CAVES The Journal of the Australian Speleological Federation Inc. AUSTRALIA

Exploring Elk River Part 2 Tasmanian Cave Rescue Juukan Gorge • Cave Phones

No. 214 • DECEMBER 2020





COVID-19 is still disrupting international travel and events. Many events are now providing virtual attendance options. Information on UISsanctioned events can be viewed at http://tinyurl.com/y7rgb8ah

Don't forget that 2021 will be the International Year of Caves and Karst. You can find more information about what's going on and what you can do to help the cause at http://iyck2021.org/

EDITORIAL

JOHN has used up all the space on this page with his swan song report so I need to keep it brief.

Thanks for your efforts as President, John, and we all hope you enjoy your post-presidential period and all the pension and perks which come with it.

This issue, amongst other things, we see the second instalment of Peter Freeman's Elk River exploration article and a brief account of the recent rescue of one of our own from a Tasmanian cave.

I hope you enjoy this issue and the holiday season in whatever city or state you're locked down in and hopefully we can get back to normal caving duties before too long.

2020 is drawing to a dramatic close and 2021 is threatening to provide a thrilling sequel. Seatbelts on.

— Alan Jackson

President's Report

 \mathbf{S} O IT IS that all good things must come to an end — this is my last report as President as, after seven years in this role, my time is up at the next Council meeting.

It has been a pleasure being in this role and serving along with the Council members and I thank everyone for your hard work and support.

I look forward to a smooth transition with the next President you vote in and wish them an enjoyable and productive tenure.

In the meantime, let's take a look at some of the events of the past few months.

The ASF Executive have set up a Media Commission with Corey Hanrahan as the inaugural Commissioner — welcome aboard. This commission aims to help promote both Clubs and the ASF, and engage with the media and the wider community.

The ASF has published a Media Manual for the use of all. It is there not only for when we need to respond to an emergency, but for use by clubs on how to best deal with the media in promoting the club with positive good news stories. The manual is available at https://tinyurl.com/yxl8r2l9

If you have upcoming events or exciting news and achievements to promote, get in touch with Corey and his team. The ASF also has grants available, through the Grants Commission, for Club promotional materials.

It is also interesting to note the Media Commission received a baptism of fire when during their first video meeting, the Tasmanian participants were interrupted due to a caving accident in the Mount Cripps area. This was a successful rescue with excellent coordination by Tasmanian emergency services and cavers. There has been a great working relationship between Tasmanian stakeholders over many years. The training and exercises have been time well spent and our ASF member is safe and recovering at home.

Don't forget to add the upcoming 17th



DARREN BROOKS

ASF Caving Conference in Ceduna to your forward plans for 2022. Welcome BBQ 16 April 2022; Conference 17 to 21; Nullarbor field trips 22 April to 1 May. Start planning.

2020 has been an interesting year, with many challenges, but also many opportunities to do things in a new way. So where opportunities exist for caving areas to open up, follow the advice and regulations of your state Government, get out, go underground, and enjoy.

And as I sign off I would once again like to thank the Commissioners, The ASF Executive and the other volunteers who make the ASF run so well. If you have some spare time, consider volunteering or nominating for a position. I have found this extremely rewarding.

And finally, a big thank you to my best mate - my wife - who makes me smile and laugh every day and whose constant support allows me to volunteer time and energy for the things I am passionate about.

Wishing you and your families a safe and happy festive season.

Yours in Speleology

- John Cugley



CAVES AUSTRALIA

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Cover: Sandy Varin in Elk 2, Elk River. Photo by Liz Rogers

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The Exploration of Elk River Part 2

Peter Freeman VSA

In Part One you read about the excavation and exploration of Elk River Cave at Buchan, Victoria, by the Victorian Limestone Caving Team, followed by the discovery of over a kilometre of Master Cave stream passage by cave divers Agnes Milowka and Jim Arundale. The story continues here.

THE INTERMISSION YEARS 2011-2012

Although we didn't know it at the time, the August 2010 trip marked the end of the first series of dives, now collectively referred to as the 'Elk River Diving Project'. Agnes spent the last weekend of January 2011 helping me explore and dig in Davies Cave (soon afterwards to become Victoria's longest). Sadly, that was our last time together: exactly four weeks later she met her tragic death in Tank Cave. Later in that same year Jim returned to the UK to take up a position as the master of a merchant ship. Therefore the two principal divers for the Elk River project were no longer available and the question of "what happens in and after sump D6" languished.

Fortuitously, in the middle of 2011 VSA experienced its second influx of cave diving talent and those divers soon sensed that Elk River was the place to be. The first serious conversation about picking up the challenge, between myself, Liz Rogers and others, occurred at a VSA Christmas barbecue in Melbourne. This was followed on 24 January 2012 by a meeting at my home to discuss strategy. Present at the meeting were Liz Rogers, John Dalla-Zuanna (JDZ), Wayne Johnson, Lynne Amore, myself; and James Arundale by phone from the UK. Our meeting confirmed everyone's interest and an action plan was agreed. We recognised that a long and tactful lead-up would be required before any caving could occur.

Liz Rogers was the most enthusiastic of the new VSA cave-diving cohort. She was an accomplished diver (from an accomplished cave diving family) and a renowned underwater photographer. She already had a connection to Elk River Cave in that she had long been a close friend of Agnes. Liz became the Director of the new project and opened up a productive communication channel with Parks Victoria. I had kept Dale Calnin, the Chief Park Ranger at Buchan, closely informed of events during the first project, and we knew that it would be essential this time too. Fortunately, Dale understood the historic significance of these explorations and he was receptive to our plans, now to be known as 'The Master Cave Extension Project'.

During the first project Chalky Thomas was a frequent and valuable member of the support team. Sadly, he does not appear further in this story as he was diagnosed with MND in 2013 and died in 2015. However, dry support gained another consistent participant: David Rueda-Roca. David had arrived in Australia from Spain in 2011 and contacted me via Jim Arundale. He'd been referred to Jim by UK cave diver Jason Mallinson, whom he had met while supporting the cave diving at Pozo Azul (and who later paid a guest diving visit to Elk River).

THE NEW PROJECT BEGINS

The first visit by the new team to the now-two-kilometres-long Murrindal Potholes Eastern Master Cave occurred on 26 January 2013, one year after the planning meeting. Liz Rogers was the lead diver. All the other divers who had participated in



the meeting were unavailable, and so Liz called in, at the last-minute, the assistance of two close cave-diving companions -Sandy Varin and David Bardi. This couple were already known to me - they had participated in one of my Davies Cave trips in 2012. With David Rueda, Ken Murrey and Rowan Bulpit joining me in dry support (all of these had participated in my exploration of DD31 at Drik Drik), it was clear to me that we had a supremely capable team to continue Jim and Ag's work.

On the divers' first day in Elk - Australia Day - sump D4 (fourth sump downstream) was reached. Photos were taken by Liz and a missing piece of the survey was completed: the winding inlet passage that enters from the west near the D2 sump pool. This first visit set our standard trip pattern: a quick pitch-rigging descent by the dry support team on Friday evening, a long-duration penetration attempt by the dive team on Saturday, and a gear retrieval and de-rig descent (by the dry team or by both) on Sunday.

The trip also instantly acquainted the new dive team with the nature of the cave: its tight and difficult dry approach to the stream passage through Baby Berger Cave, including the partial descent of an awesomely wide and deep shaft via SRT followed by an audacious (and initially un-nerving) departure from the rope into a hole in the wall of that shaft; the awkward flat-out crawl down (and, even worse, back up) the claustrophobic Balcony Tube; the challenging tight dive through sump D1; and the beautiful stretches of airspace streamway. To emphasise the first sump obstacle, here is Liz's description, made after her first experience of taking her underwater camera through it:

"This sump is a difficult dive, and getting the housed camera through it can be interesting. Jim Arundale was the first person to pass it. Over a number of attempts he pushed his way through the short underwater distance to the other side. The most pertinent feature of the first sump isn't the



length though, it's the height. The fact that I can fit the camera housing through means that the sump is at least 28 cm high - but I'd be very surprised if it was much more than that. The dive through can therefore be a bit exciting. After a crouching, crawling and roof-sniffing journey down the stream from the gearing-up spot, there's a nice pool to stand in while putting your tanks back on. Once prepared you kneel in the water, grab the line firmly in one hand and wedge yourself into the (underwater) flattener. Forward progress comes from wriggling on your belly and pushing with your toes against the roof and floor. The rock ... ridges ... have a nasty tendency to grab at gear and hold you back. ... It's also as silty as you would expect. If we haven't spent too long standing in the mud and gearing up, then the first person through might see something, but the ones after that definitely don't."

Most of us on this first descent in the new project would have been surprised then to hear that it would be trip number one out of twenty-six, over a period of more than four years.

THE NEW DIVERS REACH SUMP D5

Enthusiasm being high, we returned one week later. Liz was absent, but Ken Murrey, only assisting in dry support on the previous visit, joined Sandy and David on the dive team. This time sump D4 was passed, D5 was reached, and air tanks for future trips were deposited. The tank dump was near the location later to be known as Camp Fireball, just upstream of sump D5. The underground duration for the divers was 14 hours: this, and even longer durations, would become normal. On this first journey, route finding down the unfamiliar Long Streamway (Elk 5, between sumps D4 and D5) was a delaying factor. Since we had done two successive weekends we now optimistically planned weekly visits, so the cave was left rigged.

SUMP D6 IS PASSED AND M14 IS SURVEYED

In fact it was two weeks before we were at Buchan again. The dive team had expanded, Steve Fordyce now joining Liz, Ken, Sandy and David. This group of five divers would become the core explorers in the epic Master Cave Extension Project: an adventure about to unfold. Steve, the youngest member, would eventually prove to be the most intrepid and productive explorer in the project. Steve and I had caved together many times by now, at Davies Cave, at Bungonia and in Exponential Pot. EXPLORATION

Also, three new cavers joined the





support crew. Tom Porritt was an experienced caver, originally from Victoria but at this time visiting from Queensland, Alen Milosevic was an experienced vertical caver visiting from Croatia, and Topaz Aral was a friend of Rowan. The required equipment now filled eleven large packs, and so portage and haulage was a demanding component of the trip. As support withdrew from the cave, leaving the divers to their work, Tom and I performed a survey from the base of Uncles Aven out to the surface. My map was growing again.

The diving push was spectacularly successful. Only Liz and Steve went through sump D5. Being almost as far as anyone had ever penetrated the cave, Liz plunged into D6, went quickly to the former limit in clear water, tied on her exploration line, and swam straight out of the sump's far end into Elk 7. That virgin airspace, around fifteen metres in length, was named Liz's Room. After a suitable pause, Steve followed her line through; and the next sump, dropping vertically at the far end of the chamber, was assessed.

Ag and Jim, in their cloud of silt four years previously, had been only ten metres short of passing D6! Their reel was later to be seen two thirds of the way through the sump, but lying on the floor in a deeper part. It had presumably fallen out of the rock-cleft into which Jim had pushed it and it was removed during a subsequent cleanup. Ag's slate with its smiley face was also found. It was taken through the rest of the sump, and now hangs, out of the water, in Liz's Room.

With the time underground being 16.5 hours, a journey to the sharp end of the exploration was now a marathon undertaking, and would become ever more so.

SUMP D7 IS ENTERED

It was mid-April before we again had our ropes strung through Baby Berger. Tasmanian guest diver Andreas Klocker accompanied Liz, Steve and Ken. Today's push diver, Steve, went with Ken as quickly as possible to Liz's Room, where he swam



vertically downwards into sump D7.

This was a different-feeling sump. Steve was in clear water, so he could see how the passage descended, turned back on itself, levelled out, and turned again to reach a restriction. This was a square section, about 60 cm in dimensions, but it was between secure and clean rocks so there was only a brief hesitation. Around 30 m on he surfaced into a closed airspace. With nowhere to climb out, he tied his line, re-submerged and swam on. Twenty more metres and he surfaced again. This airspace at first seemed to branch off to the right, but it turned out not to continue in that direction. Again Steve tied the line, submerged and continued, with the passage descending between tall walls and with plenty of space and one more small air bell. A little further on he ended his exploration for the day. He'd laid more than 80 metres of new line.

Meanwhile Liz and Andreas had halted just before sump D5. They did some photography and explored up the Escalator (traversed three years earlier by Jim, Ag and Mark). Fifteen hours were spent in the cave, and a very tired team, as usual, emerged into the night on the Potholes Reserve. The same team, and I, hauled eleven packs out from Uncles Aven the next day.

Visits to the master cave in May, June and July did not extend the cave, but there



was progress on other fronts. Liz surveyed most of the way through D6. Catherine Hemley and I surveyed from Uncles Aven to sump D1, allowing me to dispense with reverse-engineering of the VLCT map. Safety improvements were made at various points in the cave. An improvement in our dry-cave rigging was the installation of a semi-permanent rope down the Balcony Tube and a short length of wire ladder down the 2 m drop at its lower end, which made the return journey easier and reduced the chances of a fall at this tricky point.

THE GREAT FLOOD

The weekend of June 15/16, when Liz and Steve were joined by Stefan Eberhard, and by Wet Mules Ken Smith and John Dalla-Zuanna, had been preceded by prolonged heavy rain, and rain was still intermittently falling as we entered the cave on Saturday morning. The effect was dramatic: Baby Berger was awash. Everywhere, from the surface shaft downwards, was running with little streamlets, and Elk River itself was flowing strongly. The upper roof sniff had effectively sumped: I looked into it optimistically, but was sternly told by Liz not to be so silly as she began to lay a dive line through it. All the divers dived through it, and through the lower sniff, but at the first real sump caution prevailed. The sump pool is normally hardly above knee depth, but this time Liz was "standing in chest-deep swirling brown water".

A return was begun, with the water level rising further. By the time of Sunday's pack retrieval and de-rig, with rain still falling, the cave was almost unrecognisable and quite spectacular: there was a rather scenic little waterfall at each drop in Baby Berger, and a rather noisy big one on the 40 m pitch. Despite the flood, Steve managed to survey in the upstream direction as far as sump U3 - Ag's far point. The strong flow probably assisted by maintaining good forward visibility. Stefan collected an invertebrate sample from the cave stream - possibly a new species of isopod.

An additional activity planned for the trip was radio-location. Ken Smith had briefly provided me with some training in how to use his Pinger, and we verified that



the signal could be received, at least from the upper part of Baby Berger. However, the trip curtailment by the flood put paid to those plans - for now.

PROGRESS IS MADE IN D7

Progress resumed in October. Tim Muscat, who'd participated in dry support, graduated onto the dive team, this time joining Liz, Steve, Sandy, David, and Ken Murrey. We entered Baby Berger carrying eight cave packs.

Beginning with this trip I began to receive really useful data from Steve's wristworn dive computer. In processed form it can show a graphical version of a sump depth profile, which was invaluable to me in verifying the integrity of in-sump survey data (which is written on waterproof notepaper by the diver as he follows the dive line).

David and Sandy were the support divers, so they halted to wait at the usual equipment dump just upstream of D5. In sump D7 Liz and Steve dived together and laid another 150 m of line in gradually deepening water. During her return swim, Liz surveyed the whole way back through that sump, despite becoming very cold, and added the final shot to the unfinished D6 survey.

SUMP U3 IS PASSED

While Liz, Steve, David and Sandy were busy downstream, Ken travelled solo upstream following Ag's line to the outflow of sump U3, and then successfully passed right through that sump, which turned out to be quite short. Beyond it he entered and partially explored a significant airspace section ('Ken's Room', of course), and surveyed that and also the sump that he'd passed. Having over-stayed his expected return time and knowing that Tim, back at Uncles Aven, would start to worry, he reluctantly turned around, despite more open airspace passage being in view ahead.



Trip durations in the project were still quite daunting. On this Saturday the fardownstream divers were underground for 16 hours, Ken and Tim for 13 hours, and

support cavers for 5 hours. In addition there were the pre-rig and retrieval descents, with divers assisting in the retrieval. My records show that this time we took down 12 packs and came out with 15. We all remember the dismay that would greet the news that Liz was bringing her 'big camera'. Carried in its own special bag, this fragile item was not heavier than any of the standard caving packs, but was far more bulky and inconveniently shaped. Caving packs have a nice round cross-section, but the camera bag was rectangular. Being responsible for that load was to be avoided - it was bound to repeatedly snag.

CAMPING PROOF-OF-CONCEPT

I rigged the pitch, solo, on a Friday evening in November, ready for another, non-push visit. Our guest was the UK cave diver Jason Mallinson. He actually did dive in the frontier sump, D7, but not to the end of the line. He was impressed by the cave, and it was interesting and useful to hear his perceptions and advice about our project. He expressed a general view that short, sharp direct attacks on the leading edge are optimal. Ironically on this trip, since our divers would undertake a trial sleep-over, Jason did not favour the use of camping tactics at our stage of extension.

Objectives this time were to stage some more food and first-aid supplies and tanks ready for the next push. Liz, Steve, Sandy and David would camp in the cave overnight. While Jason and Tim came to the surface after 8 hours, the campers were underground for 29. The camping experiment was considered successful. Camp Fireball, just upstream of sump D5, was established, acquiring its name from an incident with a gas stove. Next day the support crew arrived at the top of Uncles Aven at the appointed rendezvous time, and amazingly the campers appeared below us within half an hour. Together we brought ourselves and the usual mountain of packs up the corkscrew, up the Balcony Tube, up the main pitch, and out to the surface late on Sunday afternoon. Most then went home, while David and I stayed over to take Jason for a recreational descent of Baby Pierre on Monday.

Four weeks after this trip, just before Christmas 2013, we held a tactics-andstrategy meeting (the 'Pizza Meeting') at my home. It was reminiscent of our project launch meeting almost two years earlier. Attendees were Liz, David, Sandy, Ken, Steve, JDZ and myself. We had the recent interaction with Jason Mallinson to take in; and the first in-cave camp had been held, considered by the participants to be a successful initiative. Importantly, sump D7 had been incrementally extended over eight months, but we had no idea how much farther it would go. Employment of re-breather technology in place of open circuit was therefore a hot topic. Much time was spent discussing staggered entry times for combined push-and-supply trips. Ken produced some meeting notes shortly afterwards, and although no really new practices emerged from the meeting, several practical short-term measures were agreed. They were implemented over the next few trips. Most were safety improvements: re-lining the sumps, stocking of emergency food and first-aid caches, etc.

WATER TRACING, PHOTOGRAPHS AND MOVIES

By early 2014 the Master Cave Extension Project had been running intensively for over a year. My map of the cave was clearly showing that the direction was towards the Pyramids caves and Murrindal River. It seemed most likely that the Elk water would join the Dalley-Subaqua system, so





water-tracing had been discussed for some time. Brian Finlayson and John Webb are two of Victoria's most eminent karst geomorphologists, and in order to perform a dye test they accompanied the first trip of the year (which was one of the few descents of the whole sequence in which I did not participate). Steve released one litre of liquid rhodamine underwater some way into sump 7 and Brian and John set up their detector instruments at the Sub-Aqua Cave resurgence a few kilometres away. The dye was detected about one week later and so I now added some Pyramids geography to my MPEMC map.

This visit was also a preparation for future pushing. Extra air was transported to the start of D7. Steve spent some time improving the dive line in D6 (it had always been problematic, with a persistent line-trap at one tight point) and repairing some D7 tie-offs that had been accidentally pulled off by Liz while surveying during the previous trip.



Another trip, in May, was to be a push by guest diver Andreas but technical problems forced that to be abandoned. Liz obtained some photographs from inside sumps D6 and D7, including movie footage of Andreas. Tim, in addition to also reaching into D7, obtained GoPro footage in sump D1 and in the Balcony Tube. The project would progressively accumulate movie footage of many parts of the downstream cave.

SUMP D7 IS EXTENDED

A push in June by Liz and Steve was moderately successful, extending D7 by 30 m. Most of Liz's swim after picking up the existing reel and continuing with it was in rift passage with very deep silt on the floor. The new tie-off was at -8 m to a wall projection in a 14 m tall rift, just after passing upwards through a restriction. The turnaround point was for air (Steve) and because the end of the line on that reel had been reached (Liz). Sandy and David, just supporting on this visit, were waiting on the upstream side of sump 5, and were delighted to see Liz bring the reel back empty.

BLACK AVEN IS DISCOVERED

Later in 2014, two preparation and resupply trips were carried out without push attempts, and in November Tim Muscat attempted a D7 push. However, it had to be aborted for a technical problem with the dive line attachment at the existing far end.

By March of 2015 Steve was ready to take on the seemingly endless sump again. He was supported by Liz Rogers and Ken Murrey, and five dry cavers. As usual, I rigged the cave solo on Friday afternoon, but then there was the luxury of a 3-day long weekend. The objectives were, firstly, a downstream push, aided by being able to do supply on one day and the push on the next. Secondary plans were to explore farther upstream and perform radio-location downstream.

On Saturday the fairly large group entered together and carried supplies to D1. The support team then went back to the surface to attempt the radio-location. The divers continued down the cave, leaving Ken Smith's 'pingers' floating vertically in sumps D1, D3 and D4, and staging tanks near D5 for the next day's push attempt. With that done, they returned to Uncles Aven and all three divers went upstream. Liz was using only two small 3L tanks, but to more than compensate for that she had brought in her large DSLR camera with all its paraphernalia. Underwater shots upstream were difficult owing to both the confined space and rapidly deteriorating visibility, so Liz captured some of the abundant speleothem decoration prevalent in Milowka Canal (between sumps U2 and U3) before returning to Uncles Aven.

Ken and Steve continued into Ken's Room, beyond U3. They pressed on, past where Ken had previously turned for





being overdue for his return. While Steve was shredding his wetsuit getting through a half-underwater squeeze, Ken scouted nearby and found an easier and drier parallel squeeze to reach the next point upstream. Both together again, they almost immediately arrived at the base of a surprise feature: a 10 m aven. A waterfall formed where the stream emerged from a hole in the wall about half way up, and splashed to the floor at their feet. The waterfall, and the rest of the aven, was definitely not free-climbable, so it marked the far point for this occasion. Ken and Steve surveyed out. The closest known cave to here, accessed from the surface, is M209 Black Rift. We'd formerly harboured hopes that that cave might lead into this upstream part of the streamway, but those hopes had not been fulfilled and anyway the master cave had now reached north of the conjectured meeting point. However, in recognition of M209's proximity, the waterfall received the name Black Aven. It has still not been climbed.

During the afternoon on the surface, while the divers were in the cave, the radiolocation signal was clearly received above D1. About 20 minutes was spent triangulating the fix. Similarly with the D3 pinger. Plotting the results onto the map showed only 2 m discrepancies from the expected coordinates, meaning that the survey was good, at least to there. My confidence in the map's integrity was justified. When we tried for our third and final fix at a point above D4, but on higher ground, we could receive no signal from underground. Later discussion with Ken Smith agreed that the 125 m depth, combined with interference from nearby power lines, was too much for the current apparatus.



Since our unsuccessful pinging efforts had taken us high on the Potholes Reserve's southern hill and close to a cave that had interested me for some time, we occupied ourselves with clearing scrub and blackberries from the entrance to M343 Rubble Pot. When clear enough, David and I freeclimbed to the bottom at around 20 m. It didn't go. Months later I returned three times (first with Lachlan Shore, then with Laurence Aldridge, and finally with Nina Birss) to push it deeper, but still it didn't go far enough. It is situated just downstream of sump D4 - so frustrating!

FINALLY, SUMP D7 IS PASSED

After that fairly successful Saturday, Sunday of the long weekend was the day for the downstream push. All three divers reached Liz's Room (Elk 7), and Steve, loaded with four large side-mount tanks and all the other usual appendages, set off into the sump. After a tricky manoeuvre getting himself and all that kit through D7's initial restriction, a long but steady and careful swim brought him to the end of the dive line where Liz and Tim had last been. He tied on his new line and began reeling downstream. There were no further complications but it was an extra 110 m swim and it went through the deepest water (21 m) encountered in Elk River. Eventually the underwater passage steadily rose over a short distance to emerge into walking-sized airspace.

What a breakthrough! At 366 m it's the longest sump of the cave. Steve had been the first to enter it twenty-three months earlier and it had taken six incremental advances to complete.

Only partially de-kitting, and expecting the usual miserable few muddy metres before bumping into another sump, Steve continued down the cave with little delay. The passage turned left, and left again, and left yet again before dog-legging rightwards and beginning to slowly descend. Within 20 m he was standing at the top of a series of cascades. One of these amounted almost to a waterfall with a pool at the bottom. Steve knew this was risky - he was 'walking on the Moon' - but he carefully climbed down (a permanent handline was later rigged here). Again there were only a few metres until the next surprise: the passage opened out into a huge hallway with Elk River running down the centre-line of it. With a width of 8 m, a height of 20 m and a length of 70 m, the master cave had now reached its awesome potential. Steve soon traversed to the far end to find - yes, another sump. But 110 extra metres underwater and 155 m of airspace mega-passage was enough new cave for one day: it was obviously time to turn around.

The huge chamber was named 'The Hall of Crazy Horses' (HoCH) by Steve and Liz. Steve counted its discovery at that time as the most exciting moment of his personal cave-diving achievements.

Aware that he had been gone for a long time, and dying to tell everyone his incredible news, Steve nevertheless surveyed back to D7. When I later plotted the results it appeared that the passage crossed over itself after the sump exit. In other words it performed a loop, or you might say an upwards spiral. In a linear stream cave this is a very unusual feature, and I was suspicious of it being a false impression created by a surveying error. Despite understanding my scepticism, Steve was confident of his figures. On a subsequent trip he used his camera to record a short movie sequence that proved the configuration to me.

On finishing his 155 m reverse-survey in airspace, Steve donned his dive gear at



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the D7 exit pool and swam steadily home to Liz and Ken, who had waited for 5 hours. They all laboriously exited from the cave. Their time underground was 16 hours, even though they'd carried in much of their requirements on the previous day. They reached the surface at 02:00 and returned to Homeleigh tired but exultant. We all stayed up late to debrief and rejoice, and on Monday we didn't even mind the usual laborious equipment retrieval and de-rig. It had been a momentous weekend.

On this Elk trip carbon fibre tanks had been introduced into the mix. These are lighter, and their greater strength allows them to withstand higher pressures and therefore carry more gas. Also around this time the use of re-breather scuba technology was being seriously contemplated by the team. The lower air requirement of rebreathers would ease the logistics challenge of carrying multiple tanks to the exploration frontier, but side-mount re-breather setups bring their own issues. The tactical change was therefore being considered very cautiously. Now, the break-out from sump D7 provided vindication of current opencircuit tactics and re-ignited enthusiasm to press ahead.

Three further dives occurred in the remainder of 2015. Two were resupply-only trips. On the first of these, where dry support was by Sandy and David plus new-to-Elk cave diver Craig Howell, Steve located a new branch sump on the north side of Elk 4 and named it 'Surprise Sump'. It has not been pushed hard, and is probably insignificant. That trip's real objective was resupply only, and similarly for the next one. The fourth 2015 descent, on which newto-Elk cave diver Ryan Kaczkowski joined Ken and Steve, was intended to extend the survey in sump D7, but it was aborted for a technical failure.

SUMP D8 – INFINITY

Finally, in early 2016, major progress was again made, by Liz and Steve accompanied by Ryan. Several 7L tanks that had been pre-positioned at sump D7 and elsewhere in the second half of 2015 al-



Infinity Sump survey notes

lowed their uneventful emergence from the far end of D7 with plentiful spare air. The sump's final 110 m, discovered by Steve ten months earlier, were surveyed on the way through by Liz.

Their first action on surfacing into D7's exit pool was to video a short movie sequence from the line tie-off, around three consecutive 90-degree left turns, and almost into the Hall of Crazy Horses (HoCH). The exercise was prompted by my suspicion of firm the very unusual configuration, and I couldn't resist labelling it the 'Crazy Spiral' on the map. Liz descended the 10 m waterfall, this time with the safety of a handline and with Steve recording a video of the manoeuvre. They were both very soon in the HoCH. This, the largest chamber found in Elk River Cave, had been seen previously only by Steve. Liz, having prepared herself for disappointment owing to the usual cavers' exaggeration, was duly impressed. There was also regret however, because Liz's big camera had been left behind near sump D4 where it had been found to be inexplicably dead. For now, Steve's GoPro would have to provide the only record

the survey integrity in that area. It did con-

After depositing an emergency pack of camping gear, all three divers travelled to the known downstream end of the cave: sump D8, described by Liz as "blue and beckoning". It had been named 'Infinity



Sump' already by Liz and Steve, based on their expectation of a lengthy one, but when Liz dived she surfaced after an easy and shallow 18 m. The new airspace (Elk 9) was named, of course, 'Beyond Infinity'.

Steve and Ryan swam through to join Liz. Continuing on, they climbed down a 2 m waterfall after about 140 m before turning right to head eastwards again. They shortly reached yet another sump, D9. This one was tackled by Steve, but only after the whole group had spent over an hour backtracking to the end of D7 to collect more tanks! Fortunately this second new sump of the day was another relatively straightforward obstacle, about 45 m long, reasonably large, and shallow. They soon discovered, via 'coooo-eeees', that voice communication was possible past the sump via a high parallel passage. Although it is too far out of reach to use as a bypass, it did mean that Steve was technically still in Elk 9, not Elk 10. He had emerged into a rather muddy area, and the only immediately available tie-off for his line was a mud bank at the left side of the sump exit. He stuck a pencil into the mud and tied the line to it! This part of Elk 9 became known as 'Pencil Passage'.

While Liz and Ryan remained back in



the earlier part of Elk 9, Steve noted that there was a deep pool after only a few muddy steps. At this stage he assumed this pool to be sump D10. Declining to address it right now, he instead clambered up the steep slope on the north side and explored for about 80 m along a dry but muddy and sometimes low passage. It ended at a 2 m drop, which Steve hoped might reveal a continuation that could bypass the new sump that he had noted back at the lower level. But now he turned for home, making his way back to join Liz and Ryan. He had been gone for 75 minutes. They had bagged two sumps and around 300 m of new passage - not a bad day's work.

CAMP LUXURY

X P L O K A L O V

The journey out was routine except for the fact that, as planned, they slept in the cave for one night in order to exit refreshed. Their camp-site was not Fireball, but a new one, Camp Luxury, set up in advance part way along Elk 5. Fireball, despite the initial enthusiasm, had turned out to be rather cramped and damp. The total time in the cave for the divers was 31 hours. The support crew met them at midday on Sunday in Uncles Aven.

The next two trips (one of which included new-to-Elk diver Brian Heddon) were simply for equipment retrieval and re-supply, but July 2016 saw a push at the new far-end. Steve, Sandy and David went all the way through to Pencil Passage. Hoping that it would continue after the 2 m drop previously sighted by Steve, and thus provide a dry route onwards toward their Dalley Cave goal, Sandy and Steve first went that way. Alas, it was not to be: only a little further on they came to a rockpile blockage, which was impassable and appears to have no likelihood of being excavated.

Back at the pool in the floor, David attempted to dive it and find a way on, but by now the silted water from the sump upstream had flowed into it and visibility was very poor, so the underwater lead had to be abandoned too.

The team were very tired at this point, having been caving hard for a continuous twelve hours. And now, as they returned through sump D6, the cave didn't want to play the game properly! There was plenty of air left since the far-sump push had been aborted, but the line through D6 had moved into a line-trap and, in zero visibility, they couldn't find the way through. They each had a turn, but each returned to the sump pool to let someone else have a go. On Steve's second attempt he managed to get through, and surfaced in the homeside pool. After waiting for an increasingly anxious hour, trying to stay awake and not freeze to death, he reluctantly re-entered the water to find David and Sandy. Predictably, they had just got past the line-trap! After a confusing underwater meeting, three divers managed to all end up on the correct side of the sump. By the time they finally met up with Liz, waiting at Camp Luxury, it was 05:00 and they were exhausted. Despite occasional scepticism and second-thoughts about the in-cave camping, this experience proved its worth.

THE FAR END, AT LAST

The rest of that year saw only an equipment retrieval and photography entry, but in May 2017 after a nine-month hiatus the same team descended again through Baby Berger and its tortuous access route to challenge the second half of sump D9. Sandy and David helped get a large amount of air through to the start of sump 5, before going back upstream to camp. Liz and Steve pressed on along the long but now familiar journey to D9. There Steve began a solo exploration. He stopped underwater just before the Pencil Passage airspace chamber, attached direction arrows to the line, tied on his new line, and with reel in hand he branched off towards a small hole on his right hand side. He'd been studying this hole for some months, thanks to a GoPro recording from the last trip. With very little delay, in order that his silted water didn't flow past him, he entered the hole and swam forwards. Leads were vaguely noticed on his left, these presumably connecting into the pool that David had briefly probed in silt-soup ten months earlier. His continuing progress confirmed that Pencil Passage is only a half-way house along the one substantial sump, the two parts of which could henceforth be confidently designated as D9A and D9B.

He swam for only 30 m, in good visibility but through two more restrictions, before surfacing into the real Elk 10. This chamber was about 20 m in length and a few metres wide, leading to yet another sump in the form of a large round pool enclosed in a circular dome. A place to tie the line was found and sump 10 was entered. Steve swam down for about 7 m in a conical funnel, finding the outlet at the bottom: a central hole (the 'Plughole') with a large blade of bedrock lying across it. On one side of the blade the hole is open, and he tried hard to squeeze through it, past the blade, but to no avail. On the opposite side





Stefan in one of the squeezes between Uncle's Aven and D1, in high water, emerging from Upper Roof Sniff.



Dave, Sandy, Steve and Liz Rogers on self timer with the camera perched on top of a waterfall in Elk 5 the morning after our first overnight sleep at Camp Fireball



RAPLORATION



Tim Muscat under the bridge formation in Elk 2



Steve starting a dive into D7 heading downstream, carbon fibre tanks underneath with steels on top, silt pegs bungeed in and reels fully loaded.



Steve, Hall of the Crazy Horses, camera looking upstream



Underwater in the start of D7 looking downstream, piles of silt just waiting to be disturbed.



The Exploration of Elk River Part 2



Steve, Beyond Infinity, standing in trickle of streamway, camera looking upstream



Dave coming back through Elk 2

of the blade the hole is blocked by loose rocks embedded in silt and mud. Steve assessed these as perhaps being movable, and so some excavation could (on another day!) provide a way past.

After these observations he surfaced. Alone at this location and feeling very remote, he was within 275 m of our goal, Dalley Cave, and at the same altitude. He captured some GoPro footage and briefly inspected possible airspace leads, and then swam back to Liz and told his tale. They made their long, lonely, heavily-loaded journey out, meeting up with Sandy and David at Camp Luxury for a well-deserved sleep.

It had been accepted that further push diving would not occur for some time, if at all, so a final visit occurred four weeks later. All equipment was retrieved from the dump near D5 (the day's far point) and almost all from Camp Luxury. After nearly five years, the second project was over.

CONCLUSION

The team recognises that extending the cave downstream has become difficult and hazardous. The exploration front is at the end of a very long supply chain, with the logistics therefore becoming progressively more challenging. Trip durations of eighteen hours non-stop for the divers have become normal, and more than thirty hours when including a camp. One trip took in and brought out eighteen packs. Also, dreams of finding another entrance that would avoid one or more of the downstream sumps have faded.

To set against all that, the core participants are now well-practised, the route down to the water and through the Master Cave to the longer sumps has become familiar, there is reliable dive line to the end of the cave, pack handling through Baby Berger's Balcony Tube has become streamlined, and the use of re-breather technology is a possibility. When, or whether, the underwater challenge will ever be taken up again remains to be seen.

The upstream direction is not so daunting. Its prospects for revealing wondrous cave passage are low, but it would be nice to know what, if anything, is at the top of Black Aven.

In statistical terms Elk River is the second longest (3130 m) and the deepest (135 m) cave in Victoria. It's arguably also the most important, finally revealing the



hydrology of the state's pre-eminent caving area. And the most beautiful: what a pity that so few people will ever see it! If I added that it's the most difficult and 'sporting' cave I would be guilty of the most profound understatement.

Although no new entrance has been found into the master cave, in either the upstream or downstream directions, we do know that the water re-appears at the outflow of M26 Sub-Aqua, and so Elk River will connect to somewhere in M35 Dalley. The upstream Dalley explorations in the 1980s ended in rockfall. With that point being only 275 m away from the Plughole and at the same altitude, the most practical and safest place to pick up the challenge will be there. Good luck to all future explorers - and please write the final chapter of my story for me.

NOTES

- Not all supporting dry cavers have been individually mentioned above, but their help is gratefully acknowledged. In addition to those named in Part 1, they were: David Rueda-Roca, Rowan Bulpit, Topaz Aral, Tom Porrit, Alen Milosevic, Ian Barnard, Chan Maneesilaran, Seamus Breathnach, Jason Goldstein, Michelle Doolan, Brian Finlayson, John Webb, Nina Birss, Bradley Dohnt, David Ramm, Oliver Tomlin, Melanie Roberts, Craig Howell, Abhijeet Anand, Lewis Clarey, Peter Stoner, Liz McCutcheon, Lachlan Shore, Amy Robertson, Dan Mitchell.
- 2. This two-part account is condensed for *Caves Australia* from a longer single document. That full version is available to bona-fide interested parties from the author on request. A comprehensive 'Atlas', and descriptions of the complete cave system, are also available.

Cave Animal of the Year 2021 What will it be?

Production of our Australian Cave Animal of the Year materials is now in process and we will launch our 2021 effort at the ASF Council Meeting on 10 January 2021.

Our exciting 2021 materials will be available after the launch date.

Please get ready to support our 2021 efforts for cave animals and place your orders for posters, bookmarks, stickers and cups at: hello@caveanimaloftheyear.org.au

www.caveanimaloftheyear.org.au



Cave Rescue — Mt Cripps Karst, Tasmania

Alan Jackson

HOPE we're all wasting our time and will never need to put this into practice.' — David Wools-Cobb after practically every rescue training exercise he has attended.

On 10 October 2020 a joint Southern Tasmanian Caverneers/Savage River Caving Club trip to CP11 Snowy Mountain Cave in the remote Mt Cripps karst area in Northern Tasmania resulted in serious injury to a caver and a full rescue involving Tasmania Police, Ambulance Tasmania, State Emergency Service and members of the four Tasmanian caving clubs.

The rescue was conducted successfully and efficiently and has been largely considered a great success by all participating agencies. Of course not everything went perfectly and lessons have been learned for doing it better if we're unfortunate enough to have a 'next time'.

This article does not intend to provide an exhaustive account of the incident and ensuing rescue but rather a synopsis of events. Full details will be published in the Tasmanian caving club newsletters like *Speleo Spiel, Troglodyte, Illuminations* etc. for those interested in the nitty gritty.

THE CAVE AND THE INCIDENT

A party of four cavers (Serena Benjamin – STC/NC, Paul Darby – SRCC, John Oxley – STC/MSS and David Wools-Cobb NC/ SRCC) visited CP11 Snowy Mountain Cave in the Mt Cripps karst area in central northern Tasmania — west of Cradle Mountain, approximately one hour's drive from the nearest major population centres of NW Tasmania, Devonport and Burnie. Lyndsey Gray (SRCC) was also present but was to be based at the hut (i.e. not caving).

Snowy Mountain Cave is a ~270 m long, 21 m deep cave located approximately 1.5 hours walk from Savage River Caving Club's hut (Th'ut) via a variety of dense rainforest and patches of post-bushfire regrowth on steep slopes. The entrance is located in the side of a steep-sided doline after which about 80 m of crawling and



The rescue helicopter arrives to extract the casualty

stooping passage is followed to an 8 m pitch. A \sim 3 m free-climb is located halfway from the entrance to the pitch. Beyond the pitch is a series of well-decorated horizon-tal passages.

The party entered the cave around 1100 hours on 10 October 2020. The 8 m pitch was negotiated using an 'electron wire' standard caving ladder with an 11 mm belay rope rigged parallel. The pitch is rigged from a ~2 m diameter chockstone a few metres of crawling/stooping back from the pitch head and the ladder sits in a low point, hard up against the lip of the pitch, in a channel which contains a small stream. Beyond the initial lip the pitch is free-hanging. All four cavers descended the ladder with only one, John, electing to be belayed. It was wet and unpleasant. Much photography and touristing was enjoyed.

Returning to the pitch, David headed up first (unbelayed) and found he was unable to negotiate the lip of the pitch where the ladder was jammed against the wall. He was encouraged to climb back down and during this process he fell from the ladder from about 2.5 m above the floor, landing on his back. It was around 1400 hours. He was wearing a cave pack with Pelican cases containing photography gear. The floor was an uneven flowstone surface (i.e. not very forgiving). David remained conscious and could move his feet and hands. With assistance from the other party members he was relocated to a dry ledge a few metres away from and above the pitch floor, out of the water.

THE INITIAL RESPONSE

After initial assessments Paul and John exited the cave to raise the alarm while Serena (Registered Nurse) stayed with David. The walking route was re-flagged to make it easier to follow. Th'ut was reached around 1615 hours and phone reception was sought several hundred metres back up the road. Paul contacted Police and Northern Caverneers. John contacted Southern Tasmanian Caverneers. Paul stayed with the phone to deal with the Police process while John returned to Th'ut, gathered warm clothing, sleeping bag, sleeping mat, fuel stove etc. and returned to the cave to resupply Serena and David. David later considered that having insulation and warm gear had been a game changer, as at that stage he expected to die of hypothermia. John was also asked to retrieve some food and gear from the packs outside, which he did before returning to Th'ut in darkness and drizzle.

In the meantime, the emergency response callout process at Police, Ambulance Tasmania, SES, NC, MCCC and STC swung into action. Available people and resources were mobilised via helicopter and road.

THE RESCUE

Personnel starting arriving at Th'ut from around 2000 hours. There were plenty of logistics to sort out, plus a few delays, and an advance team of Police, paramedics and SES were guided to the cave by Paul Darby, setting off from Th'ut at around 2230 hours. This party was slowed by the difficulty in following the track in the dark and drizzly conditions and time was invested heavily taping the track for subsequent parties. A second group (including the main





contingent of cavers) set off for the cave at around 2300.

The first of the second group reached the cave very shortly after the advance team, as they were able to follow a much improved track that had seen many more people walk on it and lots of extra flagging tape. At around 0100 hrs a small core group of Police, paramedics and cavers entered the cave to assess the casualty's and Serena's condition and formulate a plan for extraction.

Serena opted to stay with the casualty and assist the paramedics. The paramedics did their thing and administered pain relief. The Police, SES and cavers set to work. Comms (Michie phones) from the entrance to the top of the pitch were installed and operational by 0210 hours. Parts of the cave were quite tight and there were concerns that the Petzl Nest stretcher would not fit through some sections. For this reason, the casualty was 'double-packed' into an Oregon spine splint stretcher as well as the Nest so the low profile Oregon could be used rapidly if required in the tighter sections. The following obstacles required dealing with (refer to annotated map - Figure 1):

8 m pitch

Cavers installed and operated a triple $\hat{\Xi}$ bolt load share anchor in the ceiling above

the pitch with a counterweight placed to hang down the dry gap between the two waterfalls on the pitch. This would get the casualty from the dry ledge to pitch head (in the vertical stretcher orientation).

Police and cavers set up a simple 1:1



Cavers and ropes everywhere on the second pitch

haul with progress capture from the large natural chockstone rigging point to land the casualty atop the pitch. A 'head-foot' stretcher manoeuvre was performed at the pitch head to 'post' the stretcher into the low ceiling space landing at the top of the pitch. Two cavers (on safety lines rigged to the chockstone) operated the counterweight and steadied the stretcher during the head-foot and landing. AVVE RESC

Chockstone Squeeze

The large rigging chockstone largely blocked the passage. There was an option to go under or over the chockstone but both would require enlarging to fit the loaded stretcher. The over option required removal of numerous speleothems and under required removal of mud and gravels from the stream bed.

The traditional caver route at this obstacle is under, so that route was chosen. Despite the removal of mud and gravel, this was still an awkward hole and the stretcher was rotated almost 90 degrees at times to fit through. At this point a small chamber allowed for personnel to easily overtake the stretcher and prepare for the next section.

Mud Crawl

Narrow, low but straight stream passage. The first half of this passage was wide

CAVE RESCUE — MT CRIPPS KARST, TASMANIA



and high enough to allow alternating and opposing cavers to squat and slide the stretcher over their thighs. The second half narrowed and had a keyhole profile with insufficient room for thigh-sliding. For two body lengths personnel lay face down in the narrow floor channel and the stretcher was slid over their legs and backs, pulled by cavers further along the passage via an attached rope.

Mud Crawl Exit

A tight window with a short vertical step from the narrow end of the Mud Crawl to the Small Chamber above. Significant 'deobstruction' was undertaken at this corner to allow easy passage of the stretcher.

Small Chamber

A small but sufficiently large chamber to allow personnel to overtake the stretcher with ease with flat and gently sloping surfaces for staging the casualty while preparing for the next vertical obstacle.

Climb

A ~3 m free-climb out of the Small Chamber was rigged as a redirected counterweight. The counterweight and two safety lines were rigged from a very large natural flowstone column. The counterweight was redirected via a releasable load sharing anchor on two bolts. Due to space issues, the counterweight person commenced at floor level and stayed there while the stretcher was passed up a steep slope, handled by the two cavers on safety lines. This landed the casualty on a sloping flowstone floor immediately before the Squeeze.

Squeeze

Quite tight (<300 mm) high squeeze with flat bedrock ceiling and slightly angled flowstone floor with a 1 m deep, 1 m diameter 'pot' immediately after the squeeze and continuing low crawling passage beyond. Various objects were 'de-obstructed' during preparation to make this squeeze larger. Initial attempts to fit the casualty packaged in the Nest failed. The stretcher was backed out, the Nest removed and the casualty reinserted into the squeeze in just the Oregon spine splint with a thin, slippery drag mat under it. Helmet off to allow him to fit. A caver filled the 1 m deep pot with their body to support the stretcher as it bridged over it.

Dry Crawl

Low, but not terrible, and reasonably wide crawling passage with a largely flat floor led to an awkward vertical step. Considerable de-obstruction was performed to permit passage of the stretcher. Sufficient room to fit the Nest was available in this section but insufficient room to allow repackaging of the casualty into the Nest, so this section was passed in the Oregon only.

Entrance Doline

Spacious passage at the entrance window permitted repackaging into the Nest stretcher. A tyrolean was used to float the stretcher over the steep and slippery, boulder, log-strewn doline floor. Three bolts in the ceiling and a triple load-sharing anchor were used at the entrance window end and a large (~ 2 m diameter) fallen log was used at the 'outside' end. The stretcher was then placed on belay (tree) and passed hand to hand up the final slope to level ground.

Helicopter Lift

The casualty was repackaged into a Stokes-style basket stretcher and passed up a hundred metres or so to a natural clearing where the helicopter could winch. The chopper came ... eventually.

The extraction commenced at around 0430 hrs and the surface was reached at around 0830 hours. The helicopter arrived around 1100 hours.

Credit goes to SES for deployment of enough people initially to provide real assistance and more people in the morning to help carry stuff out.

KEY INGREDIENTS FOR A SUCCESSFUL RESCUE

Relationships – as noted after the Midnight Hole rescue in 2017, the excellent rapport and personal relationships between emergency services (ES) and cavers played a crucial role.

While many of the relationships aren't as old and as strong in the north of Tasmania as they are in the south, the fact that the southern and northern ES know each other so well meant the cavers arrived confident that the northern ES knew their stuff and vice versa and cavers were delegated by Police to perform critical roles immediately and with confidence. The two paramedics had attended recent cave rescue exercises organised by cavers. Inter-club relationships are also arguably at an all-time high, critical on a large rescue like this with attendees from all four Tasmanian clubs. Basically, the importance of these relationships cannot be over-emphasised. This rescue has hopefully paved the way for strengthening of ES and caver relationships state-wide and catalysing inter-agency training.

Skills

Tasmanian cavers have invested a significant amount of time into all aspects of cave rescue training and preparedness over the last six or so years, with regular exercises in the north and the south of the state wellattended by Tasmanian as well as mainland cavers and trainers.

Equipment

NC, MCCC and STC have put together a significant equipment stockpile of dedicated cave rescue equipment (stretchers, rigging, bolting, comms etc.). Much of this equipment was used in this rescue and the ES were totally reliant on the comms and bolting equipment provided by the cavers. To quote First Class Constable Dean Wotherspoon from his debrief emails: 'Equipment: thank God for cavers!!'

CREDIT WHERE CREDIT IS DUE

Cave rescue equipment isn't free. Great Acknowledgement must be made of the various funding streams that have been made available to Tasmanian caving clubs in recent years. Key contributors include: Tasmanian Community Fund, ASF/ACRC, Meander Valley Council, Bendigo Community Bank (Deloraine), City of Burnie Lions Club, private donors (notably John Dunkley's estate via Jeanette Dunkley and clients of Tony Culberg) as well as NC, MCCC and STC general funds.

Skills and training doesn't just happen either. Credit must got to the ACRC (particularly Brian Evans), CRSNSW (particularly Al Warild), Ian Collette (WASG), Deb Hunter (MCCC), Janice March (NC) and Andreas Klocker (STC) for their efforts past and present to facilitate training and preparedness. It only takes one person to injure themselves in a cave but a large team to get them out.

WHAT ABOUT DAVE?

Dave is a very well-known figure in Australian caving circles. Any Australian caver worth their salt would have known Dave was the casualty after initial media coverage indicated it was a 62-year-old man from Ulverstone! While it was clear even before



The casualty emerges into the morning light on a tyrolean across the entrance doline

paramedics arrived that he had some serious injuries to his thoracic area the extent and seriousness of his injuries weren't appreciated until he was transferred to hospital.

The word during the rescue was along the lines of 'no doubt some bits broken (scapula, vertebral processes etc.) and some severe bruising'. He was so stoic and talkative during the whole rescue, even while we had him out of the good stretcher and dragging him over rocks, that everyone, Dave included, figured he'd be in hospital for a few days and up at 'em within a few months. Upon presentation to the North West Regional Hospital in Burnie the Xrays and scans indicated it was more serious than that and he was promptly transferred by air to the Intensive Care Unit at the Royal Hobart Hospital.

The initial damage bill was fractures to both scapulae, five ribs and five vertebral processes, one spinal fracture but no neurological damage and a pneumothorax. There were a number of sporadic complications with his lung and airways (including a thoracotomy to remove a lung blood clot), significant blood loss, bowel obstruction, deep vein thrombosis, wound infection and a delightful bout of shingles to top things off. After more than three weeks in hospital, much of it in ICU, he made it home in early November and has months of physiotherapy ahead of him.

Needless to say, his enthusiasm for caving hasn't been dented and he's planning plenty of trips as soon as he's fit and able. We all wish Dave, Joy and family all the best and hope to see him underground again soon.

THE LIGHTER SIDE

Some of my favourite quips and comments during the rescue and in the media:

DWC complains mid rescue about the pain he is in to his daughter, Jess Bayles. Jess quickly reminds him about the trauma of two bouts of childbirth she has endured. DWC

CAVE RESCUE — MT CRIPPS KARST, TASMANIA



Sliding the stretcher over rescuers' knees in narrow passage



rapidly, and wisely, concedes defeat.
DWC is both a bit 'woolly' in appearance and name, but the ABC News headline 'Cavers 'crawling on hands and knees' during mammoth rescue' was quite amusing for the literalists amongst us.

A comment on the ABC 936 Hobart

Radio Facebook page post raised the ire of many keyboard warriors when someone posted 'Pleased he's ok and has been rescued. But I must ask ... why do elderly people go out on these dangerous adventures in the first place? Last week another elderly man was injured and

The helicopter paramedic takes over care

rescued from a dangerous situation.' So DWC is officially elderly; please remind him every chance you get.

■ Cave rescues are slimming. A quickthinking rescuer proffered '75 kg' as the stretcher load when being quizzed on live radio. A beer is owed.



CONVERSATION ON CONSERVATION

Juukan Gorge Caves Destruction and its Implications

Nicholas White

ON 24th May 2020, Rio Tinto destroyed two caves in the Juukan Gorge in the Pilbara, WA in preparation for expansion of the Brockman 4 Iron Ore mine.

This was the culmination of evaluation by archaeologists who discovered occupation evidence in these caves and rock shelters in 2003. In 2012 Rio Tinto applied for permission to mine the site.

This was approved in 2013 under Section 18 of the *WA Aboriginal Heritage Act* 1972 subject to a further archaeological study. This subsequent study determined there had been use and occupation dating back 46,000 years with many stone artifacts and a human hair belt found and dated to 4,000 years old, with genetic material related to that of the present title owners, the Puutu, Kunti, Kurrama and Pinkura (PKKP) people.

These groups have contracts with Rio Tinto, which have values based on royalties but leave them constrained when it comes to negotiation, particularly when the WA legal system is loaded against recognising other than the mining values.

This destruction has destroyed the Rio Tinto social licence. It has been compared to the Taliban destruction in 2001, of the Bamiyan Buddhas in Afghanistan.

The Western Australian government has now initiated a review of the *Aboriginal Heritage Act.* However, this should have been done many years ago.

The Rio Tinto CEO has been forced to resign, as have several other executives. Over 70% of current profits are attributable to the Pilbara iron ore revenues. There is an internal review in progress.

The resignations have been prompted by pressure from Australian Superannuation funds, followed by others in the United Kingdom and the Anglican Church in the UK.

Changes in the Rio Tinto organisational structure and distancing from Australian management some years ago weakened the advice being heard and understood at the Board and upper management level.

There is a Federal Parliamentary inquiry to which ASF made a submission calling for review of the WA *Aboriginal Heritage Act* and for such reviews to be also conducted in other States. The *EPBC Act 1999* as amended, brings in some cover for National Heritage Listed sites and for cultural sites.

The Environment Defenders Office in their inquiry submission stated that Cultural Heritage Legislation needed to be consistent with International Legislation on the rights of Indigenous Peoples. This is a possible political or legal avenue to protect such sites from damage.

This whole affair is still having ramifications for Rio Tinto but there are other Pilbara iron ore miners needing to address the same issues with their native title owners and the significance of cultural sites and their dreaming places. This issue also extends to other mining activities in Western Australia.

Such conflicts are not restricted to Western Australia nor just to mining. At present in New South Wales there is a proposal to raise the Warragamba Dam wall to protect downstream development of the expanding Sydney.

This would have the effect of inundating parts of the Blue Mountains World Heritage Area and in particular the cultural values associated with the catchment. The sites that would be affected are rock shelters in the sandstone gorges with artwork as well as numerous sites with artifact scatters.

Instead of trying to protect flood-prone

property in the Hawkesbury-Nepean floodplain through other mechanisms, the simplistic solution is proposed. The Federal Department of Environment has called for a more comprehensive review of the effects on World Heritage values. In contrast, the major effects of the Snowy 2 Project were not examined in detail. These have direct effects in the Ravine Karst Area of Yarrangobilly and there are certainly inadequate provisions for dumping of the tunneling spoil.These problems between development and protection are not limited to State jurisdictions but they are also important federally.

At present the interim review from Graeme Samuel's review of the *EPBC Act* has been received and the final review with recommendations is due in October 2020. However, there is legislation before the Federal Parliament that provides for many of the Federal Act's responsibilities to be devolved to the States.

This has passed the House of Representatives but it is unlikely to pass the Senate. This situation is completely confusing to interested observers. We need more discussion and inquiry before such fundamental legal changes are enacted.

The important issue here is that these problems are not going to go away and all developments need appropriate measures to protect irreplaceable cultural (and natural) values.

Legislation needs to be updated periodically as social values change. We all need to be vigilant about these issues when they occur and to then raise a fuss.

The Juukan Rock Shelter destruction has triggered repercussions which are producing a re-evaluation of laws on cultural heritage protection in all jurisdictions in Australia.

Vale Patricia (Pat) Hyde 8/1/1939 - 1/10/2020

Garry K Smith NHVSS

T IS sad to report that Pat Hyde, founding and life member of the Newcastle and Hunter Valley Speleological Society (NHVSS), passed away peacefully in the Calvary Mater Hospital Newcastle around 12:45 am on 1st October 2020.

Pat was instrumental in the formation of NHVSS in 1984 and remained an active member, even attending a Timor Caves trip in March this year.

Over the years Pat held a number of positions on the NHVSS executive, including several stints as secretary. She was always keen to assist others and made friends easily. Her warm and friendly personality was always evident. She had a keen eye for written detail and would often pick up the smallest error overlooked by others. Sum Pat has made significant contributions to NHVSS and caving in general over 36 years.

Pat participated in countless caving trips and attended a number of ASF conferences, including Galong NSW in January 2013; Exmouth WA in June 2015; Devonport Tasmania in January 2019; and the five-day International Union of Speleology (UIS) conference at Penrith Panthers in 2017. Although not a caver, Pat's husband Geoff would accompany her to many caving locations as one of the surface party. Pat and Geoff were inseparable in a marriage which spanned 60 years — their diamond-wedding anniversary was celebrated in January this year.

Pat was 19 when she met Geoff and they married two years later. They had five children, Ronald and Anne (both passed as young adults), Victoria, David and Amanda.

Having a busy family to manage did not stop Pat from pursuing a career in teaching. She initially taught science and biology at high school and later switched to primary school teaching. She taught at twelve different schools, but spent most of her time at Waratah and Williamtown schools with about 17 years at each. She also spent some time at Stockton Centre, teaching children with special needs and retired from teaching at the age of 64.



Pat was very community and environmentally minded and particularly active in organisations fighting to save Stockton Bight and the Hunter River region from pollution and with organisations actively striving to save wildlife and their habitats.

She was a member of the community consultative committee for Orica and actively lobbied authorities about dust pollution from coal loading, PFAS fire fighting agent pollution entering the commercial fishery waterways at Fullerton Cove and saving Stockton sand dunes from further mining.

Pat was also actively involved with Parks & Playgrounds, Newcastle's oldest and longest-running conservation lobby group, as well as the Green Corridor Coalition, established to protect a continuous wildlife corridor from Stockton Bight through to the Watagan Mountain range.

Pat joined the Scouting movement when her children were young and became a Cub Leader, then a Venturer Leader and a Rover Advisor. Her leadership roles in Scouting spanned 25 years.

Over the years Pat and Geoff travelled vast distances around Australia in their campervan, including two trips to Darwin, once to Broome and Exmouth in WA, the Cape York Peninsula in Queensland, Uluru, Tasmania, Kangaroo Island and several crossings of the Nullarbor, to name a few.

As a child in Ireland she contracted rheumatic fever around the age of 9 or 10, which affected her heart valves, a condition she lived with for the rest of her life.

Later in life Pat's knees were causing her trouble and in about 2000 she had both replaced with artificial joints.

This did not stop her caving. On a trip to Gloucester Caves in 2006 Pat was having trouble getting through a tight squeeze. In frustration she grabbed her legs with her hands and bent the knee joints to their maximum to get through. She had incredible willpower and those artificial knees weren't going to stop her.

A few of our members affectionately nicknamed her The Bionic Caver — there was no stopping her.

Meanwhile, her heart valves were beginning to fail and eventually she required an operation in 2008 to replace them. The replacements worked OK for some time but in about mid 2013 their functionality deteriorated and a heart surgeon told her she could only expect to live a few more months.

Pat wasn't having any of that — determined to make the most of life, she was always thinking ahead and decided to donate her body after death to Newcastle University for scientific study to benefit others in the future.

Well, Pat, you proved that heart surgeon wrong by more than seven years and you will certainly benefit science into the future.

Pat will be sadly missed by all who knew her. Our heartfelt condolences go out to Geoff and family.

- Compiled by Garry Smith, President NHVSS, with assistance from Geoff Hyde.
- Thank you also to Jodie Rutledge, Amanda Hyde and Victoria Hyde-Smith for checking the accuracy of this tribute to Pat.



That will be the Cave Phone...

Clare Buswell FUSSI

Ken Smith CEGSA

IN THE December 2019 edition of *Caves Australia*, Ken Smith and I wrote a brief article on the CaveLink communication system that was tested in Cocklebiddy Cave by members of the Wet Mules cave diving group (Buswell & Smith 2019).

Space issues limited a more detailed write up and both Ken and I wanted to run more tests with the system before we published much more about it.

The system has now been tested at the cave rescue exercise in southern Tasmania in November 2019 and with the help of the SES in Adelaide. We are now better placed to update readers of this esteemed journal.

Cave communication is a story about the ingenuity of cavers and cave divers around the world.

The British developed the Molephone, then the Heyphone, named after its inventor, John Hey, who developed it in 2000. This phone system became the phone used in UK cave search and rescue.

The French developed the Nicola system, the Swiss the CaveLink and the Australians the Michie phone, named after Neville Michie. All, with the exception of the Nicola and CaveLink systems, are 'homemade' or do-it-yourself systems. Although developed by cavers, both CaveLink and the Nicola systems are commercially available.

The CaveLink system has certainly been embraced by cavers around the world for rescue application since its appearance on the scene around fourteen years ago. The reasons for this are its easy user interface, its good signal range through rock and the reliability of digital communication.

Currently the CaveLink system that Flinders University Speleological Society purchased consists of two units: an underground unit and the above ground unit with a GSM modem (Global System for Mobile communications) that allows messages, if you have mobile coverage, to be sent to and from the underground unit to any mobile phone anywhere. Thus, the surface rescue



The above ground unit with GSM modem and aerials attached.

coordinator based in their home can be in direct contact with the underground rescue coordinator.

We have just added a wideband directional antenna, which helps increase signal strength to and from mobile phone towers in remote locations.

The advantage of CaveLink is that it operates via text messages sent between the units and a mobile phone if coverage is available.

The surface unit does not have to be directly over the underground unit to communicate with it. The units 'chatter' to each other and will send a message when signal strength is adequate. The message is error checked so corrupt messages do not appear. Communication may take longer in poor signal conditions — many retries may be necessary to successfully transfer the message. All this is done automatically. The signal strength is easily checked when you set up the units as signal strength is displayed on the screen.



The above ground unit with the directional antenna attached. Ken Smith is sending a message from a remote cave in the Flinders to a mobile phone in Adelaide.

When messages are being received or sent, the unit will indicate this via a blinking red/green light. Thus, it is easy to tell if the message incoming or outgoing has been sent.

A beeping sound indicates that a message has been received. Both the underground and above ground units can have a horn attached to them. The horn produces a loud signal to let people know that a message has come through, so you don't have to have a person near the units on standby all the time.

As all messages are text-based, there is no confusion in trying to decipher unintelligible speech or hear what is being said over the noise of underground waterfalls, for example.

Further, you can attach the printer that comes with the system to the surface unit and print the text messages.

Thus, if rescuers underground send you a long list of what is needed, all you do is print the list and give it to the person in

THAT WILL BE THE CAVE PHONE...

The surface station





The underground station



The underground aerial case: contains: screwdriver, aerials, earthing base plates and foil.

CLARE BUSWELI

charge of getting supplies. This saves time and takes away the need to transcribe unintelligible speech.

You can also back-check messages, as the system will store the last 99 messages that have been sent. The display numbers the messages, so you can go back to previous messages to read them easily. All messages are date and time stamped, which is a useful record of events.

The units are self-contained with builtin rechargeable batteries whose life can be measured in tens of days. The units will go into sleep mode if left unused for a time. This saves the battery. However, in sleep mode they will still receive and store messages for later recall. Just press the menu button to wake the unit to view messages.



The underground unit in a smaller Pelican case for ease of transport.

Although the units come in mediumsized Pelican cases, the underground set, including its aerial, can be easily removed and carried in two smaller Pelican cases for ease of transport, as per the two photos above. They can also be placed in sealed 'dry tubes' to be carried underwater. It is also important to carry a compass with the underground unit so you can orientate the aerials correctly.

SO HOW DOES IT WORK?

Radio waves are categorised into twelve bands ranging from Extremely Low Frequency, (ELF) starting at 3 Hertz (1 Hertz means one cycle per second), to the Terahertz frequency (THF) band which extends up to at least 3 THz (3 million million Hz).



Printer attached to the surface unit

The wavelength is inversely proportional to the frequency. A 3 Hz signal has a wavelength of 100,000 kilometres, whereas a 3 THz signal has a wavelength of a tenth of a millimetre.

Rock, as we know, is electronically conductive, which means it absorbs radio waves. Lower frequency signals can penetrate further through rock. Therefore we choose lower frequencies for throughground radiolocation and communication. However, the rate at which information can be transmitted decreases with frequency, so a compromise must be made between the distance of penetration and the rate of data transfer. Radiolocation and audio frequency voice communication are normally done in the ULF (ultra-low frequency) band, 300 Hz to 3 kHz. Carrier-based communication for voice or data usually uses the LF (low frequency) band 30 kHz to 300 Hz.

Normal two-way radios operate at frequencies which are too high to penetrate a significant distance through rock and soil (300-900 MHz).

Radio signals can travel through cave passages, so hand-held radios can be used in some cases. However, bends in the passage usually prevent communication, as radio waves travel in straight lines.

Cave radios can be divided into two types: those which transmit the audio signal directly and those which apply the audio signal to a low frequency carrier signal.

DIRECT AUDIO SYSTEMS

These systems are generally simple to design and are popular as do-it-yourself systems.



The Cave Telephone or 'Michie' phone

This system uses a single wire which is run from an electronics unit on the surface to a unit in the cave. Each unit has a metal grounding peg so that an audio signal can be transmitted along the wire, using earth conductivity for the return signal. The system is more correctly described as a telephone rather than a radio. In Australia they are called 'Michie phones' after Neville Michie, who designed and built several units.

They have the advantage of low battery consumption, reliable operation and signal transmission of up to a few km along a wire. Multiple units can be attached along the wire, provided only one transmits at any one time.

A disadvantage is that a wire has to be laid through the cave, taking time and personnel. However, the wire can be used as a guideline for people entering and leaving the cave.

Wireless audio

Audio signals can also be sent through the ground by laying out a wire loop a few metres in diameter and applying an audio signal to the loop. A similar loop underground picks up the audio signal and it is amplified and fed to a speaker or headphones. Both electronics units can transmit or receive.

Battery consumption is greater than for a cave telephone, since reasonable power is needed to transmit. The range is limited to about 150 m through ground. However, this range may be reduced if electrical interference is present.

Be aware of any nearby electric fences or power lines, for example.

CARRIER-BASED SYSTEMS

Carrier-based systems modulate voice, or in some cases data, onto a carrier signal



in the range 50 to 100 kHz. They are classified as low frequency (LF) radio systems. Low frequencies can travel through a few hundred metres of ground. The use of a carrier reduces interference and can allow voice communication through a few hundred metres of ground.

The Molephone, Heyphone and Nicola radio all use voice modulation onto a carrier signal.

Systems that transmit data rather than voice have error checking and the ability to repeat corrupted signals, which allows transmission distances of 500 m or more in some cases.

Both the Mole and Hey phones are voice systems. A popular voice system in Europe is the Nicola radio which has now reached the Mark 3 version.

The leading data system is probably the Swiss-manufactured CaveLink system. This allows text messages to be reliably sent from cave to surface and between multiple units within the cave.

Carrier-based systems can work with loop antennas. However, the preferred method is the ground conductivity antenna, where metal plates are laid, or pegs are inserted into the ground at up to 50 m separation. Wires are attached to the electronics unit and the signal current is injected directly into the ground.

The transmitted signal probably reaches the receiver by a combination of electrical conduction and propagation of the electromagnetic field.

FUTURE DEVELOPMENTS

There are new developments in the pipeline for the CaveLink system, some of which include a WLAN/Bluetooth module which will allow operation from a laptop or smartphone. All will be compatible with the units we have here.

The CaveLink system purchased by Flinders University Speleological Society is available for cavers involved in search and rescue situations, real or practice, all over the country.

In the near future it will be further enhanced by more units which are being purchased by the CDAA and possibly by the SA State Emergency Service.

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