## JF-8 Junee Cave:

#### **ASF Diving Expedition Report**

#### January 2019

Stephen Fordyce (with input from other team members)

**Party:** Dave Apperley, Stewart Donn, Stefan Eberhard, Patrick Fitzgerald, Stephen Fordyce, Grant Pearce, Andrea Russo

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's 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.



Stewart and Andrea enjoy one of Steve's excellent jokes in the rainforest outside the cave.

#### Photo: Patrick Fitzgerald

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- $7^{\circ}$ 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 they did not have access to. Full respect was paid!

While the local Tassie cavers complain about the sherpa loads for 2-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 foci and timings. Even with this many people, there was enough space 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 I, 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 cave, we avoided having to carry them out each day and saved a great deal of time, energy and misplaced heat. A pair of 7 L tanks were used to transit through Sump 1 (about 200 m long and average depth 12 m). The dedicated setup and cleanup days were an excellent investment and this system made it possible to do long Sump 2 dives on consecutive days.



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.

Photo: Stewart Donn

Once the cave was set up, it was onto the diving, which proceeded according to the fancy of each diver. It's 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 multiple 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.

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

## "Straight ahead, in the middle of the tunnel was a triangular shaped hole at 55.5 msw with an enticing void behind it, but no chance of getting through."

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



Impressively proportioned and decorated passage in For Your Eyes Only. Photo by Stewart Donn

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 rockpile which blocks the (upward trending) passage.

Descriptions from previous trips matched the video and my impression of the end quite well. An open and welldefined tunnel of perhaps 6 m wide and 3 m high was trending up and then blocked by rockfall. Straight ahead, in the middle of the tunnel was a triangular shaped hole at 55.5 msw (Metres Salt Water. He forgot to change his computer settings to fresh water - Ed) with an enticing void behind it, but no chance of getting through. Definite flow coming out, although not a gush. 2 m to the left of the centre lead, was a dubious-looking lead 1 m lower and heading horizontal (i.e. most likely further into the rockpile) that would require some serious wriggling in sidemount or no-mount gear. Flow not noticed, but not really checked either.



Steve getting ready for a dive in Sump 2. Photo: Stefan Eberhard.

To the right, the passage trends around the rockpile 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 rockpile 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. The presence of these erratic boulders of Benjamin Limestone, which are the next strata in the geological sequence heading north, lend optimism to the prospect of an upwards trending continuation of the sump. Flow not observed, but not really checked either.

# "The trouble was, if things didn't go so well, and the theorised air chamber couldn't quite be reached, a brutal decompression obligation and extended exposure would be experienced"

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 lack 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 if things didn't go so well and the theorised air chamber couldn't 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.



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

#### Photo (GoPro still): Stephen Fordyce

Getting into the Armageddon Room was via the "Fridge Restriction" and required 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 rockpile pinching off to the ceiling.

While a second set of eyes never hurts, I sadly pronounce 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 rockpile, but it's also possible 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.



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

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

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 vintage approximately 2009, 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/out of the way. We were careful to stay in the stream or below the winter high water marks (with a few already well tracked exceptions), and 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 mud banks. 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 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. *Anaspides eberhardi* (a species of caveadapted 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.



Black rock characterises much of the cave, including the Sump 1 home-side pool. Photo: Stewart Donn

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 didn't 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 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 its generous support. A special thanks to Andrea (with assistance from Stewart) who 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 in the Addendum to this report (*following immediately - Ed*).



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



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

# JF-8 Junee Cave, ASF Diving Expedition Report – Addendum

## January 2019

Stephen Fordyce

Well it seemed like the report was just about at capacity but there was still all this gold left. Odds and ends, notes and suggestions. The sort of stuff that will hopefully be invaluable to anyone planning a return to Junee Cave.

## Junee punchlist - jobs for next time:

- Make a better video record (it will need to be on the first dive)
- Check the Sump 2 walls better the left hand wall (on way in) seems unlikely to yield anything, but the right might. The shallows give the impression of being wide, flat and more meandering (and are well worth a check) than the steep slope from about 18 m down to 63 m. The left (while going in) wall did seem to be fairly vertical, the right wall was perhaps more of a slanted ceiling, and there was no indication of side leads. With a biggish team and lots of light, a new video record and wall check could be done together.
- Push the right-hand end lead
- Second set of eyes on centre and left leads
- Wall check in Sump 1 it's been done, but it's quite fascinating, and there is a theory that more water comes out of Sump 1 than goes in (i.e. there's an infeeder in there)
- Re-survey Sump 2
- Continue line replacement (a whole lot of 7 mm Telstra line will probably still be available)
- Remove old line in deep section

## Gardening efforts at the end:

The triangle hole is ... not going to look like the photo in the report. The way to get into the Armageddon Room is to the left and then up through a slot (should be obvious if the line survives, as I think it will). Get in touch if you want to hear more.

### Survey:

A concerted effort was made to fully re/survey Sump 2. Data was collected for the entirety of the sump, with some cross-check data also collected. I believe the result is ... reasonably accurate. I have made a number of leaps of faith and massaged a few bits of data to come up with the result. Another go at it next time would be nice. *Statistics:* 

- The updated Sump 2 surveyed length is 300 m
- There is a surveyed distance of 535 m from the entrance to start of Sump 2

According to the survey, the deepest point in the sump is 64.4 m below the JC1 station at the mouth of the cave. With the depth of this point recorded as 63.8 mfw *(metres*)

*fresh water -Ed*), in reality (allowing for drops through For Your Eyes Only and also in the streamway near the entrance) the cave at this point is probably about 5 m higher than the survey indicates. If the cave entrance is in fact at 291 m ASL, then the deepest point in Sump 2 is estimated to be at about 230 m ASL, and the terminal rockpile at 220 m ASL.

The topographic maps of the area show the giant dolines which Junee is heading straight towards (and indeed, appears to be under) as having their bottoms at about 325 m ASL. As such, there is some 100 m of vertical gap between the two, and only 50 m from the bottom of the dolines to the surface towards which the sump appears to be heading.

I have visited these dolines (SS 421) and the four connected ones are giant, old, and have little to no indication of entrances (or even rock). The most eastern pit is the most prospective, but still a very long shot. The doline under which Junee currently ends, is smaller, less choked and does have visible rock. No draft was observed and if not for the location, it would not be a good prospect. It would be a desperate dig, but perhaps a worthy one.

I don't give up all hope of cave passage bypassing the dolines. The main multi-doline is obviously old, and has had a lot of stuff washed into it. Perhaps the stream has made another way, that may yet allow passage by humans.



Misc survey notes:

- 1. I've tied survey station JC1 to the (2009) GPS co-ordinate from the STC archive. Previously, the GPS co-ordinate was tied to station JF8, but this is inside the cave (see file "JF-8 Junee Cave.jpg") so very doubtful.
- 2. The original survey data of Sump 2 is still in the file but is disconnected (will show as warnings on compilation)
- 3. The shot R19-07 to 2019\_PF\_2 doesn't look right and is probably bogus.
- 4. My depth readings were in metres salt water and they are converted in the data spreadsheet. Pat's were in metres fresh water so didn't need conversion.

### Day by day rundown:

The schedule seemed to go quite well. I would run essentially the same one if visiting again.

Previously ... Dave had done a lot of work tidying line in Sump 2.

Day 0: Orientation trip to the sump in the afternoon.

Day 1: Set up/prep gear (regs on tanks, rebreathers readied, drytubes packed, etc.). Leave for cave after lunch. Portage all gear to Sump 1. Set up Sump 1 home side clothesline. Quick dive (for those interested) through Sump 1 to check the line, ferry some gear, plan routes and placement of gear piles to avoid damage to the cave, and have a quick orientation up to the start of Sump 2.

Day 2: Shuttle all gear through Sump 1 and through For Your Eyes Only to Sump 2. Set up Sump 2 clotheslines (Sump 1 far side assessed and not required) and clip off deco cylinders and wet dive gear in the water. Set up "The Corner Shop" dry base on the closest beach to Sump 2. Test the stove and other gear. Make ready as much as possible for deep dives the next day.

Day 3: Deep dive #1 (136 min)- cave orientation, Sump 2 video record/lead identification, line fixing, place staged bailout cylinders, general shakedown. The entirety of Sump 2 (including the far end) recorded on GoPro.

Day 4: Deep dive #2 (166 min) - survey the deep section, push centre lead, stage more bailout.

Day 5: Deep dive #3 (154 min) - push centre lead harder. Linework/survey of other sections.

Day 6: Deep dive #4 (187 min) - push through the Fridge Restriction into the Armageddon Room - the cave is unlikely to go further from here. Approx. 10 m line laid, up to 52 m depth.

Day 7: Rest day from deep dives. Linework/survey of other sections.

Day 8: Deep dive #5 (194 min) – clean-up dive. Retrieve gear from the end of the cave, retrieve survey lines and reality check some bearings, retrieve staged bailout cylinders.

Day 9: Pack up Corner Shop, take all gear off Sump 2 clothesline. Portage back to Sump 1, shuttle through Sump 1, portage out to cave mouth, transport back to carpark. Lay gear out for brag pic, and pack cars for departure the next morning. A big day, but even with standing around chatting and taking photos, not ridiculously so.

Day 10: Another hour or two of packing cars in the morning, then departure.

## **Temperatures, and Thermal Protection:**

Exposure, more than any other factor, was the limiting factor for just about everything.

The cave water was  $7^{\circ}C$  (6°C in the deep section of Sump 2), and the cave was near enough to this also. The weather outside ranged from 15 to 35°C. Different exposure protection was required for different scenarios (i.e. short active dives, portaging gear, long deco dives, etc.). Below is what I did, and would do again.

- Portaging gear to the cave mouth:
- Shorts, T-shirt, hat and sunscreen
- Changing into drysuit:
- On the "high and dry" rock platform just inside the mouth of the cave (bring a tarp) where it's cooler
- I still had to get into the water as quickly as possible to avoid sweating
- Portaging gear to from cave mouth to "beach" near Sump 1:
- 3mm wetsuit, or whatever you're wearing. Gloves optional, hood not needed.
- Expect a few sections of waist-deep water, some rock-hopping and also knee-deep water
- Sump 1 transit dive:
- I was ok in high quality 7 mm semi-dry (with explorer socks, wetsuit socks, wetsuit boots), dives varying from 6 to 25 minutes.
- Others were ok but getting chilly in their "standard Mount Gambier kit"
- For Your Eyes Only portaging (Sump 1 to Sump 2):
- Overheating and sweating in a drysuit is a major consideration here
- Drysuits also tend to be less flexible, more likely to be damaged on sharp rocks (especially lower legs), and require considerably more energy expenditure as a result of both
- I wore my high quality 7 mm semi-dry (with explorer socks, wetsuit socks, wetsuit boots) for portaging on setup/clean-up days. I wasn't cold at all (despite stopping at times to sort things out) and didn't have to worry about sweating.
- The wetsuit socks under wetsuit boots made a big difference, well worth doing
- For Your Eyes Only transit (Sump 1 to Sump 2, carrying minimal load):
- Wearing two undersuits and my drysuit (and carrying no load), I had to move slowly, and frequently stop/swim to prevent overheating and sweating, even with hood off.
- This is why the setup and clean-up days were so important to me.
- Sump 2 no-deco dive:
- Open circuit dives were done by Stewart up to 30-45 minutes, which were about the limits of his thermal endurance, in supplemented Mount Gambier undergarments.
- Sump 2 extended/deco dive:
- Maximum runtimes of 60 minutes were about the average limit of thermal endurance without heating. 5 mm wetsuit gloves were sufficient for some divers, inadequate for others.
- Runtimes of 3+hrs with heating and in reasonable comfort were completed

- I wore a trilaminate drysuit, with Halo3D undersuit + Fourth Element Artic undersuit + 2 layers polypropylene thermals (one of which provided about 60W of active heating). Two pairs of explorer socks plus polypropylene heated socks (which didn't do much). My toes would go numb and feet get very cold by the end of a long dive, as would my face and lips. Apart from that, deco was quite ok.
- The dependence on heating was quite sobering, and the stage battery was actually left at 6 m in the event of heater battery failure.
- Gloves: 5 mm wetsuit gloves were the minimum used for long dives (3 mm used for Sump 1 dives and portaging), and successfully by some team members for dives up to 1hr in Sump 2. Dry gloves were also used and were effective. My hands got pretty cold and useless in 5 mm wetsuit gloves at depth and on deco, but were quite happy once I turned my wetsuit glove heating on (approx.. 25 W per hand). I generally did the entire dive with glove heating on. Note that the glove heating drastically impacted my compass!

# Other useful gear:

Several things were used to good effect for possibly the first time in Junee. Plus others worth remembering for next time:

- Wheelbarrow (for portaging car to cave, Olwolgin-style) - highly prized by nearly everyone
- Note the path was judged too narrow and rooty for a trolley. Hiking packs were also used - much easier than the wheelbarrow, but much less payload.
- Tarp for changing in the mouth of the cave
- A tarp for The Beach (home side of Sump 1) wasn't necessary
- A tarp for The Corner Shop (Sump 2 store) was good for repacking sorb on
- Scooter my 1000 Wh battery was sufficient to do three trips to the end of the cave and back, plus ran heating for most of my deco, and didn't need to be taken out.
- For the saving of time and effort to get to the back, it was well worth carrying in.
- There are a few low sections, it's low vis, and stirring up silt should be avoided, so a reasonable amount of cave scootering experience is necessary
- Stage battery (1400 Wh) also ran deco heating, and didn't need to be taken out (was left at 6 m as spare heating, wasn't used much)
- Drytubes and caving bags for transporting sorb, snacks, spares and gear through Sump 1

- Caving bags or hiking packs for portaging through For Your Eyes Only
- A small caving bag stuffed with Telstra rope for replacing line (similar to canyoning rope bag method)
- A catch bag for stuffing old line into (there's a whole lot of it still in there)
- Thick bungee loops with labelled survey station markers put the loop on a rock so it stays if the line breaks or washes away.
- undersuit heating, and also glove heating (see dedicated section)

# **Conservation: take nothing but ancient reels, leave nothing but ... clotheslines?**

We were aware (and had been reminded) that portaging a large amount of gear and having a rather large number of people in the cave greatly increased the risk of damage, particularly in the rarely visited and fragile "For Your Eyes Only" section. One objective of the checkout trip into FYEO on the first setup day was to check the route and gear staging places.

By staying in the stream (in almost all places, the easiest route anyway) apart from a few obviously pre-loved climb-arounds, and mud banks certain to be washed clean in the next flood, I think we were successful in making no additional lasting impact. Gear was staged at:

- 1. The Beach sandy/muddy low area near the start of Sump 1
- 2. Sump 1 clothesline Telstra rope rigged to hang gear in the water, independent of but next to the guideline, ready for shuttling through the sump
- 3. The Sump 1 sandbar (far side) gear was left partly submerged and clipped to guideline, plus left on a low mudbank
- 4. The Corner Shop (30 m back from Sump 2) a mud/pebble shelf just above river level
- 5. Sump 2 clothesline Telstra rope rigged to hang gear in the water, independent of but next to the guideline, ready for gearing up
- 6. Sump 2 various bailout cylinders, and spare heater batteries were left at relevant places underwater

The clotheslines were left rigged in anticipation of being useful and as an aid to conservation for the next visitors. The Corner Shop, old line, leftover food, old sorb and everything else was cleared out. Survey markers on bungees were left on rocks through Sump 2, while the knotted survey line was removed.

In the spirit of leaving the cave better than we found it, a good deal of old line was retrieved from Sump 2 and brought out. Alas the deep section still has 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 vintage approximately 2009 and a Chris Brown concoction dating back to the 1990s.

## State of the cave & line:

- The primary tie-off is to a spit style bolt placed in 1992 in the wall just above water level. A clothesline for hanging tanks and gear is very close but not connected.
- If you are leaving bailout at 6 m, you'll want to wait until the 3<sup>rd</sup> (?) time the cave goes below this depth!
- The top section of the cave is mostly 6-7 mm line in reasonable condition. There are few if any line arrows, and some tape distance markers which are no longer relevant.
- In about 17 m you may notice a microwave-sized rock which has fallen on the original thick line and has been bypassed by orange line. This marks "Andreas' lead".
- Be prepared to repair line, especially from about 50 m to the deep point at 64 m. It appears to have decent flow, and the rocks are very sharp here. The rest of the horizontal deep section has plenty of lines which all appear intact (although partly buried) perhaps pick the best looking one and pull it out of the silt as you go.
- Similarly, be prepared for unexpected linebreaks which may occur when the line is gently pulled on near a frayed point, which are not always obvious. Two unexpected line-breaks occurred on dives in the second sump, much to the surprise and consternation of the divers, who fortunately were able to repair and re-join the severed sections.
- Visibility was never zero (despite much fluffing and occasional poor technique), and the way on generally obvious.
- The thin white knotted line which we had to leave is the most recent. Near the end it goes close but is not connected (maybe 0.5 m jump) to the orange line which heads right/up and into the Armageddon Room. The white line continues up into the right hand lead, and ends a few metres before the furthest point.

## **Diving Information:**

For dive duration, see the section on schedule. A 2.5 to 3 hr dive was typically required to spend 20-25 minutes at depth, using gradient factors of 50/70. Thermal protection and heating has been covered previously - I'll mention again that this was the determining factor in dive duration.

Gases used were:

- Deep bailout, and rebreather diluent: 15/55 (15% oxygen, 55% helium, balance nitrogen)
- Mid bailout: 50/15
- Shallow bailout: 100/0

Using the same deep bailout and diluent meant that we could transfill from large bailout cylinders into small diluent cylinders at The Corner Shop, rather than taking them out of the cave. The same applied to oxygen.

The deep mix was selected to allow for some extra depth if needed, a good buffer against narcosis and also with consideration to keeping gas density down. There's a spreadsheet if anyone is that interested. Yes, there are too many 5s in the bailout/deco mixes!

Each diver carried a minimum of a 12 L steel of deep mix bailout, and we staged Sump 2 bailout at:

- 3 m: 40cf of oxygen
- 6 m: 2x 40cf of oxygen, 1x spare heating battery
- 21 m: 80cf of 50/15
- 57 m: 80cf of 15/55
- (another 80cf of 15/55 was also staged at the end of the cave for the push into the Armageddon Room)

I used a pair of 5 L cylinders as dedicated diluent and oxygen cylinders and got at least three dives from them. Larger cylinders were advantageous when filling by transfilling, as a low pressure fill was still plenty for a dive. I had also carried in a set of 3 L cylinders, and used these on one dive, with a fair bit of gas left. A 40 cf of air ran my drysuit and wing inflation for four dives (given the nature of the cave, I was happy running both from one source to conserve diluent and had hoses on other cylinders if necessary). Fresh sorb was used for each dive.



Fairly typical dive profile - this one being from the cleanup dive

For Sump 1 transit, I used a pair of 7 L tanks. I could easily make a return trip breathing only the one tank and still having a healthy safety margin - this tank was then the only filling required each night. A typical transit trip took about 10 minutes. My fastest trip through Sump 1 was 6 minutes and using 450 L of gas (65 bar from one 7 L). My slowest trip through Sump 1 was 23 minutes.