi-bedroom hut, previously shearers' accommodation, as a base when caving at Timor.

This makes our caving trips to the area quite comfortable. After a good night's sleep we set out at 8.30 am to head for Main Cave on the ridge in the NW corner of Caves Reserve.

Our members really appreciate a close relationship with all the property owners around Timor, so we were able to utilise 4x4 drive tracks to get our vehicles to the top of the ridge on private property.

This meant we only had a 150 m walk along the ridge to the cave. The private property access negates a half-hour climb up a very steep walking track on the reserve, which is the only access route available to the general public. Upon entering the cave our group was immediately confronted with the horrendous amount of spray paint graffiti on large sections of wall.

The areas were assessed to identify any historic signatures which may be impacted if we cleaned them all down. I can hear the thinkers questioning, 'At what point in time does a signature change from being graffiti to a historic signature'. There are many arguments to be considered here and there are numerous in-depth published articles about this subject. A good example is the paper by Reed and Bourne (2018) under the subheading 'The value of historical writing in caves'. Hence I am not going to tackle this subject in this short article.

To document our clean-up, we decided to photograph each area of graffiti vandalism prior to and after removal.

Luckily, the majority of the walls now covered in graffiti were those which had been vandalised about 30 years earlier and had previously been cleaned down at the time using the same method which we were about to employ.

Back then I was a member of NHVSS and also heavily involved with scouting as a venturer leader and a regional caving instructor, so the Scouts on one of my caving courses were involved in the earlier clean down of graffiti.

Upon close inspection the majority of the cave walls were found to be still coated in a layer of soft calcite — not moonmilk — and the graffiti on the whole could be removed by vigorously rubbing them down with the wire brushes.

So, provided there was still enough soft calcite on the walls, I expected that the same process would be viable once again without occasioning any noticeable damage

Graffiti Removal in Main Cave at Timor NSW

GARRY K SMITH

Marcia, Brian & Trish clean off graffiti in Main Cave, Timor

to the cave walls. Wire brushes were used on a small test area and proved to be very successful.Our band of enthusiastic wire brush-wielding graffiti removers then set to work. Even the young children in our group embraced the project with enthusiasm and achieved some outstanding results in areas within their reach.

Overall, the clean-up took about two hours and achieved almost total removal of all the 2018 graffiti. The shame is that the caves on the reserve at Timor are freely open to the public to wander into at any time and as such can be targeted in the future by graffiti vandals.

In contrast to the vandalised caves on the reserve, there are caves off the reserve on private property which are in pristine condition.

There is no way we can restore the caves on the reserve to their former glory, prior to the souvenir hunters who broke off countless speleothems and carved names in walls from the turn of the century onwards.

However, the property owners around Timor recognise the importance of the caves on their property and are rigorously protecting what is beneath their land.

Thankfully, the historic signature of Fred Ward 1865 — alias Captain Thunderbolt, a notorious outlaw — in Main Cave has not been damaged. Our fingers are crossed that his signature survives into the future.

GARRY K SMITH

GARRY K SMITH

Marcia Kaye and Trish Morrow — before and after cleaning

PARTICIPANTS

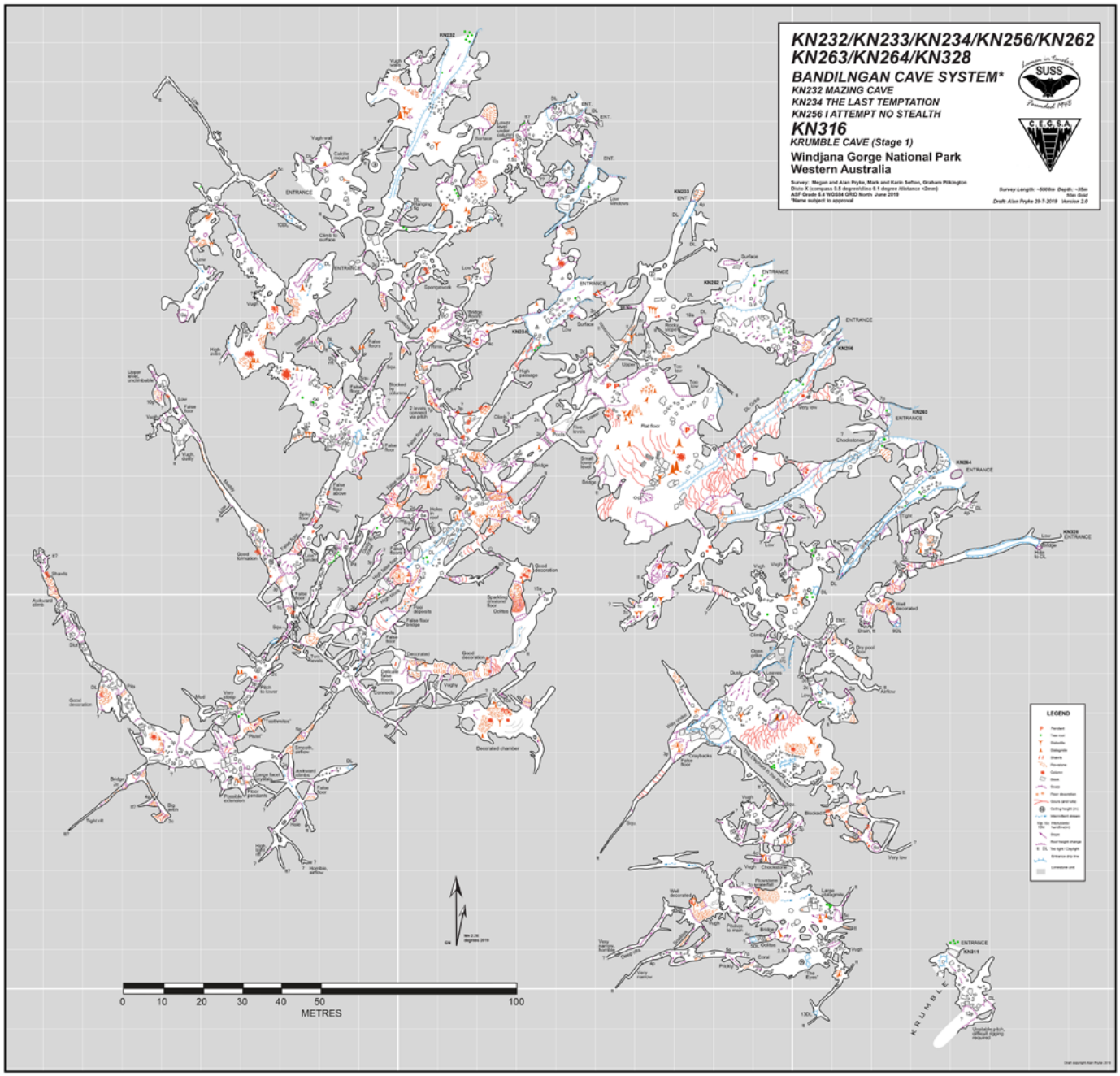
Brian Reeves, Marcia Kaye, Trish Morrow, Rod Smith, Ellie Brown, Connor Brown and Garry K. Smith.

FURTHER READING

Reed E. and Bourne S., (2018). 'New evidence confirms Thomas Hannay as the first photographer of Naracoorte Caves and emphasises the importance of historical writing in caves'. *Helictite* 44: 45-58.

Windjana 2019

Alan Pryke
SUSS



A FAINT breeze issued from a small gap deep in a dimly-lit grike.

A fallen rock was heaved aside to reveal a tight descent to a flat-floored walking passage, leading to a large chamber via a low crawl, with a huge decorated calcite mass as a centrepiece, illuminated by reflected light from a nearby daylight hole. The formation mass was named "The Elephant in the Room".

As previously reported in *Caves Australia*, ongoing exploration and surveying at Windjana Gorge National Park over the last six years has revealed a number of significant maze caves, notably, Fanackapan, (6,700 metres), the previously recorded Coral Maze Cave (3,200 metres), Joinery, and many smaller caves.

In 2018 a previously tagged series of entrances were found and investigated, and, as scant documentation was on hand, and no drafted map known to exist, it was decided to add these entrances to the expedition mapping goals. Mapping commenced with CEGSA's Graham Pilkington and Mark Sefton, and SUSS's Alan and Megan Pryke, surveying at a high grade 1:200 scale.

Access to the caves across the plateau bristling with tall, spiky spinifex, and equally tall, spiky, rillenkarren tower mazes kept the team searching for easier routes, as initially the team was climbing around in circles. Eventually they settled on a route

***Note:** Clicking on the map above will take you to a larger PDF version on the ASF website*

ALAN PRYKE

Elephant in the Room

ALAN PRYKE

Bandilngan Cave gours with Karin and Mark Sefton

taking a surprisingly short one hour or so from camp.

Tall rifts and large chambers, some lit through small daylight holes made the cave very attractive.

Rooms festooned with extensive flowstone, rimpools, columns, shawls, stalactites and stalagmites were revealed as the team surveyed deeper into the system. A stegamite was noted.

One room had a mass of very large faceted calcite crystals, another, a nest of pure white cave pearls amidst sparkling rimpools.

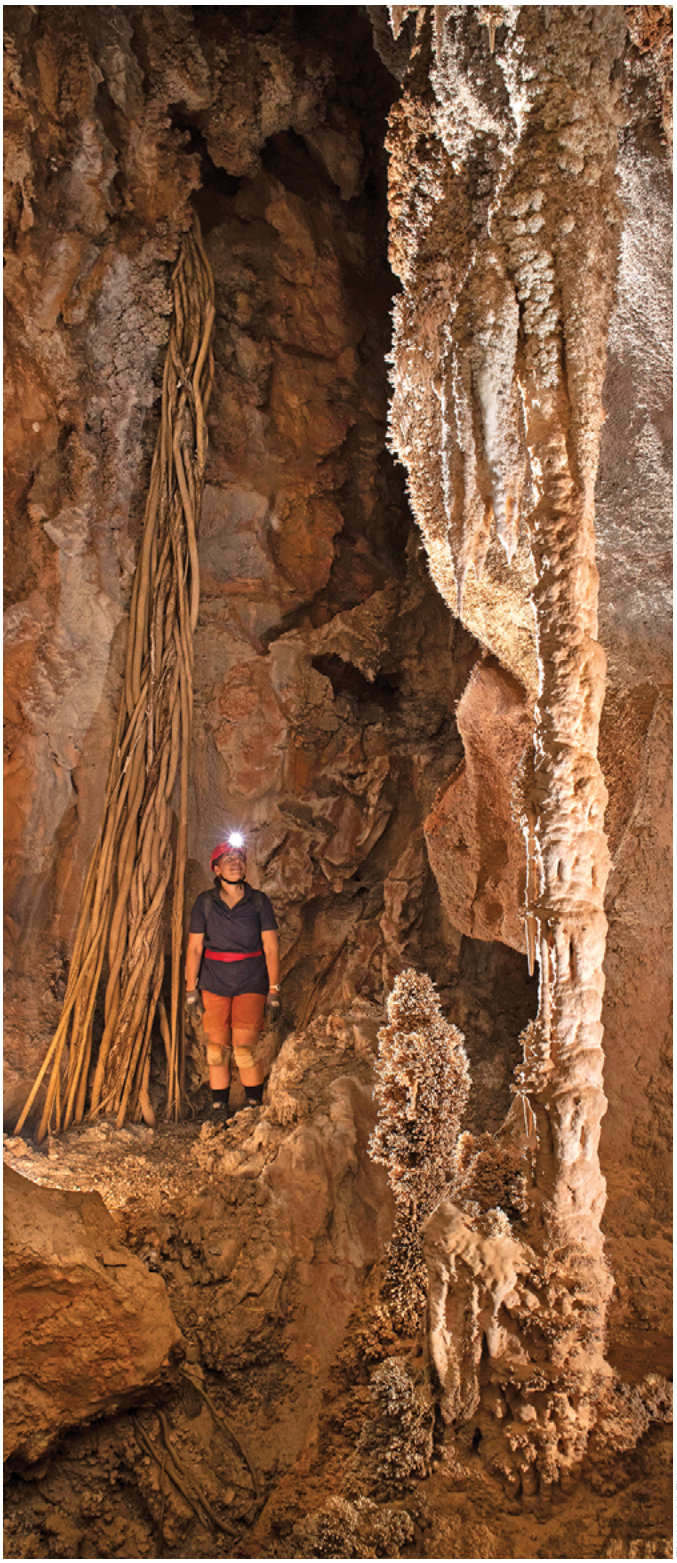
False floors forming bridges hinted at the cave system's immense age, sometimes stacked in several layers reaching up twenty to thirty metres.

Large craybacks loomed in dim daylit chambers, with phytokarst visible on the walls. With around 1,800 metres of passages surveyed in 2018, many leads beckoned.

June 2019 saw the return to the system and recommencing of surveying. Passages continued to be discovered during the expedition. The previously mentioned "Elephant in the Room" chamber led on to a series of complex deep chambers, one with a thin, 5 metre column as a centrepiece. A section to the south came quite close to the outer cliff line, but no connection was found.

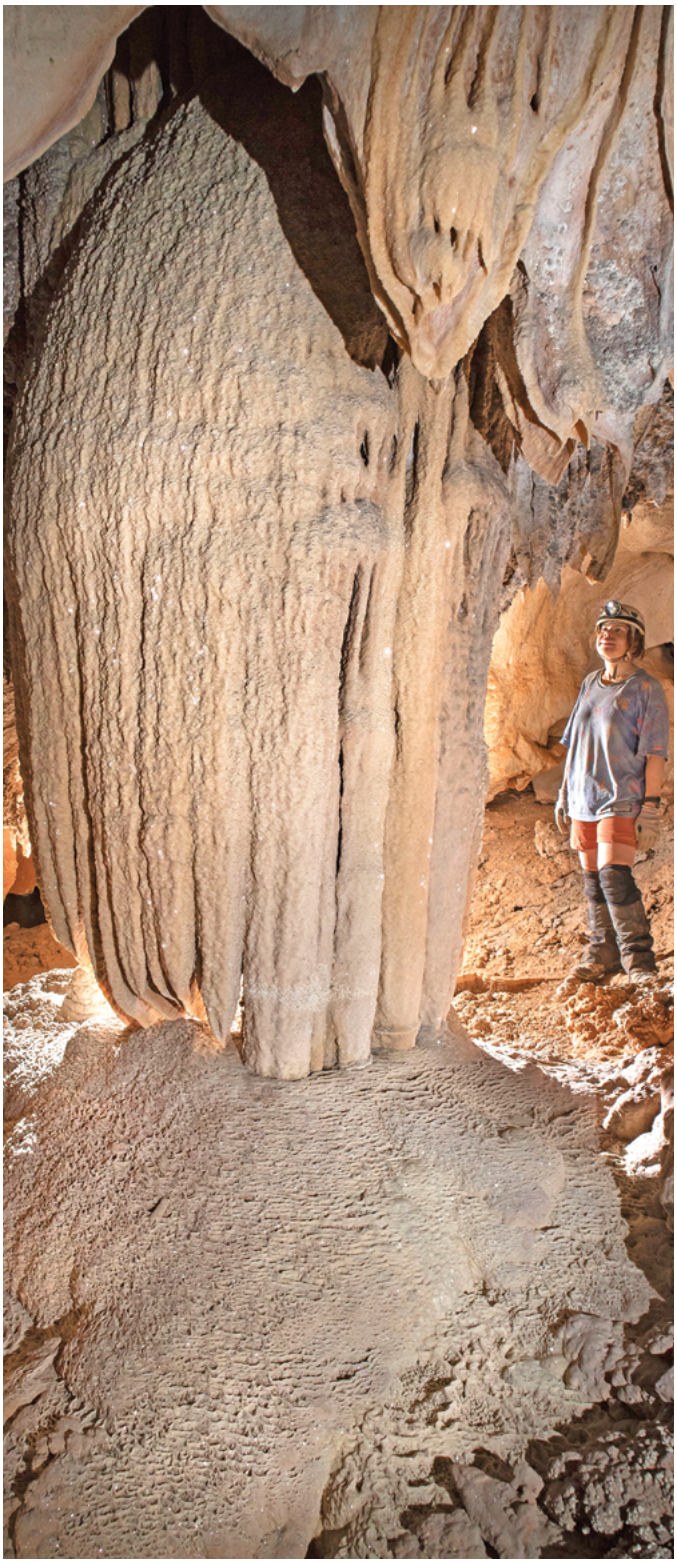
By the end of the expedition a system of just on 5,000 metres of surveyed passages was documented with 35 metres of depth.

It is likely that the system, with further



ALAN PRYKE

Bandilngan Cave column



ALAN PRYKE

Megan Pryke with Bandilngan Cave decoration

work, will reveal many more passages and chambers, as many vertical climbs, etc., were not pursued. Ladders were used on some pitches, and passages that turned into too tight rifts as the cave approached the outer cliff line.

A cave that had been found in 2017, Krumble Cave, was mapped to the edge of a loose dangerous pitch, and, when mapping was aligned, was found to be very close to the larger system.

Another cave found in 2017, Left Right In, was mapped from the deep grike rock pile westward and found to be close to Krumble.

A surprise was that "Left Right In" is also very close to 2017's Galaxy Cave, seen through a roof window in the grike rock pile. All these caves are likely, with some difficulty, to be connected eventually.

The team personally invited the local Indigenous Bunuba custodians to name the overall system.

In the meantime, the name Bandilngan Cave was chosen as a placeholder, as Bandilngan is the preferred Bunuba term for the general gorge area.

We would like to thank West Kimberly Parks and Wildlife Service acting district manager Dave Woods and the Broome office for issuing the necessary permit, the traditional owners via the Bunuba Dawangarri Aboriginal Corporation, and all the staff on the ground at Windjana, with senior ranger Rod O'Donnell, Erin Davis and Henry Corpus for looking after us.

Preliminary Work on Building a Portable Cave Detection Kit

Nullarbor 2018

Cathi Humphrey-Hood
MSS

IN OCTOBER 2018, an assortment of cavers from a variety of ASF clubs set out on a research trip to the Nullarbor armed with two drones, a set of seismic survey equipment borrowed from Macquarie University, some electrical resistivity measurement apparatus, a large hammer, the support of the ASF and a surplus of optimism and good intentions.

Our team consisted of Roderick Smith, Aengus Porter, Cathi Humphrey-Hood, Jim Crockett, Michael Sliwka (all from MSS), Rodney OBrien, Alan Pryke, Megan Pryke (from SUSS), Daniel Burt, Brian Reeves (from NHVSS), Dirk Stoffels (from CSS) and Graham Pilkington (CEGSA).

The purpose of the trip was to combine drone photogrammetry with seismic survey readings and electrical resistivity data in order to investigate the possibility of building a 'relatively' portable cave detection kit. We wanted to test a combination of techniques that might work to characterise an area where there are likely to be navigable voids. And by 'relatively portable' we mean that the equipment fits into the back of a 4WD, but still leaves room for a fridge and the driver, and possibly even a passenger.

There were many uncertainties: would a sledgehammer produce enough acoustic energy to provide the depth penetration needed to pick up anomalies associated with even the shallowest Nullarbor caves?

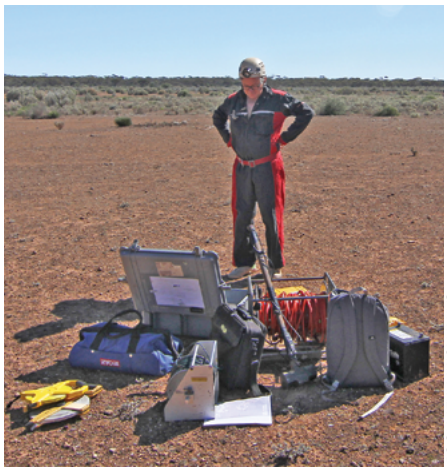
Some previous small-scale seismic studies suggested that the hard surface layer of the Nullarbor limestone acts like a high cut filter for seismic waves (Levin & Barton 1991), which if true would certainly cause issues for our small sound source. Would the surface conduct enough electricity to enable our resistivity experiment to work? Would our drones be able to provide the resolution needed to build a surface topographic model more precise than the current publicly available satellite imagery? We hoped at least that the flat expanses of strata would make it easy for both the drone flying and the seismic work. As it turned out, the answer to this last one was drone flying yes, the seismic not so much.

CATHI HUMPHREY-HOOD

Mullamalang 2018

Even though this was a research trip, it began with some sightseeing, including a visit to Weebubbie (6N-2), as several of the team had not been there before.

Prior to reaching Weebubbie some of us also made a detour via Picanninnie Ponds, Mt Gambier and Naracoorte Caves. We arrived at Weebubbie to find a group of divers who were nearing the end of their trip.



CATHI HUMPHREY-HOOD

Alan Pryke with the seismic survey gear unloaded at Witches Cave prior to setting out the first survey line. It might not look like much, but it doesn't pack well.

This team was led by Rob Main from Reef2Ridge (who operate out of Mt Gambier) and they very kindly allowed us to use their ladders to enter the doline, which saved us a lot of hassle and was very much appreciated.

So we started the trip with some cave-diver watching, photography and a little preliminary drone flying (outside the cave, though it is certainly big enough to accommodate a drone inside). The weather was not overly inspiring, with cloud in addition to the usual Nullarbor wind (though it was warm when the sun came out), and we were missing Graham Pilkington, who had been expected and whose whereabouts at that point were unknown. We camped at Weebubbie for a couple of nights before heading to Mundrabilla.

STARTING THE SURVEYS

The science program began at 6N-193 Witches Cave, as Alan Pryke had kindly made his incredibly detailed map of it available so we could position our seismic and electrical resistivity lines over "not cave" and "cave" for comparison … except

that some problems with caching the maps meant that we managed to just clip the main cave instead of passing right over the top of it. Of course, it is highly likely some of the "not cave" areas near the entrance doline may indeed contain cave, as there are leads going in that direction. We concentrated on running a seismic refraction survey as our first study at Witches, since this takes much less time than a reflection survey - though it does not see as deep and will not image the subsurface in the same way that reflection does, nor will it give accurate results if one of the underlying layers has a slower seismic velocity than the one above it. This would be the case if there was a cave, however voids can sometimes produce characteristic 'lumps' in the travel-time data (Whiteley & Greenhalgh 1979) and this is one of the things we would be looking for.

Witches Cave — while very dusty — is one of the more beautiful caves on the Nullarbor and it is also one of the shallower ones at 8 to 12 m. This should be well within the range of a sledgehammer and refraction survey. We set out four lines, one after the other, with two intended to be over 'not cave' (at least not 'known' cave) and two over 'cave'.

The seismic program began collecting good data right from the beginning, but attempts to use electrical resistivity were very soon put aside. This technique has been used in the Nullarbor in the past, and in very dry karst areas overseas (e.g. Abd El Aal 2017) but the equipment we had was not sensitive enough. Not being able to borrow the University's electrical resistivity testing set (it was in use for teaching at the time), I built my own and tested it against the University's set, where it worked tolerably well over grass and heavy soil with less than 1 amp of current as a source. Fast forward to the Nullarbor and even after a sprinkle of rain, the ground was so dry and so well insulated that the readings were less than the errors and therefore useless. Even when applying AC current directly from a generator rather than a battery there was no measurable effect. With little time for trouble-shooting I decided to abandon this part of the experiment, at least for this trip. My Macquarie geophysics contact had been worried we might electrocute ourselves with this experiment, but I think we would have struggled to zap even a single grasshopper.

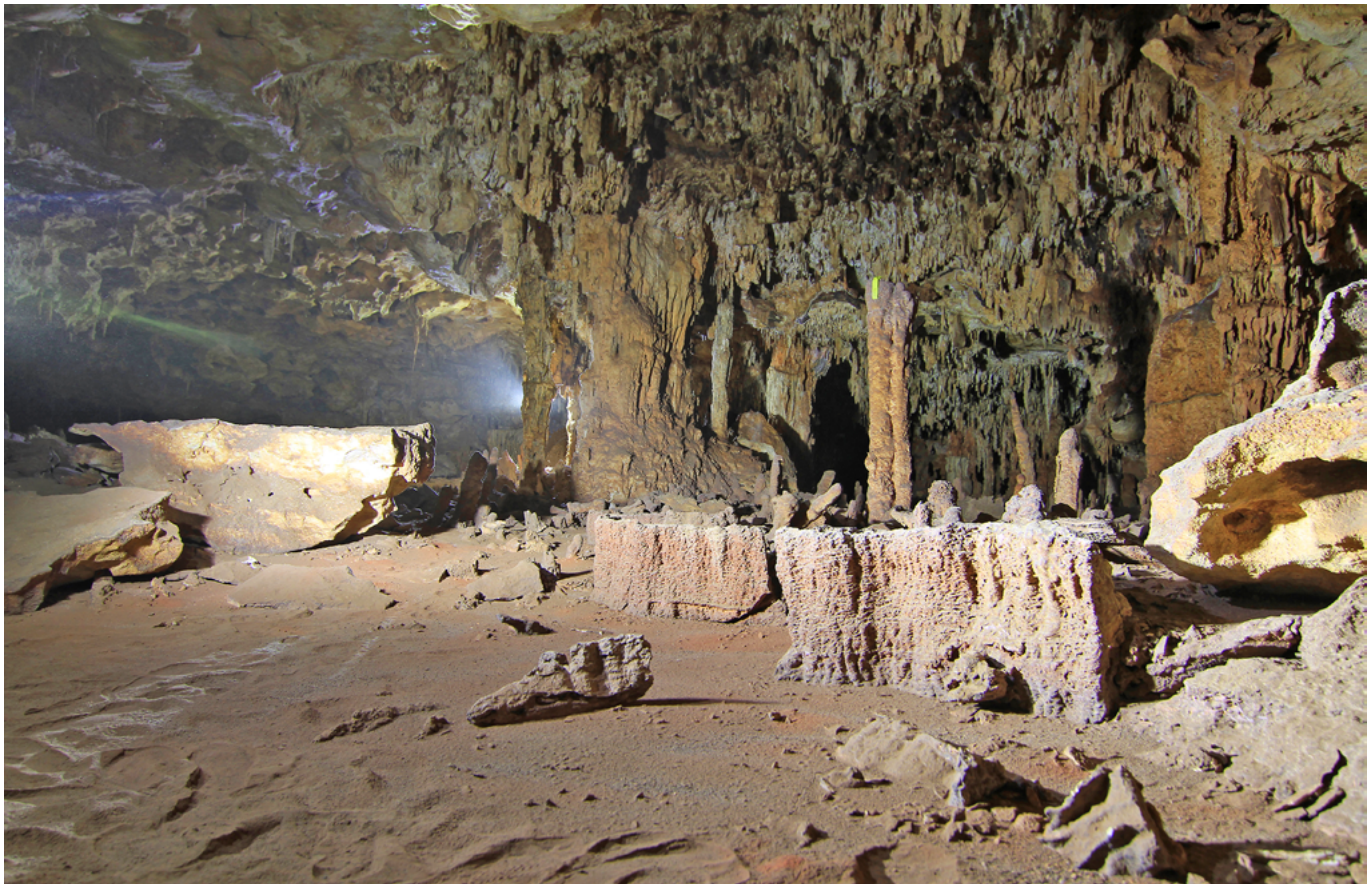
DIRK STOFFELS COLLECTION

Dirk Stoffels wearing the latest in seismic fashion

The drones, on the other hand, worked really well and coped far better with the varying strength winds than we expected, though they chewed through the batteries doing so.

We had two drones on this trip, a DJI Phantom 4 owned by Daniel Burt and my DJI Mavic Pro. Daniel was using Pix4D as his acquisition software, but my Pix4D set-up hadn't gone through correctly, so I was forced to fly my photogrammetry missions manually (at risk of having chunks of the image missing).

Thanks to the ASF supplying some extra batteries for the Mavic Pro, I was able to produce a decent DEM (digital elevation model) of both Mullamullang and Thylacine Hole (though focusing problems later troubled an attempt at 6N-683, a small



CATHI HUMPHREY-HOOD

Inside 6N-193 Witches Cave

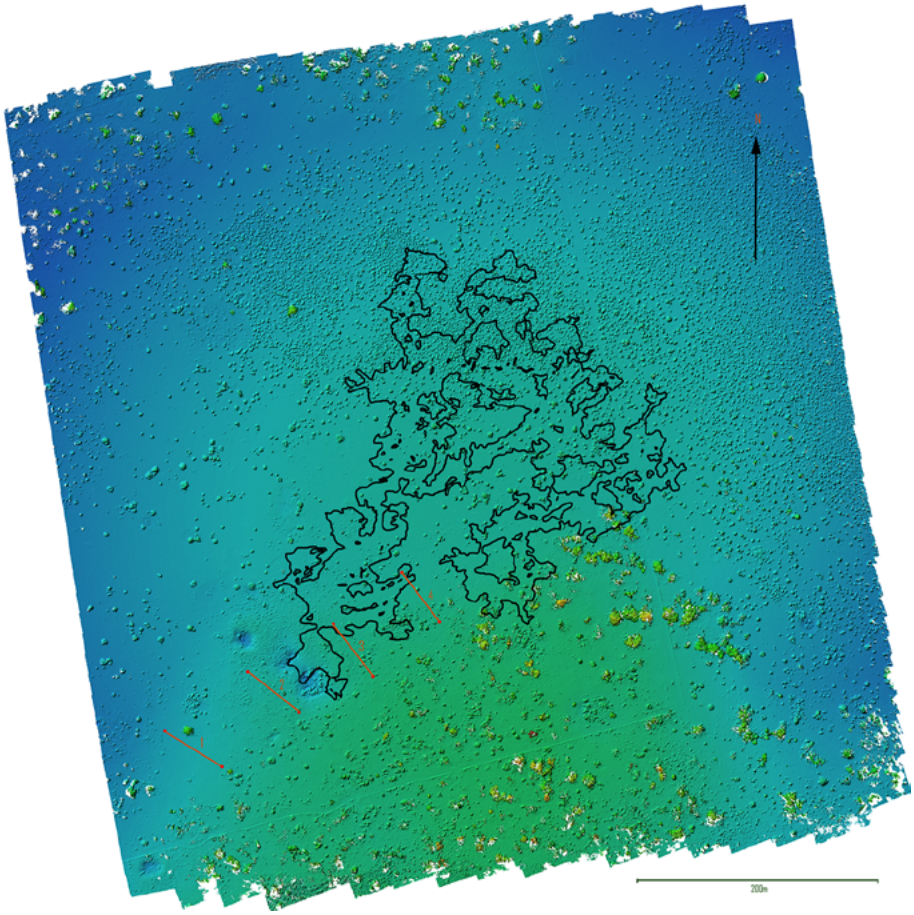
blowhole north of 6N-83 Old Homestead). Daniel Burt's photogrammetry of 6N-193 Witches Cave produced a DEM (in the field using Photoscan Pro as the processing software) to an accuracy of 10 cm.

Some surface exploration was undertaken and Alan Pryke had a go at pushing some leads in Witches Cave, which remained stubbornly resistant to his efforts. We also attempted to remove a camel from inside the fenced enclosure around the cave. These fences had apparently been put there to help keep camels and other exotic animals out, but this one was doing a better job of keeping the camels in. Some of the fences we found around several caves on the Nullarbor were starting to show signs of disrepair.

Before moving from the Witches Cave area the team finally (thanks to the SMS ability of our hired satellite phone) made contact with Graham Pilkington - he had been ill and was behind schedule, but would join us in a day or so. Daniel Burt had to leave us as his day-job needed him back, but we effectively swapped him for Jim Crockett, who had returned from overseas and flown into Adelaide, borrowing a friend's 4WD.

The next objective was 6N-63, Thylacine Hole, though we camped near Thampanna (6N-206), where we stayed for several days and where Graham Pilkington soon found us.

For those who have not visited this area before, Thylacine Hole has an approximately 8 m abseil down a fairly straight tube into a low entrance chamber which then peels away downward and opens out into some beautifully decorated chambers.



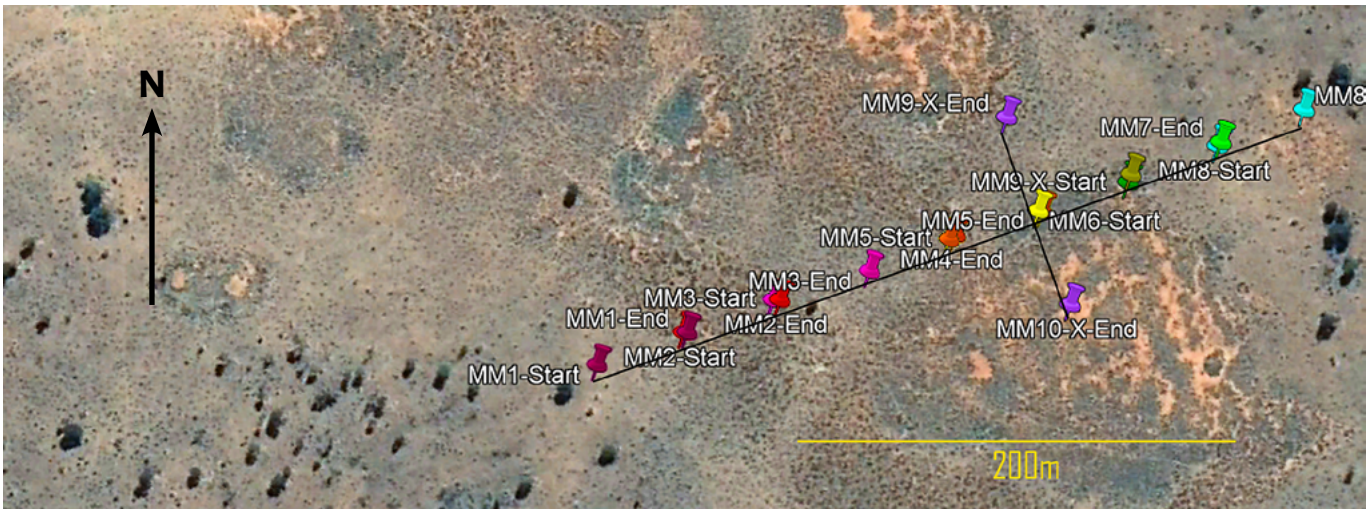
Digital Elevation Model (DEM) of the area over Witches Cave, courtesy of Daniel Burt, with overlay of cave map traced from Alan Pryke's kmz file, and seismic lines 1 to 4 in red

The primary decoration is no longer active, but there are halite speleothems and whisper-thin slivers of salt, drifted into piles like tufts of cotton wool. Thampanna has a slightly longer abseil through a round hole into a wide round entrance chamber — it feels like dropping into the middle of a doughnut with a howling gale blowing all around you.

This cave is nowhere near as well

CATHI HUMPHREY-HOOD

Chamber in 6N-63 Thylacene Hole



Mullamullang reflection survey line location over Google Earth, set out on the advice of Graham Pilkington

decorated as 6N-63, and is fairly strenuous to traverse. It can be quite muddy and frequently holds water.

Alan Pryke, Megan Pryke and Graham Pilkington continued to work on their already impressive survey of Thampanna while the rest of the team set out to do another four seismic refraction lines around Thylacine Hole.

While we had a better idea of where 'cave' and 'not cave' were for the more compact Thylacine than for Witches, Thylacine is deeper (over 20 m) and at risk of not being picked up by the more reliable inner shots along the refraction line. There is an apparent lithology change just inside the entrance shaft, below the lip of the abseil, and I was curious to see if our refraction survey would detect this.

A photogrammetric drone survey followed the seismic lines the next day, and then we moved on to Mullamullang (6N 37) via Madura.

MULLAMULLANG

With the exception of Graham, we spent a night at Madura Roadhouse, where Dirk made some temporary repairs to his camper van's solar panels.

Dirk then left for a tour of Woomera, while the remaining members of the team set off to meet Graham at Mullamullang. Because this is a deep, long cave system, I wanted to try a seismic reflection survey over it — or two.

In the end, due to time constraints, we opted to just run one long line (approx. 350 m) over a valley at the south-eastern end of the doline where Graham thought there was a higher possibility of an extension. The reflection technique should give better and deeper resolution than the refraction; however, the surveys take longer to run and the data take longer to process.

It wasn't all surveying, though. We did spend some time in Mullamullang itself, emerging after several hours in the cave to find the weather had taken a dramatic turn and a storm had demolished the camp, drenching everything and ripping two gazebos to shreds. Rod OBrien had an upcoming cave diving meeting in Mt Gambier; he left us the following afternoon after we finished off the last four segments of the reflection survey, hoping the roads had dried out enough to be passable (they had, just). The rest of us packed up the camp the next morning and headed for Old Homestead (6N-83).

Graham, Megan and Alan went back to the main road, while the remaining team set out to travel from Madura and cut across country to the Old Homestead road, just for something different. It did indeed turn out to be something different; we soon discovered that the road marked on the topographic map no longer exists, so we stubbornly continued until we reached our objective, over some 70 km of 'not-road' with an unplanned night camp in the middle of nowhere, while Jim Crockett did his best to demolish his borrowed 4WD by dropping it into a wombat warren.

GPS tracking later showed that we had actually criss-crossed the old road for most of the trip, even though we saw no sign of it. Graham, Megan and Alan, meanwhile, had an uneventful arrival and night at Old Homestead, and were ready to go caving by the time we turned up the next morning.

OLD HOMESTEAD AND 6N-683

We had scheduled a number of days around Old Homestead and Alan and Graham were keen to continue their mapping program of this extensive and complicated cave. They found a willing survey slave in Jim Crockett, freeing up Megan to join us for a trip to Forrest on one of the days we decided to have a break from surveying and drone-flying.

We had been looking for something completely unknown to run a seismic and a drone profile over, and there was a small blowhole that Brian Reeves had noticed on a previous trip but had not been able to explore. Sadly for his hopes of a new discovery, it was already tagged (6N-683), but it had potential in that we could get into it and see a way on that we couldn't quite squeeze through.

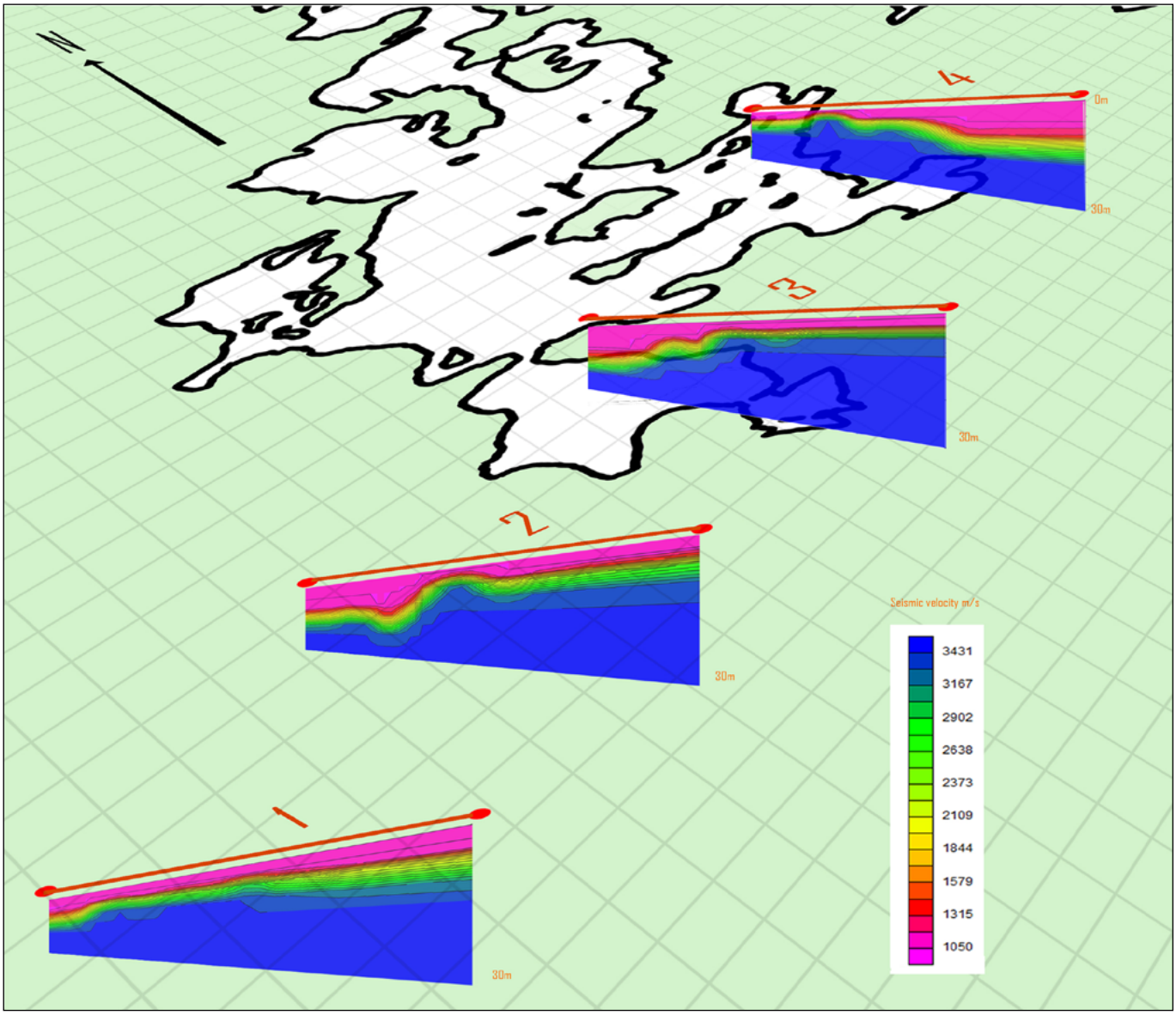
So we decided to do two quick perpendicular seismic lines over it in the direction we thought it was going, and to fly a quick drone survey. The day got hot very quickly — it reached 42°C, by far the hottest of our trip — and it was very windy, such that the measuring tape we were using to set out the line was almost whipped out of our hands. The drone flying was left to the following day.

We left Old Homestead on 21st October, with most of us beginning the long haul back to NSW after a couple of issues with a battery and a flat tyre, via a tourist stop at Abrakurrie and a civilised night in the cheap motel rooms at Eucla.

INTERPRETATION OF THE SEISMIC DATA: REFRACTION

Work on interpreting the seismic data is ongoing. The biggest issue in processing the refraction data has been dealing with noise in the signal, primarily due to the wind. The areas around both Thylacine Hole and 6N-683 are completely open with little to no vegetation and both lines at these caves were conducted on windy days (Mullamullang and Witches Cave each have a small scattering of low trees nearby that slightly lessen the wind).

The hot strong wind on the 42°C day we visited 6N-683 added so much noise to the end shots (needed for depth penetration) that little of that data is usable. Likewise, the outer shots at Thylacine were ambitious to begin with (given that we only had a sledgehammer as a noise source), but after



CATHI HUMPHREY-HOOD

Witches Cave with initial 2-layer models from the refraction data

initial processing, the very outer shots over the area of known cave do show an anomaly in the travel time data at about the right depth, but which do not (at least not yet) convert into a neat layer model. Initial 2D models have been generated for Witches Cave (see the overlay image) — it seems fairly clear where we are sure there is no cave, and we appear to have an anomaly in the seismic lines where there is known cave … but are we also seeing cave even where there hasn't been cave found (yet)?

INTERPRETATION OF THE SEISMIC DATA: REFLECTION AND MASW

Because we were using relatively low frequency geophones (14 Hz), we also had a good chance of recording some decent surface wave data, and our 2 second recording time for the reflection data was just long enough to make use of the Multichannel Analysis of Surface Waves (MASW) method. The processing software is very sensitive to small changes in input parameters, however, and as I did not collect refraction data at this site, the surface velocities entered into the models are estimates. Over-zealous applications of filters in an attempt to remove noise often removes everything and there is further processing to be done before I can present a final line of the Mullamullang data for both the reflection and the MASW.

MY LONG THANK YOU LIST!

This research trip was supported by the ASF Grants Commission and I would like to express my gratitude to the ASF for their helpful advice and their patience. I would also very much like to thank everyone who came on the trip, as you all put a lot of effort into helping with the seismic work.

Thanks also to the managers of Mundrabilla, the station hands at Madura who pointed us in the right direction (at least, to where the road should have been), Rob Main and his diving team from Reef2Ridge who allowed us to use their ladders at Weebubbie, Robert Block of DBCA WA and Shannon Alford of DPLH WA for their help with sorting the permits, and a very, very big thank you to Dr Mark Lackie from Macquarie University for trusting me with his seismic gear and for showing great patience with my naive questions both before and after the trip.

REFERENCES

Abd El Aal, A. 2017 Identification and characterization of near surface cavities in Tuwaiq Mountain Limestone, Riyadh, KSA, "detection and treatment", *Egyptian Journal of Petroleum* 26(1): 215-223

Levin, J. & Barton, T. 1991 Seismic Field Trials on the Nullarbor Plain, South Australia 1991, Bureau of Mineral Resources, Geology & Geophysics Operation Report, Record 191/87, p.31

Whiteley, J. & Greenhalgh, S. 1979, Velocity Inversion and the Shallow Seismic Refraction Method, *Geoexploration* 17: 125-141 (p.129)

JF-8 Junee Cave

ASF Diving Expedition Report, January 2019

Stephen Fordyce
VSA and STC

With input from team members Patrick Fitzgerald, Stewart Donn, Andrea Russo, Stefan Eberhard, Grant Pearce and Dave Apperley

A CREW from four states (three Victorians, one South Australian, one New South Welshperson and divers from both southern and northern Tasmania) assembled in the height of summer with the goal of making an assault on Junee Cave (JF-8).

This is the resurgence of just about all the caves in the Junee-Florentine karst, lying under Mount Field, which includes such well-known caves as Growling Swallet and Niggly Cave (the deepest cave in Australia).

The cave is at the centre of the Junee Cave State Reserve, managed by the Tasmanian Parks and Wildlife Service. It is well known for flooding and even summer weather can include snow and torrential rain in the mountain catchment above.

While we were lucky to enjoy mostly rainless weather, the nearby bushfires had to be carefully monitored and planned around.

Junee Cave has seen a number of heroic pushes over the years by many of the who's who of Australian cave diving. Those hoping to dive to the current end of Sump 2 can expect a thorough spanking from the cold water (6-7°C), depth (max ~65 m) and access (short Sump 1 dive, plus streamway walking both sides, not to mention the cave entrance being 400 m from the carpark).

Doing productive 'working' dives is even more challenging. As usual, seeing the progress made by previous teams was mind-blowing, especially given the modern technology to which they did not have access. Full respect was paid.

While the local Tassie cavers complain about the Sherpa loads for two-tank dives in other JF caves, this dive was an order of magnitude more gear — we collectively used about 40 SCUBA tanks for various things in Junee, plus a scooter, rebreathers, and various other exciting paraphernalia.

Having informed the *Spirit of Tasmania* that we had too many SCUBA tanks to unload (and couldn't empty), they were kind enough to make special arrangements so that we could leave them in the cars.

The Australian Speleological Federation (ASF) was also kind enough to contribute $500 towards consumables for the expedition — rebreather sorb and helium.

The team arrived at different times and split into groups with different focus and timings. Even with this many people, there was enough space so that nobody got in anyone else's way, and with some considered planning, minimal impact was not compromised.

The Victorian contingent spent a leisurely two days setting up gear, portaging everything into the cave and preparing to dive Sump 2. For Pat and me, our plan was to stage near Sump 2 everything that would be needed for the entire week of diving (sorb, oxygen, diluent, reels, food, tools, etc.).

With odds and ends added by everyone else, this staging area was soon known as 'The Corner Shop'.

By replenishing our rebreathers in the

STEFAN EBERHARD

The obligatory team brag pic. Left to right: Stefan Eberhard, Stephen Fordyce, Patrick Fitzgerald, Grant Pearce, Andrea Russo, Steward Donn, Dave Apperley.

STEWART DONN

The Junee River emerges at the base of the mountain range from this spectacular entrance (complete with tourist viewing platform).

cave, we avoided having to carry them out each day and saved a great deal of time, energy and misplaced heat. A pair of 7L tanks were used to transit through Sump 1 (about 200 m long and average depth 12 m).

The dedicated setup and clean-up days were an excellent investment and this system made it possible to do long Sump 2 dives on consecutive days.

Once the cave was set up, it was on to the diving, which proceeded according to the fancy of each diver. It is a whole lot of effort, so some preferred to dive only every second day; others had gear to test and, of course, getting a feel for exposure limits had to be done with a good deal of caution.

For Your Eyes Only is a spectacular piece of decorated streamway cave between the sumps, and was the subject of several dedicated photography and video days (camera work by Stefan and Stewart, with lighting by Grant, Andrea and anyone else who was handy). It was Stewart and Andrea's first experience in Tassie caves and they did a great job of hauling more than their share of gear, as well as doing some survey dives in Sump 2. They even professed to having enjoyed it.

STEWART DONN

The streamway cave between Sump 1 and Sump 2 named For Your Eyes Only is extremely spectacular and seldom visited. It's also good for photographers taking pictures of models looking speculative.

STEWART DONN

Impressively proportioned and decorated passage in For Your Eyes Only.

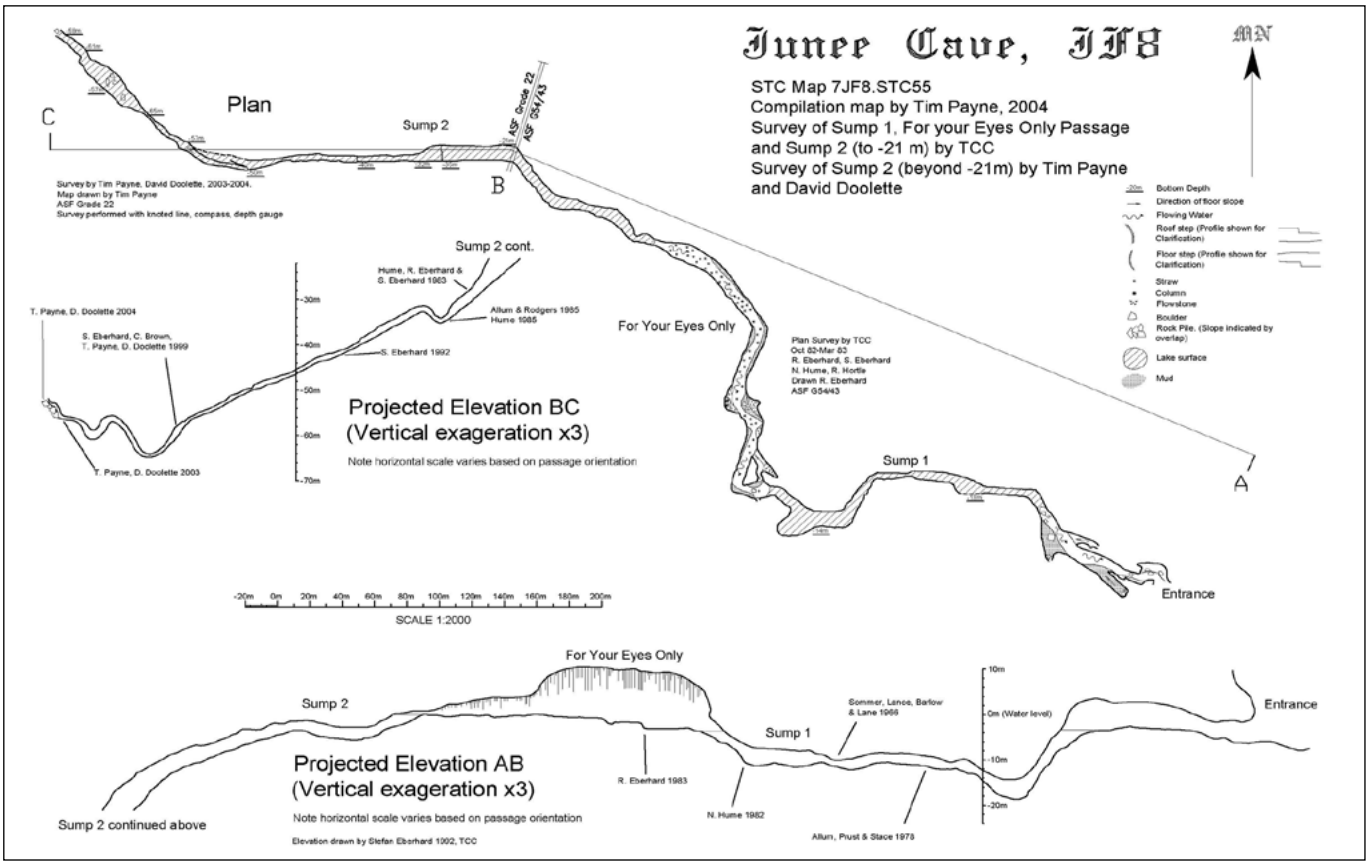
The end of Sump 2 has been pushed by several very capable people, so it was always going to need something special to yield anything new.

A good start to giving a push the best shot is to give it lots of shots and knowing this, our dives could be incrementally increased in duration and productivity.

A major advantage in the use of rebreathers is to reduce the amount of gas consumed each dive to almost nothing in comparison to 'open circuit', which also made the logistics of multiple dives much easier.

Rebreathers are also warmer than open circuit, a major advantage in cold water. Backup 'bailout' tanks are still required against the possibility of rebreather failure, but by staging these through the sump and leaving them for the entire project, the amount carried on each dive is minimised without compromising safety.

This also means that the overall amount of bailout tanks can be limited to those re-



Existing map of Junee Cave compiled by Tim Payne, including original survey from entrance to 22 m depth in Sump 2 by Tasmanian Caverneering Club

STEFAN EBERHARD

Steve getting ready for a dive in Sump 2.

quired for the small number of divers in the water at one time, rather than a set each for the entire team.

Our early dives focussed on staging bailout cylinders, identifying (and videoing leads), checking exposure tolerance and adjusting thermal protection, laying and surveying knotted line, and fixing existing line, with little time spent at the end. Intermediate dives saw the end reached quickly and smoothly, for maximum time pushing. The final 'clean-up' dives were for the retrieval of gear, line and bailout.

Much time was spent and technology used in Sump 2 (my dive log records 14 hours in there across five dives) and some progress was achieved.

Sump 2 meanders up and down a bit until dropping to 18 m or so and then heads steeply down until hitting 64 m maximum depth after 200 m.

The deep section meanders along at 54-58 m depth for 100 m and then ends in a rock pile which blocks the (upward trending) passage.

Descriptions from previous trips matched the video and my impression of the end quite well.

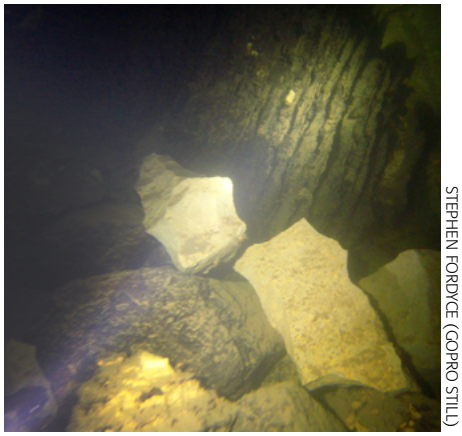
An open and well-defined tunnel of perhaps 6 m wide and 3 m high was trending up and then blocked by rock fall. Straight ahead in the middle of the tunnel was a triangular-shaped hole at 55.5 metres salt water (MSW) with an enticing void behind it, but no chance of getting through. There was a definite flow coming out, although not a gush.

Two metres to the left of the centre lead was a dubious-looking lead 1 m lower and heading horizontally (i.e. most likely further into the rock pile) that would require some serious wriggling in sidemount or no-mount gear.

Flow was not noticed, but not really checked either.

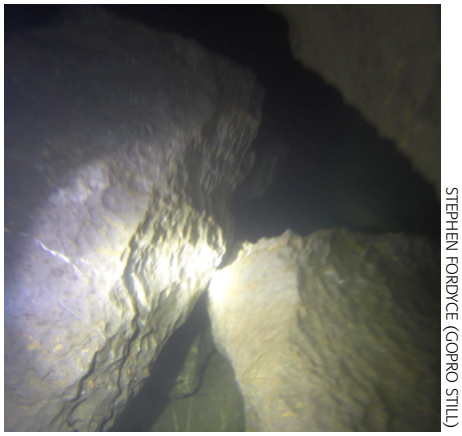
To the right, the passage trends around the rock pile and up for a surprising few metres more to 53 MSW. There is then a horizontal lead which might be negotiable in sidemount gear and upwards in the rock pile would be worth another look.

Of particular interest are many blocks of black/ribbed, thinly-bedded Benjamin Limestone (kettle to microwave size) which do not match the bedrock walls and ceiling which are formed in the thickly bedded, lighter coloured Cashions Creek Limestone and appear to have rolled down from higher up.



STEPHEN FORDYCE (GOPRO STILL)

Near the end of the right hand lead - black/ribbed Benjamin Limestone block against Cashions Creek Limestone walls and floor rubble



STEPHEN FORDYCE (GOPRO STILL)

The centre lead/triangle hole, with the Armageddon Room beyond.

The presence of these erratic boulders of Benjamin Limestone, which are the next stratum in the geological sequence heading north, lend optimism to the prospect of an upward-trending continuation of the sump. Flow was not observed, but not really checked either.

The centre and right-hand leads were most prospective and in fact the rest of the trip was dedicated almost entirely to the centre lead and to accessing the void behind it.

Two subsequent dives were dedicated to careful and painstaking gardening, as well as some other jobs like surveying, and making a way to access what was named the 'Armageddon Room' up and around to the left.

The push dive was a tricky one and involved a great deal of planning — if things went well, the cave would open up, mirror the other side, and a barrelling tunnel would head towards an airspace and dry cave.

This would allow a break out of the water and, more importantly, a reset of thermal and decompression obligations. While very optimistic, it would be a shame to have the time and motivation to achieve this if opportunity presented, but to be lacking a thorough plan or some small but crucial piece of gear.

To this end, even a stick of salami was carried for energy while exploring dry cave on the other side.

The trouble was that if things didn't go so well and the theorised air chamber could not quite be reached, a brutal decompression obligation and extended exposure would be experienced due to having to go back down to depth and return to the known surface at the start of the sump.

In reality, it was acknowledged as unlikely that a remote airspace would be reached on this dive and that a careful decision would need to be made according to what the dive presented.

Getting into the Armageddon Room was via the 'Fridge Restriction' and required the removal of butt-clipped reels and suit inflation cylinder, and a bit of wriggling, which took some time.

Even at this early point in the push dive, the possibility of surfacing in a new air chamber was quickly evaporating. The enticing void beyond the triangle hole was found to be a squalid, nasty thing, although trending up a slope, with enough space to turn around and tie off the reel but not much else.

The highest point reached was 52 MSW, a couple of metres beyond the tie-off point, with rubble and rock pile pinching off to the ceiling.

While a second set of eyes never hurts, I sadly pronounced the centre lead a 'no go'. Getting in and then out again is not a trivial exercise and would only be possible for an experienced sidemount diver.

About 10 m of 3 mm orange line was added (not surveyed) and left in place — it will be interesting to see what this does after some time in higher flows.

Compared to other parts of the cave, more flow would have been expected; most likely this is just due to flow filtering through small gaps in the rock pile, but it is also possible that there may be a bypass and another way on.

Other sump dives further upstream in the master cave system have been in relatively small, uncollapsed passages that I feel may be recent bypasses of more ancient collapses and rockpiles.

In the spirit of leaving the cave environment in better condition than we found it, a good deal of old line was retrieved from Sump 2 and brought out — particular kudos goes to Dave for the time he spent on this task.

Alas, the deep section still has as many as four lines running in parallel.

Also recovered was a reel with 'Harry' on it (the day before he became Australian of the Year — it's no doubt now worth millions) of approximately 2009 vintage, and a Chris Brown reel heirloom dating back to the 1990s.

Nothing was left in the cave apart from some of the 'clotheslines' set up to help keep the large amounts of gear tidy and out of the way.

We were careful to stay in the stream or below the winter high watermarks, with a few already well tracked exceptions, and we were confident that our impact was minimal.

Three discrete signs were placed in three areas with sensitive mud banks in For Your Eyes Only. The signs are small plastic plant tags about 50 mm x 40 mm, marked with permanent ink asking visitors to avoid the mudbanks.

No other protective measures were considered necessary.

In what turned out to be a supreme team effort, knotted line was laid, surveyed and retrieved, as most of the Sump 2 had previously only been surveyed via ready reckoning.

The result is not perfect, but a reasonably accurate survey is claimed and we have in fact reduced the length of the cave. Gathering more survey data should be on the list of future visits.

STEPHEN FORDYCE

Historical Chris Brown reel (from the 1999 expedition) sees the light of day again.

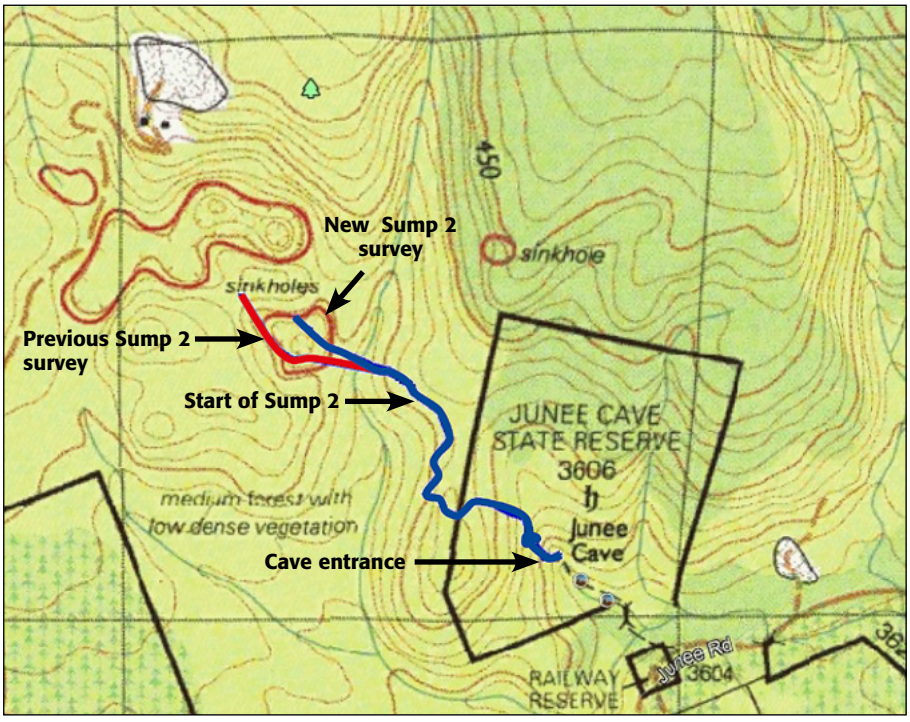
Anaspides eberhardi, a species of cave-adapted Tasmanian mountain shrimp, were everywhere in both sumps, and pale native fish with eyes *(Galaxias truttaceous)* about 20 cm long were spotted, including near the far end of Sump 2.

A lot of video footage was taken with a Sony A7iii and Keldan lights in FYEO and Sump 1, although it was quite silty when filmed, and while there is rather average GoPro footage available of all of Sump 2, it would be fantastic to film it with a better camera and video lighting; this would take some co-ordination and a bit of luck.

Sump 2 did not start crystal clear, and silt was disturbed easily, although visibility was never low enough to be a big worry, either in or out. At this stage, a return has not been written off, but it is not planned either. There are still things to do and leads to check and push — best of luck to any who venture there.

Thanks again to everyone on the team and to the ASF for their generous support. A special thanks to Andrea who, with assistance from Stewart, over-catered so drastically that the entire team was fed a delicious dinner on more than one occasion. Honourable mention goes to the owner of our accommodation for leaving a slab of beer in the fridge for us.

Further details — dive profiles, gas mixes, schedule, thermal considerations and more — are available from the author upon request.



STEPHEN FORDYCE

Overlay of the cave showing old and new surveys

Georeferencing Best Practices

Sarah Gilbert and Bob Kershaw
ASF Executive

DURING April 2019 the ASF Executive received the following email from Arthur Chapman from the Australian Biodiversity Information Services regarding geographic location (georeferencing) of and within a cave:

> We are writing a new edition of a book on *Georeferencing Best Practices,* the first edition of which was published in 2006.
>
> We are wondering what the terminology is for location within a cave. We realise that caves are generally georeferenced (lat/long) at the entrance and either depth or distance below surface is used. But we would like to describe how a location is georeferenced within the cave system. Is it just distance and direction from the entrance (direct or along a path?) or is there some other convention to describe where one is (or a fossil, an insect, etc.) within the cave.
>
> Preferably would like a reference to cite, but any information would be of value to us.

The book *Georeferencing Best Practices* can be found at the following link and makes interesting reading: http://herpnet.org/herpnet/documents/biogeomancerguide.pdf

What follows is a summary of answers supplied by Sarah that included some information from Bob.

Cave entrances are recorded by GPS usually with lat & long but some areas use UTM coordinates, measured at the cave tag (physical identifier attached near the entrance to a cave) or at an identifiable natural feature close to the entrance. The coordinate systems are generally standardised within a state or geographic region, but not Australia wide. Unfortunately there is no definitive reference either! But I have attached a few ASF surveying guidelines.

Caves are surveyed and mapped from the tag (or GPS location), by recording the distance, bearing and inclination between two 'survey stations' which are line of sight within a cave. Multiple survey stations are recorded throughout the cave system covering the extent of the cave including side passages. Traditionally this was done with clinometer & compass, but laser distos are now becoming standard https://paperless.bheeb.ch/

While surveying, in-cave semi-to-scale sketches are made of the plan and elevation (for deep caves) and include details of passage shape and significant features such as rocks and speleothems.

Survey stations are sometimes relocatable (to allow for multiple surveying trips into the same cave, or at passage junctions), however most survey stations are temporary (e.g. a projection on a wall which is recorded during surveying but the location has no permanent identifier to minimise human impact on the cave).

Survey data is then digitised in cave mapping software such as Compass (http://www.fountainware.com/compass) to produce a line plot of the cave. When tied to a surface GPS coordinate the cave line plot can be georeferenced using ArcGIS or similar. This can be used to align the cave with surface features and other known cave entrances in the area.

The cave detail is then digitally sketched to scale to flesh out the final map. Significant passages and chambers are often named and can reflect the odd imagination of cavers!

The digital data and the ability to georeference the entire cave usually remains with the individual(s) who did the survey and the cave map sketch is then more readily available to other cavers and researchers.

This means locations within a cave are generally referenced by passage or chamber name, and/or annotated on the cave map. Also cave location coordinates are never included with the map, or published elsewhere, to help protect the sensitive nature of the caves. However each state and/or caving area has a database of cave locations for use by cavers.

Attached are a few examples of final cave maps (often included at the end of each *Speleo Spiel* newsletter) and an example of cave passage GIS overlay. Please note that these are all subject to copyright by Southern Tasmanian Caverneers https://southerntasmaniancaverneers.wordpress.com/

Arthur sent back a couple of questions:

> In the document re caving symbols there is mention of a very accurate altitude to two decimal points. What does this refer to: Altitude above the ground, or elevation against Mean Sea Level or to a geoid? If the latter — how is it determined to that accuracy?
>
> Also there is mention of a Horizontal Datum point with fixed coordinates. How is this determined, what geodetic datum is generally used and to what accuracy is the mentioned Horizontal Datum determined?

The ASF reply was rather mixed:

> To be honest the symbols sheet is just intended for illustrative purposes for the symbols — and although it was revised 10 years ago, these symbols date back to the 1980s ... these values would probably relate to theodolite and barometer measurements.
>
> The details of datums and standards in the 'ASF Cave Survey & Map Standards' document I sent previously are still generally applicable, despite being just as old.
>
> Current practice is to record surface locations to the accuracy of the GPS used and referenced to a standard Australian datum (i.e. GDA94). In-cave distances would realistically be accurate to 1 decimal place and bearings/dip to the degree.
>
> When surveying trying to get a loop closure helps to determine the accuracy of a survey (and to pick up on any transcription errors), and the Compass Soft-

ware can calculate errors based on this.

http://www.fountainware.com/compass/WinDemos/closure.htm

It's worth noting that sometimes measurements are recorded very precisely (e.g. survey distances to the mm) simply because the laser distos read to three decimal places, but in-cave measurements by hand held devices will never be that accurate! This is simply a reflection that cavers aren't professional surveyors and all measurements need to be interpreted based on the limitations of the equipment/technique used and the people using them. Cave survey sheets should include the equipment used (e.g. specify if a laser disto or fiberglass tape was used) as this has implications for the accuracy of the survey. Attached are a couple of examples of in-cave survey notes and sketches.

Resurveying a cave has been known to change the depth by 5-10m.

It appears that our practices are the envy of biologists when Arthur replied:

It is amazing how detailed and precise the work appears to be. We can only wish that biologists were equally as precise and accurate with respect to recording location.

But in a reply John Wieczrek, a colleague of Arthur, posed these comments:

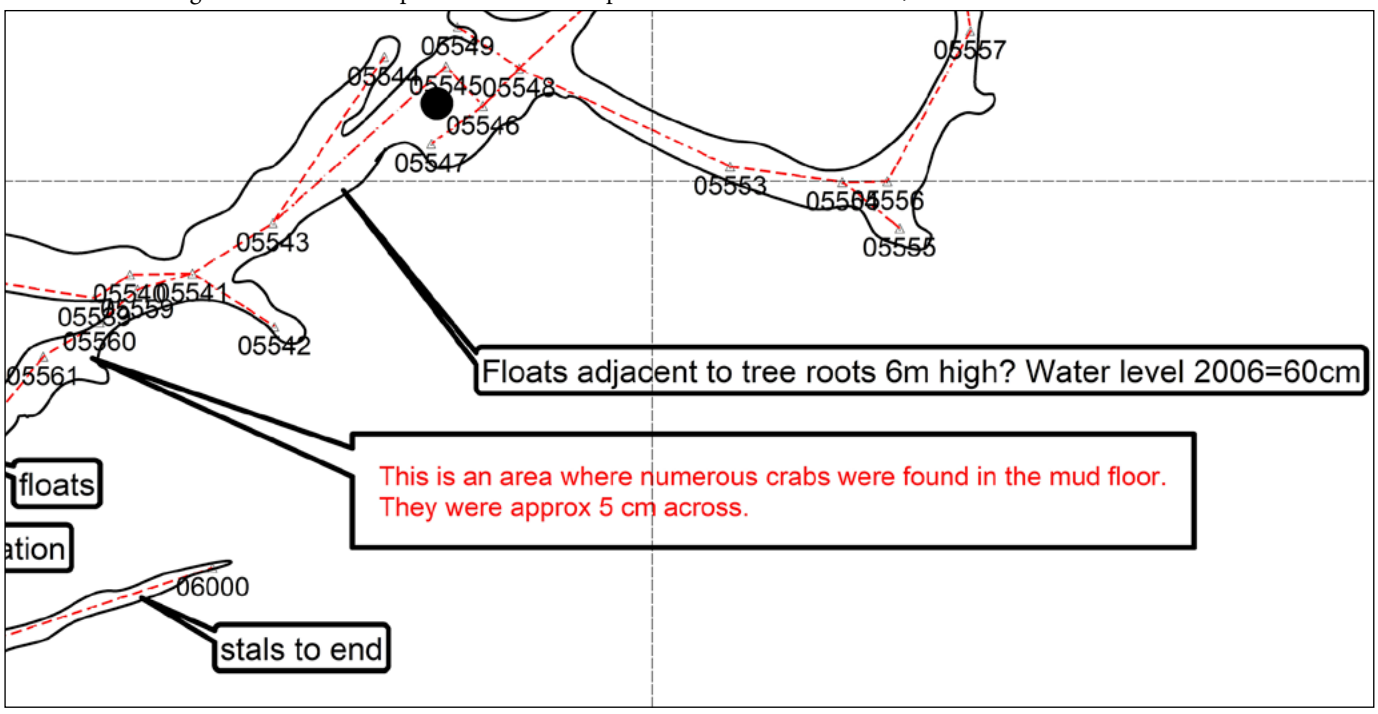
Ultimately we are trying to give best practices for how to record absolute location as well as possible within the constraints of the terms in the Location class of the Darwin Core standard (http://rs.tdwg.org/dwc/terms/#location), which offers the following:

- Decimal latitude;
- Decimal longitude;
- Geodetic datum;
- Coordinate uncertainty in metres;
- Minimum elevation in metres;
- Maximum elevation in metres;
- Minimum depth in metres;
- Maximum depth in metres;
- Minimum distance above surface in metres; and
- Maximum distance above surface in metres.

The hope would be that with these, the user of the data shared this way could find the same spot in the cave where a specimen was taken, or where something was observed - even in a core sample at the bottom of an underground lake! Looking at all you have sent us, I think the person using information encoded this way in Darwin Core would also need to have the cave map handy, plot the location on it, then go in with the map. Can you anticipate anything that would be "lost in translation" this way?

Bob replied, saying that in the real world, place a note on the map as a couple of members who collect specimens in Australia do, as shown below and hope that the next generation to use the map will be able to find the location of what was found. But if it is a complex maze cave or the cave subject to flooding, the specimen may never be found again or that a predator species may have consumed the specimen that was found.

***So, is it time the ASF revised its survey symbols in light of* Georeferencing Best Practices?**



Specimen georeferencing map

FURTHER READING:

Longley, Paul A., Goodchild, Michael F., Maguire, David J., Rhind, David W. 2006 *Geographic Information Science and Systems* 2nd Edition. Wiley Publishers

Kershaw, B. 2018 New Ideas in Cave Mapping and Navigation, *Caves Australia* 204: 6-7

STC: https://southerntasmaniancaverneers.wordpress.com/

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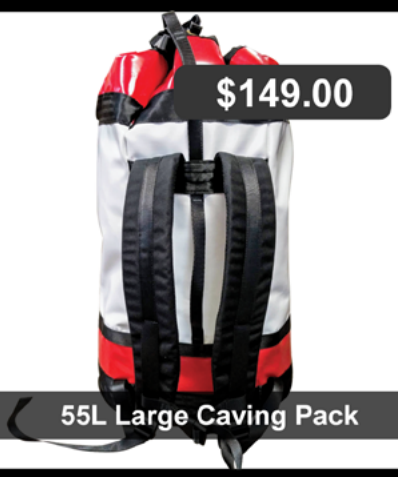

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