

Journal of the

Australasian Cave and Karst Management Association



The ACKMA Journal

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FRONT COVER: Straw in Jersey Cave, Yarrongobilly Caves, New South Wales, with hair embedded in the calcite. Photo: Steve Bourne

BACK COVER: Scenes for Wee Jasper, New South Wales. Photos: Steve Bourne

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FROM THE EDITOR

The AGM weekend was another successful ACKMA event attracting around 60 members to Wee Jasper. A number of reports appear in this journal and I thank Cathie Plowman, David Wools-Cobb and Mary Traves for their accounts, and a number who provided images. I have only been able to use a small sample, but will endeavour to provide an electronic pictorial account of the weekend on the website.

This journal again covers a breadth of issues, with reports from Garry K. Smith of Eisriesenwelt Cave in Austria and John Brush on the Vulcanospeleology Conference in Jordan. John also provides an interesting account on a number of US caves. Both Garry and John provide their thoughts on the cave management at the respective locations.

Rolan Eberhard's contribution covers a rehabilitation project on a site in Marakoopa Cave, Mole Creek, Tasmania, that was visited during the ACKMA conference in 2011. The result is spectacular and I encourage everyone to view the colour version on the website to see just how effective this work has been.

We acknowledge the enormous contribution by Peter Berrill to cave conservation in Australia. I only met Peter once, during the ACMA AGM weekend in Rockhampton, but admired his determination and perseverance to conserve Mt Etna's caves. Unfortunately, Peter was never an ACKMA member. I am sure we could all learn from his experiences - I am grateful for the time we had with him in Rockhampton.

Andy Spate reviews an excellent new volume for any interested in caves, and having seen his copy in Wee Jasper it won't be long before I purchase a copy.

We have the first information regarding the 2013 Waitomo Conference in this journal, and a suggestion from Moira Lipyeat on a side visit while we are in New Zealand.

Dale Calnin is preparing for a Guides' Workshop at Buchan Caves in September. I hope all cave managers support their staff and Dale has a strong turn out for this workshop.



**Parks Victoria invites you to the
2012 Cave Guide Presenters Conference**

The aim of the 2012 Cave Guides Conference is to develop a new generation of informed cave guides, well learned in cave and karst of various areas, and voiced with the greatest interpretative techniques. Parks Victoria will showcase not only the Buchan Caves Reserve and its amazing show cave system but also several old show caves including the Shades of Death Cave, visits to nearby karst areas and the magnificent Snowy River National Park. As usual the event will be a mixture of formal presentations, outdoor activities and tours with some adventure caving for those that are interested. All participants are encouraged to present on their cave and karst operations and collectively we should all learn more about the world of show cave interpretation. At present we hope to have presentations from our good friend Elery Hamilton Smith, Weidmuller Lighting, a PHD student studying climate and cave relationships, the Friends of Buchan Caves and members of Victorian caving clubs.

If you are interested, a formal registration form will be sent out shortly or please feel free to call the Buchan Caves on 03 51621900 for information.

When: Sunday 2 September - Tuesday 4 September 2012

Where: Buchan Caves Reserve

RSVP: 1 August 2012

Email: BuchanVisitorCentre@parks.vic.gov.au



Healthy Parks
Healthy People



PRESIDENT'S REPORT

Peter Chandler

Looking back over the last month, so much happened, the AGM weekend seemed like a whirl wind! I would like to thank the 60 or so people who made the time to attend at Wee Jasper. Of course this didn't just happen, a great many of this number helped to make the weekend special. Special thanks must go to Suzanne for all the admin and catering, with her helpers of course, and Geoff for being happy, for his peaceful valley to be invaded by ACKMA folk for 36- 48 hours , and of course to Andy Spate for the organisation including gathering of guest speakers of a high calibre, bringing everyone to his old home patch, even though home now is in W.A. Many of the long distance travellers to the event, including us, did extend the weekend in both directions, and the hospitality extended was much appreciated.

Being an AGM weekend there wasn't the formal structure of a conference week - in fact the main meeting point, on the eastern side of the converted shearers quarters around the bonfire, was very fresh but well attended by the usual suspects until the early

hours! It would be great to return to spend time with Geoff and Suzanne and their community – soon.

Also to be noted was the attendance of Elery and Angela Hamilton-Smith - thanks Elery for adding your wisdom to discussions over the weekend and to the Association of which you are still a large part. And Angela, it was great to see you again!

It was also great to spend time with our erstwhile publications officer, pictured below with Libby Chandler outside Castle Cave, Yarrangobilly .

At the Tasmanian AGM there was some discussion about raising profiles of small cave operators, certainly having up to date info on the ACKMA website is a great place to start. Congratulations to Peter and Dan and the Jenolan team, raising the profile of caves and karst by scooping the national tourism award- well done!

Here at Waitomo I can report the pre-conference meetings are helping to shape the event, at this stage we really would appreciate material for the Journal about the next conference theme- 'the triple bottom line'



Top left: President Peter, third from right, listening intently to Andy Spate's directions.

Bottom left: ACKMA Committee in session.

Above: 2013 Conference Convenor Libby Chandler with Kent Henderson.

WEE JASPER (and YARRANGOBILLY) ACKMA AGM WEEKEND

Steve Bourne

The Annual General Meeting of ACKMA was held at Wee Jasper on Saturday 5 May 2012. Most members started gathering on the Friday afternoon at the Cooradigbee Shearers' Quarters on the banks on the Burrinjuck Dam. Andy Spate, Suzanne Newnham and Geoff Kell had done a tremendous job in attracting over 50 members and an even better job of gathering them together. Over the years of ACKMA events I have noted this group is not the easiest to coordinate!!

The Friday night was the usual catching up with friends and meeting members who were at their first ACKMA event. Those from the northern climes, particularly Lana Little and Brian Clark, struggled with the sub zero evening temperatures, although the Kiwis and Tasmanians revelled in the conditions. The New Zealand contingent was particularly strong, with most enjoying an extended period "across the ditch".

The committee met on Saturday morning while other members enjoyed a Geoff Kell cave tour, apparently the abbreviated version as they were back in time for the AGM itself. Geoff has a well deserved reputation as a great cave guide and raconteur and did not disappoint with this morning's presentation. The International Show Cave Association (ISCA) conference in 2014 at Jenolan Caves must include a pre or post conference trip to Wee Jasper to show world cave managers how to really entertain visitors.

The AGM went through the standard fare, with only one election, that being for the Executive Officer position. Catherine Sellars retained her position with the only



Rillenkarrren. Photo: Greg Martin

other change being Geoff Deer not renominating and John Brush taking the vacant committee position. Geoff has been coordinating the private cave owners and I hope he continues to undertake this role and feed information into the committee (and journal). The full list of office bearers appears on the inside front cover. After any years of no elections in ACKMA, I think that makes it three years out of four with elections.

The journal costs have been greatly reduced as we no longer pay for the layout. I appreciate everyone's patience in waiting for journals that have not been out on time, and forgiveness for occasional errors, which are mine and not the two excellent proof readers I have;



ACKMA AGM 2012. Photo: Greg Martin

Tony Culberg and Andy Spate. Articles for the journal have been excellent in my first 12 months as Publication Officer, albeit a little slow in coming in. Again, I encourage everyone to write about what there are doing and where they have been in caving. The committee foreshadowed a possible reduction in membership fees in line with reduced journal costs – how many associations do you belong to where fees may go down??!

Cathie Plowman, David Wools-Cobb and Mary Traves have provided reports on Careys Cave with Geoff Kell, and wild caving trips of the weekend that appear elsewhere in this journal.

Andy Spate arranged an excellent series of speakers for the Saturday evening. The talks were held in the wonderfully restored Cooradigbee Homestead.

Doug Mills from the New South Wales Parks Service gave a talk on his bat research at Wee Jasper and Bungonia. This particularly interested me, as I had brought Doug to Naracoorte a couple of years ago to advise us on bat



*Gavin Young presenting in Cooradigbee Homestead.
Photo: Steve Bourne*

counting methods. Doug has really led the way with Thermal Tracker technology in Australia and has been a great resource for Fulbright scholar Kristen Lear (see ACKMA Journal 86).

Gavin Young presented the Wee Jasper fossil fish story and what a story it is! Of Australian fossil fish sites, Gogo has received much more media attention, but the level of scientific endeavour, quality and quantity of the resource, and the information available to science, makes Wee Jasper one of the best fossil fish sites in Australia. Although I prefer my fossils to be younger marsupials that I can readily identify, I really enjoyed Gavin's presentation. One wonders what needs to be done to have this site recognised with National Heritage listing - it is surely one of Australia's most important fossil sites.



*Top and Middle. Rigging the tyrolean in Punchbowl Cave.
Photos: Lily Petrovic
Bottom. Andy Spate leading his karst walk with Pete and Libby Chandler, and Dan Cove.
Photo: Miles Pierce*



*Everyone has a first ever caving experience. Al Warild (left) shares his with John Ash. Anemone Cave, a humble beginning for a caver who has been over 2km deep.
Photo: Celina Yapp*

Gavin's talk was followed by a (very) brief presentation by Tim Sendon. Tim has done amazing work with Gavin, creating replicas of Wee Jasper fish fossils using scanning technology and a 3D printer. The software he uses with Gavin is extraordinary, enabling you to 'fly' through a fish eyeball or any other fossil they have scanned. Awesome stuff!

The final talk was by Fred Ford on his work examining Holocene fossil cave deposits in eastern Australia, and examining what they can tell us Australia's fauna prior to European settlement. Some elements of Fred's work complement the work Liz Reed presented in ACMKA journal 86.

Saturday evening saw the usual frivolity and an auction to raise funds for the Wee Jasper school. Brian Clark had a number of his excellent Mulu books which raised a good sum and Geoff Kell offered a number of 'exclusive' Wee Jasper books, signed by the three authors. I paid \$40 for a copy (retail at \$15) and discovered I already had an 'exclusive' signed copy at home!! It was for an excellent cause though. The auction raised over \$1000 which is again an excellent contribution by ACKMA to a local community.

On Sunday, I participated in the Wee Jasper fossil tour. This is offered to visitors by Ian Cathles, and his

knowledge and presentation of the fossil site is first class. I really enjoy seeing someone presenting their own site, not as a trained scientist, but as a passionate person who lives on and cares for the site, and has spent a lifetime working alongside scientists to understand his land. Ian is on his farm daily and always discovering new fossils. I note similarities with Dave Elliott, a farmer in outback Queensland, who has discovered numerous dinosaur fossils and has established the Australian Age of Dinosaurs Museum.



Ian Cathles leading the fossil tour. Photo: Greg Martin

All too soon, we had to pack up, bid farewell, with a small group of us heading to Yarrangobilly Caves. There we spent Sunday afternoon with Manager George Bradford who showed us through the Caves House renovations. George has previously renovated the single storey building (which our group stayed in) and is currently working on the two storey building. It's a great project and I hope George will report on it in a future edition of the journal.

In the late afternoon and early evening, we visited North and South Glory Caves. The new stainless steel infrastructure and lighting in South Glory is first class. There are plans to upgrade interpretation in this self-guided cave.

On Monday morning, a few of our group headed off to Castle Cave, while others inspected the septic system - ACKMA members have diverse interests! We then toured Jillabanan and Jersey Caves, both of which are exquisitely decorated. I photographed some small straws above the tourist path in Jersey Cave and was surprised at the amount of hair/clothing fibre attached to, and embedded in, these straws. The front cover shows this in detail. A more detailed report of Yarrangobilly will appear in the next journal.

All too soon, it was time to leave and drive the 1200 km home, once again catching the red light at roadworks in the middle of the Hay Plains. Another superb ACKMA event was over.

A TRIP to CAREYS CAVE with GEOFF KELL

Cathie Plowman

Saturday 5 May 2012 and I woke huddled in our tent at Wee Jasper to freezing temperatures. Outside the day was bright, sunny and warming very slowly. The morning's agenda was a trip to Careys Cave with operator Geoff Kell, followed by the AGM. Before leaving for the cave, several ACKMA members implored me to 'keep Geoff moving' to ensure that the AGM was able to start on time.

Well, Geoff is not a man to be rushed and in the hidden pocket of the Wee Jasper valley time hardly seems to matter. It gets light in the morning and dark in the evening. Beyond that, time does not seem important.

Outside the entrance gate, Geoff talked about what he tries to do on his cave 'tours', or perhaps it was rather what he tries not to do. His cave presentation is definitely 'out of the box'. As we descended the steps, rich colours and formations greeted us. Geoff left us to 'ooh and aah' for a few minutes before ushering us into a second chamber with rows of plastic seats. While explanations of stalactites, stalagmites and the like is not a regular part of Geoff's tour, getting people seated and getting them to look up and around while he gradually lights the cave, one candle at a time, is a key part of Geoff's efforts to have the visitors immerse themselves in the cave.

Geoff explained that on his 'tours' there's no obligation to leave the seats and look further into the cave, or even leave the cave at the end of the 'tour'. People were welcome to sit there all day. Parents can venture into the rest of the cave with their children or sit in quiet reflection while children either explore the cave or focus

on the very interesting collection of items on the touch table, including a piece of limestone that had depressions and cavities in it with models of cavers, lights and ropes. In short, here is a cave where you can, to a large extent, suit yourself. You probably do have to leave at the end of the day though.

Taking photographs of visitors is also part of Geoff's standard, he won't allow a family member to step out of the frame to take the photo and, if people don't have a camera, he borrows someone else's and gets people to swap email addresses. While park managers rarely reflect upon it, research shows that family relationships are enhanced in natural environments. The family photos that Geoff encourages add to this dimension.

While many show caves have far too many visitors to be as flexible and unstructured as things are at Careys Cave, cave presenters and guides could generally take a leaf out of Geoff's book and consider what options they have 'out of the box' in allowing and assisting people to immerse themselves and fall in love with the cave environment.

Speaking of love, the cave is a popular wedding venue. I'll finish with one of my favourite quotes from Elerly Hamilton-Smith: 'Our job is not to teach people about caves, but to allow them to love caves; and the rest will follow.'

Well done on your efforts Geoff and thanks for your part in hosting a great weekend. And, we did all arrive promptly for the AGM!



*Left. Geoff introducing Careys Cave with some ACKMA members listening.
Right. John Ash and Travis Cross in Careys Cave.*

Photos: Greg Martin



Geoff Kell in in full flight. Photos: Greg Martin

PUNCHBOWL CAVE, WEE JASPER

Mary Trayes

I arrived at Wee Jasper's Cooradigbee Shearing Shed for the ACKMA AGM about 1.00pm on Friday May 4th, a trifle earlier than most people. After waving my brother good bye, bagging a bunk and checking out the kitchen I went out to see some other early-comers, including John Brush and Marjorie Coggan, who were putting up their tents.

They were soon set up and asked if I'd like to go up to Punchbowl Cave where some of their friends from the Canberra Speleological Society (CSS) were setting up a tyrolean traverse for the following day. Just wear boots and bring a light. So off we went by car, back out through the farm and past the T-junction turnoff at Wee Jasper and along to a local Nature Reserve where there are three or four caves in a small catchment headed by a doline area called the Devils Punchbowl.



*Entrance to Punchbowl Cave.
Photo: Mary Trayes.*

There's a good track to Punchbowl Cave from the carpark and I set off with Marj and a friend of hers, for the fifteen minutes up to the cave. Warren James, from CSS, was to follow shortly with another load of rigging gear. The route led up the hill, over a stile, past a cave entrance by a big gum tree, clambered over a few stretches of limestone rocks, then headed down into a cave entrance – just mind the blackberry bushes and slippery rocks.

Inside we found Dirk Stoffels (CSS) in a large outer cave area, working on setting up a tyrolean traverse across the top of a wide 20m deep pitch which leads down into the cave proper. As a permit is not needed for access to Punchbowl Cave it's much used by recreational caving groups, like Scouts, who want both some straightforward SRT work and a round trip.

Basically the round trip entails going down the abseil pitch, heading across the chamber at the bottom up and to the left, through a short crawl and then following on round a route which takes in some very large chambers such as the Ballroom. Eventually the route reaches a high point on the other side of the entrance pitch looking back 30m or more across to the daylight of the main entrance. At this stage most people abseil into the entrance pitch chamber then prusik back up the original abseil rope to exit the cave but for the Wee Jasper 'wild caving' experience the local cavers decided to take out the last two steps and set up a tyrolean traverse. A good practice for them and the visitors wouldn't need to bother with SRT gear.

Warren had arrived with another load of rope and gear by this time and after some dialogue about what was and wasn't needed he and Dirk abseiled into the cave to go round the loop to the 'other side' to do more work on the rigging over there. The rest of us, having had a good look around the rest of the outer cave, debunked back to the cars and so back to the Shearing Shed where we found many more people had arrived. ACKMA 2012 was underway.

That night Andy Spate blew all the previous choices we'd made for the weekend out the window and made us do them all again. Not to worry. This time my Saturday choices were a trip into Carey's Cave, going to the AGM, then an afternoon trip to Punchbowl Cave. The morning over on Saturday, John and Marj were very busy after lunch fitting out those wanting to do the Punchbowl trip, with whatever gear they didn't have, courtesy of CSS. As most were New Zealanders, that meant harnesses, and for some like me, helmet and

light as well. Most people wanted to do the round trip but Deborah and me opted for testing the lower – raise aspect of using the tyrolean traverse.

Up at the cave it took a while to get the ‘round trippers’ down the abseil but soon they were all gone leaving Deborah Carden and I to be hauled out, one at a time, over the pitch then lowered down. This didn’t quite go to plan when Joe Sydney, over on the far side of the tyrolean, couldn’t haul me out far enough for a mid-pitch lower – too much tension in the system? - and Dirk ended up lowering me down the pitch ending up just to the left of the abseil line. Deborah, being a bit lighter did better, but she too was against the wall much of the way down rather than being hauled out to hang free, then be lowered.

By the time Deborah was down and we’d done an initial exploration of our new home for the next hour, we could hear voices high up on the far side. Here we’d found a rope hanging down a very steep slippery slope and Travis Cross soon appeared, abseiling his way down to us. After having a brief chat and admiring his caving gear (shorts) he set off back up the original abseil rope. Having foregone a turn on the tyrolean, he would end up helping haul people across instead.

It wasn’t long after that we then sighted Dave Smith swinging his way through space way above us, enjoying someone else doing all the work for once. After watching Celina Yapp have her turn and trying to take some photos of her (which didn’t turn out) Deborah and I went off to look for the way they’d gone. Eventually we found it up at the back of a mud bank we had thought was a dead end, and she crawled on through to explore for a bit while we waited our turn to be ‘retrieved.’ Being without overalls and a really good light was a bit of a deterrent for me so I spent some time looking at strata in the cave and thinking about the way it had been formed.

Eventually it was our turn again and the rope, with a weight on the end was dropped down to us mid-pitch. On the return trip we were hauled up (Deborah first) away from the cave walls until almost at the pulley and then pulled into the cave entrance side of the pitch by the tyrolean set-up. This worked pretty well except for a bit of spinning on the way up for both of us and for me almost going through the pulley (I did say 1m!) and then being dropped (a bit) once when they re-set the Z-pulley system. Not to worry, it all made for a very interesting afternoon. By the time we got our gear off, packed up and carted out some rigging gear to the cars we were late for the Bat Talk and had to tiptoe in. Thanks Marj for the ride back and to Joe, Dirk and Warren who did all the rigging.



Left: Deborah Carden abseiling into Punchbowl Cave.

Above: Dirk Stoeffels rigging tyrolean.

Photos: Mary Traves

NICE CAVE (WJ 135) WEE JASPER, NEW SOUTH WALES: MANAGEMENT REPORT

David Wools-Cobb*

EDITOR'S COMMENT

The owners of Nice Cave, Ian and Helen Cathles, kindly gave permission for a small group of ACKMA members to visit the cave during the AGM weekend. Advice on the management of this spectacular cave was sought and David Wools-Cobb compiled this report, and I thank him for taking the time to do so. David also liaised with John Brush, Andy Spate, and Ian and Helen to review his report and their feedback is a footnote to this report. I was on the trip and I concur with David's report for the outer section of the cave. Unfortunately, I could not access past the gate restriction, only small cavers will ever see this section!

LOCATION and ACCESS

Nice Cave is located in the Wee Jasper valley NSW, on private land. The land owner states that she rarely allows visitors, parking nearby makes visitation obvious to any passer-by. A key is required for a gate about 180m into the cave.

CURRENT CONDITION

With no gate at the entrance, it is obvious that this cave has been visited very often in the past. Mud tracking has been extensive, making conditions particularly slippery. For much of the first section of the cave, the route is not always obvious, so mud has been tracked over many surfaces.

Unfortunately in this type of limestone, the amount of embedded clay is extensive, resulting in a muddy layer over many surfaces, regardless of human visitation.

Some management has been installed in the form of plastic tube track delineation (much of this is brittle and readily broken), sometimes on only one side of the "track", and a crude but effective gate. At the time of visit the padlock was in place, however unlocked; as it appeared to be extremely gritty, making locking and unlocking difficult.



*Top: John Brush at work in Nice Cave.
Below: Some of the "nice" decoration in Nice Cave.
Photos: David Wools-Cobb*





Chamber in Nice Cave. Photo: David Wools-Cobb

Some signage has been installed advising of two boots-off areas and a “de-trog” area.

In places it is not obvious just what side the visitor should be on the stringline, and in one place three different fragile routes may be followed.

MANAGEMENT IMPROVEMENTS

Due to the extensive areas of mud, interspersed with areas of flowstone, some of which have significant mud tracking, I believe it would be virtually impossible to clean a route. Much of this mud is of considerable depth. In my experience, natural rock surfaces and to a slightly lesser extent, flowstone surfaces are cleanable, however the mud is so extensive that I feel such cleaned areas would not remain so for long. It is impractical to install boot wash stations in what would be become dozens of places. Water access is also extremely limited.

If such cleaning were to be undertaken, I would recommend a large water storage container be placed immediate outside the cave entrance, with black 12mm polypipe used to gravity feed throughout the cave. Fire-

fighting hand pumps attached at the end of such piping make for an effective ‘high pressure’ cleaner.

The best contribution for improved management would be replacement and extensive additions to the string lining of the route and some ‘no-go’ areas. This may be easily done, using natural tie-off points and stainless steel pegs (not aluminium as they corrode in a cave environment). Route sections not requiring string lining could be marked with reflective discs on each side.

The route width should be minimal but practical, taking advantage of well used areas and the natural ‘flow’ thru the cave. Stringlines and route markers should be placed in such a manner that leaves the visitor in no doubt as to the correct route position from either direction of travel. Any delineated no-go areas should be marked in an obvious manner, however at times consideration should be given to the possibility of temporary removal (end looped onto a natural anchor) of the stringline where it crosses a particularly photogenic scene...or placed low enough to be effective without intruding into the photograph.



Left: Fossil



Right: Helictites. Photos: David Wools-Cobb

Below: David Wools-Cobb speaking with Marjorie Coggan in Nice Cave. Photo: Steve Bourne

“Boots off” and “de-trog” areas need replacement signage: waterproof paper, laminated with good border seal around the sign. These areas also require some matting, to ensure that the visitor is able to step on to a non-muddy area before proceeding. At the end of these sections, further matting is required, to allow a transition from clean area to muddy. Matting must be suitable for at least one caver plus associated gear, but accommodating more is desirable. I note that some cleaning of both the boots-off sections would be of value.

For crossing areas of clean flowstone cavers should be encouraged to use soft-soled, non marking shoes/thongs/wet suit booties rather than socks. Large plastic bags for outer caving suit is also good practice, or caving suit turned inside out, with gloves & boots and pack placed within.

Some areas involve quite delicate thin flooring and would be best marked off as “no go” areas.



One loose bank area would benefit from a permanently placed climbing tape; less damage and less mud tracking would result.

In one place the route along some muddy/soiled banks is not obvious, improved track marking with regard to going into the cave and the return would be advised.

The gate is unusual, placed in a position that is very difficult to access and requires a new lock and perhaps total replacement. I recommend consideration be given to the placement of a new bat friendly gate at the entrance, with landowner permission and A.S.F. specific restricted access, thereby protecting the whole cave.

*David Wools-Cobb - Coordinator, Karstcare: cavers caring for caves tascaver@bigpond.net.au

SUMMARY

Nice Cave involves some 350m (estimated after visit) of passages. The first section has been extensively visited and muddied, with considerable speleothem damage. After the gate and "squeeze restriction" which have offered some protection to the latter section, the cave is quite beautiful.

It is a cave in which some of the previous damage may not be reversible, however the limited and mostly inexpensive suggestions outlined above would reduce much further mud tracking and greatly influence in-cave behaviour by visitors.

FOOTNOTE

Since the ACKMA AGM weekend and the preparation of the above comments, there have been several developments:

- the landowners have agreed that visitor impact issues in Nice Cave should be addressed and would like to convey their thanks to ACKMA members who provided comments;
- the padlock on the gate has now been replaced;
- work has already commenced in the outer parts of Nice Cave to improve track marking and signage and replace the deteriorating lines and signage; and
- the landowners have decided that to reduce visitor impacts, future trips will be limited to those that are led by someone who is on their list of approved leaders.



*Marjorie Coggan admiring helictites in Nice Cave.
Photo: Steve Bourne*

EISRIESENWELT - ICE CAVE

Garry K. Smith

Location

Eisriesenwelt (pronounced – ice-ree-sen-velt) which in English means “World of the Ice Giants” is reputed to be the largest ice cave in the world. It is designated an ice cave because it contains ice formations which remain all the year round. However, in reality this cave is a limestone cave which contains ice decorations.

The cave system is the most significant in the Alps and is located in the Tennen Gebirge mountains near Werfen in the Province of Salzburg - Austria, approximately 40km south of the capital Salzburg. The main entrance is approximately 1000 metres above the Salzach Valley at an elevation of 1641m ASL.

The carbonate strata in this part of the Alps extends from the Triassic to the Jurassic and the caves were formed during the late Tertiary period.

To date there is approximately 42km of surveyed cave. The first kilometre of cave passage contains the majority of ice sculptures and covers approximately 30,000 square metres. The ice is more than 20 metres thick in places.

A timber walkway, throughout the tourist part of the cave, leads visitors through a series of large chambers and connecting passages, past magnificent ice decorations and climbs steeply in places over large ice flows to an elevation of 1775m.

Getting To The Cave

Tourists can travel to the area by private vehicles or by using several modes of public transport (train, bus & taxi). Alternatively, several companies run half day coach tours from Salzburg to the Cave. The coach route passes through the township of Werfen (548m ASL) nestled in the valley between two huge limestone



*Looking out the entrance of Eisriesenwelt Cave.
Photo: Garry K. Smith*

mountain ranges which tower some 1900m or so above the valley floor. The narrow road winds steeply up to a small parking area next to the new Welcome Centre (ticket office and souvenir shop). From here there is a 15 minute walk up a well graded track which winds around the side of the steep mountain. A tunnel through one ridge can be used to reduce the walking distance to Wimmer Hütte, where the cable car lower station is located. A 15 person gondola takes visitors up a further 500m in 3 minutes to an elevation of 1586m where a restaurant (Dr. Oedl-Haus) is perched on the side of the mountain. Here visitors can purchase a drink, snack, meal, or rent a simple room for the night. From this point there are excellent views of the Salzach Valley and town of Werfen far below.



*Looking along the shortcut tunnel on track to Eisriesenwelt. Right. Final section of the path leading to Eisriesenwelt.
Photos: Garry K. Smith*



*Above. The guide burns magnesium ribbon to illuminate ice decorations in Eisriesenwelt. Below. Ice decorations.
Photos: Garry K. Smith*

The 900-year-old Burg Hohenwerfen Fortress, once used as a film set for the James Bond movie “Where Eagles Dare”, when viewed from Werten village looked so grand perched high on a rugged peak, yet from the high vantage point of Dr. Oedl-Haus restaurant, it looks so small and insignificant.

From the restaurant there is a further 15 minute walk up a steeply graded track, much of which is under a concrete awning to protect against avalanche or rock fall. The first glimpse of the Ice Cave entrance can be seen



just before the covered walkway begins. The valley side of the covered walkway is completely open which allows an unobstructed view of the fabulous scenery.

The cave tour lasts about 75 minutes. Visitors not travelling with an organised tour group should allow three to five hours for the complete trip from Werfen.

The Cave Tour – a personal account

The first glimpse of the cave entrance is a very impressive sight with a large opening (20m wide x 16m high) in the face of a huge wall of limestone. It was a warm pleasant day and only required the wearing of light clothing so far. We are greeted by our guide at the entrance (1641m ASL).

A carbide lamp with an exposed naked flame is given to every fifth person as the guide tells us some of the cave’s history. (See history details at the end of this article.) We are told that this form of lighting (carbide lamps) was used a hundred years ago to explore the caves, so is used today so tourists can experience what it was like in the early days. Thankfully the guide suggested that people with the lamps be careful not to burn themselves or the person next to them as the naked flame is very hot.

We were then warned to remove any loose clothing such as hats, scarves etc due to the strong breeze which will whip them away when the cave door is opened. The



*Left. Layers of ice contain a valuable record covering 1000 years of the Earth's history. Right. Ice column.
Photos: Garry K. Smith*

heavy metal door was opened and sure enough an icy gale force breeze rushed out as we entered. Several of our party's carbide lamps were extinguished, then relit by our guide.

Thankfully I had rugged up at the entrance. Twenty metres inside the entrance the breeze subsided and eventually was not noticeable in the large chambers.

The guide burned magnesium ribbon to light up the huge ice decorations. Several times he lit long strips tied on pieces of wire behind the ice sculptures. It is all extremely beautiful with ice stalagmites, stalactites and columns illuminated to reveal various shades of translucent aqua, blue, through to white and glass clear. There are numerous large chambers and halls connected by narrow passages. Ice decorations range from small delicate crystals up to numerous figures of gigantic dimensions.

There are approximately 700 steps along the wooden walkways which allowed us to climb a total of 134 metres over a number of large and very steep ice flows to the upper chambers at an elevation of 1775m ASL. All through the tour the guide continued to break off strips of magnesium ribbon from a roll and ignite them with the flame of his carbide lamp. The burning magnesium was waved in the air like some magic wand to illuminate the passages. Lumps of burning ribbon continuously dropped onto the ice decoration and timber walkway while trails of white smoke issued from the burning ribbon. All through the cave there are clumps of magnesium oxide on the floor and the timberwork is pitted with small burn marks.

At the start of the Great Ice Embankment, about a third of the way into the cave, there is a point where people who get acrophobia (scared of heights) or feel they are unable to complete the strenuous tour may pull out and cross over to the exit path. Several of the less fit in our tour group opted to wait at the junction so the guide gave them one carbide lamp. I guess for light, but maybe

also warmth, as they were bitterly cold and shivering deeply when our tour returned to them an hour later.

Overall the experience was unforgettable and I would recommend the tour to anyone fit and able to climb the total of 1400 steps on the cave tour.

General Information

The walk up the mountain was very pleasant on the day we visited, however it was probably the exception to the norm. Hence be sure to take warm clothes and raincoat for the walk up the mountain and include gloves to be able to hang onto the frozen metal handrails inside the cave. Also wear good insulating shoes with thick socks. Needless to say the temperature inside the cave is just below 0°C.

I didn't see any calcite speleothems on the route taken by the tour, however there may well be some further into the cave.



*Cable car to Dr Oedl-Haus restaurant.
Photo. Garry K. Smith*

Depending upon the outside temperature, it is either warmer or cooler inside the mountain and this causes the air to circulate upwards or downwards. Eisriesenwelt is basically a dynamic or cyclical cave which is influenced by the chimney effect airflow. During winter, when the air inside the cave is warmer than outside, cold air streams into the cave and reduces the temperature of the lower areas of the cave to below freezing point. During our spring visit a strong breeze was rushing out of the lower entrance when the door was opened. This was due to the colder heavy air in the cave sinking to the lowest point and rushing out the lower entrance, thus dragging in slightly warmer air from an entrance higher up on the snow capped mountain. The melt water entering the lower chambers through cracks in the rock freezes to create the wonderful ice sculptures.

The oldest layers of ice in Eisriesenwelt have been dated at approximately 1,000 years, however the cave itself has formed over 50 to 100 million years. Hence the ice formations are an extremely recent phenomenon in comparison to the age of the cave.

Opening Times and Entry Fee

Eisriesenwelt is open to tourists from 1 May until 26 October. The guided 75-minute tours start at 9 am, with the last tour departing at 3:30 pm, (4:30 pm in July and August).

A combined cablecar/cave ticket is priced at €20 for adults, €18 for members of mountaineering or caving clubs, and €10 for children of 14 and under. If you're feeling super energetic it is possible to save some money by hiking up and down the mountain or taking the cablecar in just one direction. Up-to-date information can be found at the official website [www.eisriesenwelt.at]

Concerns Related to Management Practices

We were told that the tour basically covered most of the cave containing ice decorations. What we saw illuminated by the burning magnesium ribbon was very impressive despite no fixed lighting. Due to the environmental conditions within the cave, it could be difficult to maintain fixed lighting if it were installed.

I asked the guide how they clean up the magnesium oxide and was told that they just wash down the caves at the end of each season and the decorations rejuvenate with fresh water seeping in and freezing. I personally can't see that this approach is an environmentally friendly solution to the magnesium oxide waste. There are certainly many lighting options which would better fulfil the requirements of displaying this cave to the public.

The hand held carbide lamps, provided to tourists for lighting, had exposed naked flames shooting out the front of each lamp. As most people are not experienced with the use of these lamps, there is a real chance that those with the lamps may burn themselves or other tourist. I witnessed several near burnings while on the tour, particularly when our group bunched up on the narrow timber walkway. When in the large chambers the



*Fossils at 1640m ASL at the entrance to Eisriesenwelt.
Photo. Garry K. Smith*

area illuminated by each carbide lamp was not much more than the timber walkway immediately in front of each lamp bearer, so they had very little benefit in lighting the cave. When held by the wire handle the lamps dangled at kneecap level, so had excellent potential as kneecap warmers!!!?, not to mention the possible hole burns in expensive clothing.

At the start of the tour season when we visited there were approximately 200 visitors per day and in the peak season visitor numbers rise to above 2000 per day, with tours starting every 6 minutes. Due to the low number of tourists on the day of our tour, our group of 40 people was not overly rushed. However, I suspect in the peak season the feeling would be more like cattle class – hurry up - keep moving, as the timber walkways are mostly one person width. I personally prefer a little time to admire the decorations, not moved along in a constantly moving crush of people.



*Guide burning magnesium ribbon.
Photo. Garry K. Smith*

There were sections of metal handrail on steep staircases which were covered in sharp ice crystals. Good handrails are a must for the safety of visitors. Sharp ice crystals could be potentially hazardous to visitors not wearing gloves, although where metal hand rails were free of ice, they were just too cold to grab more than a few seconds with bare hands. In hindsight it would be a good idea if the Eisriesenwelt management warned visitors to bring gloves in all promotional literature.

Brief History

The existence of the cave was only known to hunters and poachers at the end of the nineteenth century. In 1879 Anton Posselt from Salzburg explored 200 metres into the cave until he reached a huge flowstone wall and was unable to continue due to a lack of equipment. One year later he published a detailed account of his exploration of the cave in a mountaineering magazine. He is now recognised as the “discoverer” of Eisriesenwelt.

Interest in the cave was short lived and it slipped back into obscurity until a pioneer caver, Alexander von Mörk, came across Posselt’s written article. He mounted a series of expeditions beginning in 1912 which yielded an extensive cave system. Von Mörk was killed in 1914 during World War I, and his ashes were later interred in the Mörk-Dom, or “Mörk’s Cathedral,” a chamber of ice that rises 35m above the cave floor. The discoveries soon attracted tourists and a small cabin “Forscherhütte” (Discoverer’s Refuge) was constructed in 1920 as well as a primitive climbing route established to the cave and into its interior. By 1924, the ice covered sections of cave were accessible to tourists without the need for climbing gear. However it was a long arduous steep walk up the mountain from Werden.

There is a frozen lake measuring 70m x 25m in the chamber called the Eispalast (Ice Palace). “Incredible as it may sound, this lake of ice was used in the 1930s for training purposes by a couple of ice skaters preparing for the Olympics. At that time there were virtually no ice rinks and so they prepared here with music from a wind-up gramophone and light from various Davy lamps set up around the lake” (Angermayer, E., 2005).

From 1953 onward it was possible to drive a car up Eisriesenweltstraße (Ice Caves Road) on an unsealed single lane road to the Welcome-centre. Then in 1955 the cable car was completed. This alternative reduced the walking time over the steepest part of the climb by 1.5 hours.

Today the Eisriesenwelt cave is world famous and attracts large numbers of tourists to this part of the Alps region in Austria.

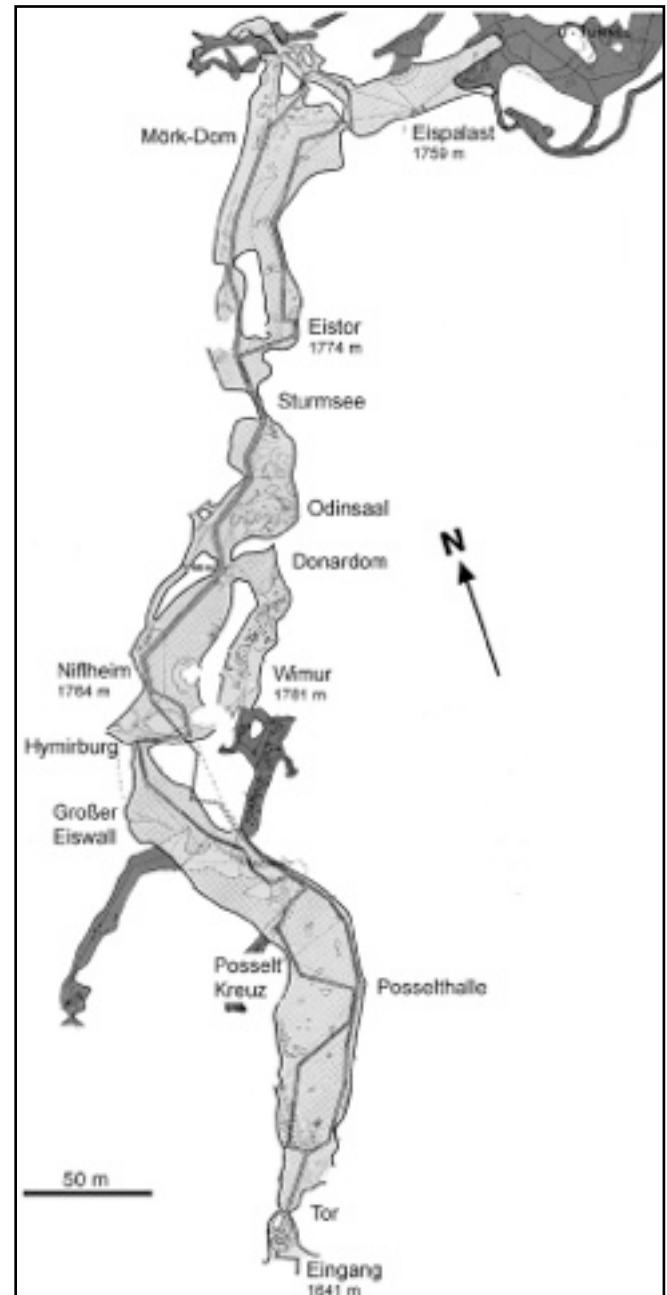
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Map of the ice covered part of Eisriesenwelt Cave in Austria. Light grey areas are ice-covered, dark grey are ice free. Map courtesy www.the-cryosphere.net. (May, B. et al 2011)

Welcome to Waitomo

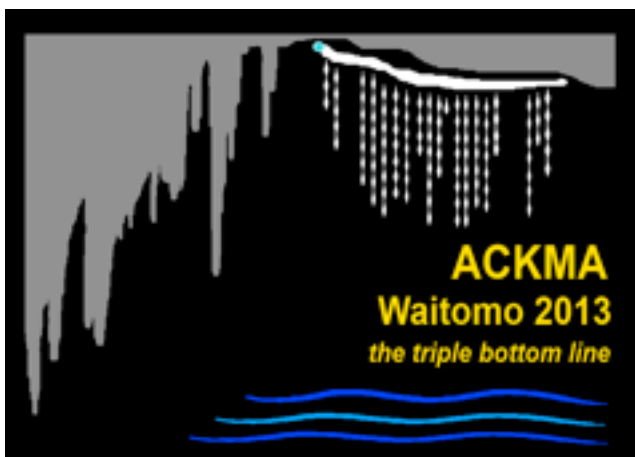
Come to Waitomo's 2013 Conference!

The village of Waitomo Caves is set amongst rolling green hills of farmland and forest, at the edge of one of New Zealand's largest karst areas. Cave tourism has been a part of Waitomo life since the 1880s.

Since the last ACKMA Conference in Waitomo – way back in 1997 – a lot has changed. The Ruakuri Cave has been re-opened, and the Spellbound Caves have been developed. A new, architecturally iconic, visitor building has been developed at the Waitomo Glowworm Cave and new accommodation food and retail outlets have developed. But some things haven't changed – there is still a pub in the centre of the village and the local karst scenery remains spectacular.

Conference theme

The Conference Theme is 'the triple bottom line'. Also known as 'people, planet, profit', triple bottom line is a framework for looking at social and environmental outcomes, as well as financial outcomes. More broadly for us, what does cave tourism really deliver for its stakeholders – financially, environmentally and socially? Guest speakers, and we hope, conference delegates will explore this theme in key conference sessions.



Getting to Waitomo

Waitomo is three hours south of Auckland, the usual air gateway into New Zealand. We will have airport transfers for late Thursday to support the pre-conference activities, and Sunday for the Conference itself. The Sunday bus will depart the city first and then pass the airport around 2pm, so flights need to arrive 1:30pm latest. There is some public transport south by bus or train. For those taking public transport, if you can get to the nearby towns of Te Kuiti or Otorohanga we will bring you to Waitomo. An Auckland airport transfer will leave Waitomo around 9am on Saturday morning after the conference, suitable for flights departing 3pm or later (including 2hr check-in).

Accommodation

Accommodation will range from \$10 a night BYO sleeping bag at the local caving club hut, to over \$150 a night at the other end of the market. In between, Waitomo has a range of motel units, backpackers, bed & breakfast, cabins – and even boats and planes. Most are only a short walk from the village centre and the Conference venue.



Waitomo services

Waitomo is a small village with plenty of accommodation options. A general store, 3G phone and wireless/wired broadband, cash machine and food and beverage are all available. Larger towns are about 20 minutes away and have banks, supermarkets, pharmacies and petrol stations.

More information

Pre-conference #1**Wild caving**

Saturday and Sunday will have wild caving options for those arriving early. Short dry trips will be available for all levels of ability (a dry trip in Waitomo means no more than knee deep). Cave tours are likely to include Hollow Hill, Zweihohlen, Waipuna and Flood Caverns. If enough experienced cavers are in town either Rangitaawa Shaft or Mangawhitikau will be available. Both are multi-pitch SRT and involve swimming (at less than Mulu temperatures). Local transport and some equipment will be available.

Pre-conference #2**Rotorua and Taupo geothermal**

Another post conference option will tour a different form of geodiversity – the geothermal and volcanic heritage of the Rotorua – Taupo area. The very fit might be able to include the Tongariro Alpine Crossing. This tour is likely to be three days.

**Post Conference****West Waikato karst & Auckland lava caves**

A three day post-conference tour will ramble from Waitomo back up to Auckland along the less known karst of the Waikato's western coast. The route passes several harbours and some fantastic karst scenery, as well as the largest polje in New Zealand and the Nikau Cave tourist operation at Waikaretu. We will finish the tour with some lava caves in Auckland and the Auckland Harbour islands. Places on this tour are likely to be limited.

**Touring New Zealand?**

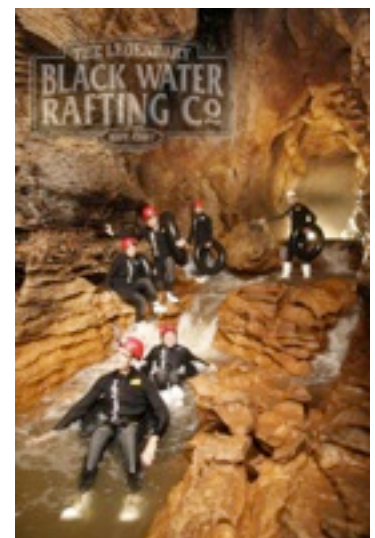
If you're taking a bit more time to visit more of New Zealand, feel free to get in touch with local ACKMA members for advice. The Waitomo Caves Discovery Centre also has an information centre that can help you with advice and bookings for much of the country.

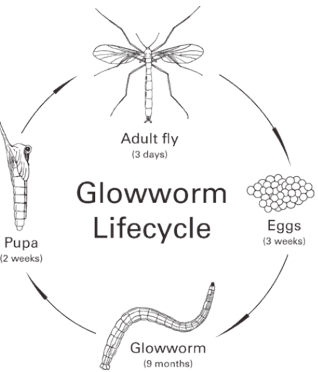
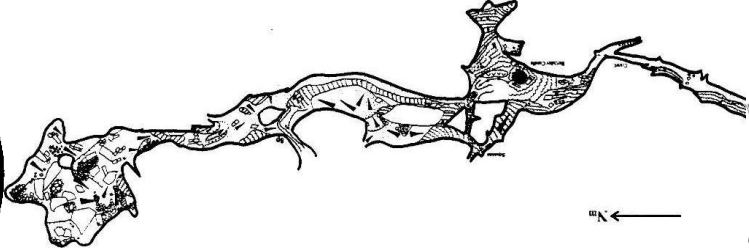
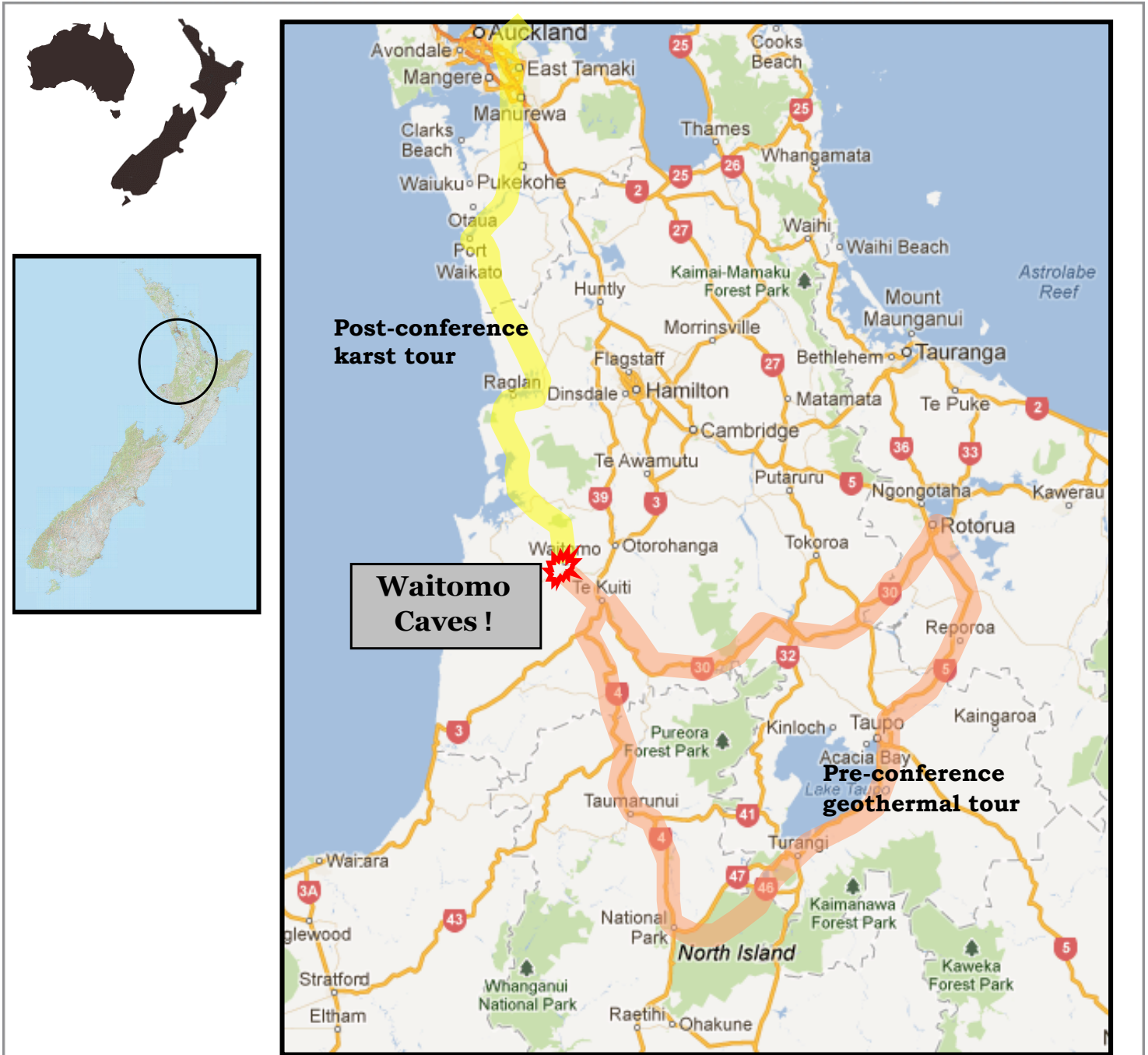
e: info@waitomodiscovery.org



Conference program

May 2013	Morning	Afternoon	Evening
Friday 10th – Sunday 12th	Pre-conference options: #1 Waitomo wild caving trips, or #2 Geothermal Rotorua & Taupo		
Sunday 12th	Transport leaves Auckland CBD about 1pm and Auckland airport around 2pm, arriving Waitomo approx 5pm.		4pm – 6:30pm: Registration open at Waitomo Caves Discovery Centre. Leave 6:30pm for powhiri (welcome) and function at Waitomo Glowworm Cave
Monday 13th	Papers	Split groups: #1 Spellbound cave tour, or #2 Aranui Cave & Ruakuri Natural Tunnel	Committee meeting
Tuesday 14th	Papers	Split groups: #1 Spellbound cave tour, or #2 Aranui Cave & Ruakuri Natural Tunnel	Waitomo Glowworm Cave tours
Wednesday 15th	Papers The AGM	Options: workshops, free time, adventure cave tours, other cave and karst options	Waitomo Caves Discovery Centre behind the scenes tour
Thursday 16th	Papers	Split groups: #1 Ruakuri Cave or, #2 Caves to Coast limestone tour	Maybe a local hydrology session ...
Friday 17th	Papers	Split groups: #1 Ruakuri Cave or, #2 Caves to Coast limestone tour	Final function
Saturday 18th – Monday 20th	Saturday 9am bus departs Waitomo, arriving Auckland Airport around 12-1pm Post conference tour – karst of the western Waikato		





UNUSUAL KARST at WAIRERE BOULDERS

Moira Lipyeat

Always having an 'eye out' for eccentric landforms, especially karst, I was fascinated by a TVNZ 'Country Calendar' program screened 26 Jun 2010 and decided we would visit this area. It appears I wasn't the only viewer as I believe crowds visited the Wairere Boulders after the program was aired. How could these boulders have formed? Basalt with all the features of karst! It seemed nature had been up to its tricks again.

Spending Christmas 2011 with family within a hundred kilometres of these formations, we made it our business to explore this area. Felix and Rita Schaad came from Switzerland in 1983 with the intention of buying land in New Zealand. They found this block on the Wairere Stream, quite near the Hokianga Harbour in North Auckland. Reading about this area I discover a William Webster, one of the early white settlers, erected the first water-driven timber mill in New Zealand here in 1845. Most of the kauri and other valuable timbers were milled and over the years the creek had been overgrown with gorse and every other sort of vegetation, and the boulders were not visible. Neighbours questioned them purchasing such a weed-infested area but they still felt happy with their purchase and started clearing it. Although it took a number of years, every day brought fresh surprises. This was unique, they had uncovered, and are now assuming that 'Wairere Boulders' is the only known karren eroded basalt boulder valley world wide. It is composed of such an enormous number of karst like rock in the middle of clay and basalt country. The rocks are 2.6 – 2.8 million years old. They are the erosional remnants of a basalt layer. The erosion of the rock called fluting, lapiez, karren or solution runnels.

Felix and Rita gave me a website www.wairereboulders.co.nz (image below sourced from this excellent website -Ed.) where a friend helped me source an article on this area by J.A. Bartrum and A.P.

Mason, Auckland University, published in 1948. It seems this area was known of but perhaps forgotten, as back in 1916 J.A. Bartrum had recorded this phenomenon and samples were in the Auckland Museum. "Karst in Stone" by Jill A. Kenny and Bruce Hayward (2009) also record these formations on p.7.

An explanation for pseudo karst bizarre forms is

Kauri and the erosion of rock surface. Leaching caused by rain dripping through the acid foliage of the rain forest and runoff over acid soil is thought to have created the world unique flutings on the rock surfaces of the Wairere Boulders. Kauri has played an important role in this process because of its acid foliage, which is thought to produce organic acids. The kauri has contributed to the bizarre form of erosion.

explained on a walkway notice:

The Schaads have constructed bridges, paths, lookouts and information notices that make this geological gem a picturesque and fascinating walkway. The loop encircling Dragons Cave and a Nikau Forest took us about an hour. For \$15 it was excellent value and they made us welcome to park our campervan there for the night in this magical valley. The next morning my husband rose early and explored the area right up the viewing platform about another hour up the valley and enjoyed that.

This is a private park and the enterprise was established by years of hard work and without government funding. Inspect their website and read more of the geology of the area. A spot well worth visiting on your next New Zealand visit – perhaps after 2013 ACKMA at Waitomo.



THE SAGA of the PINK TERRACES: A CASE STUDY of CAVE IMPROOOOVEMENT!

Rolan Eberhard

Caterpillar: Recite.

Alice: Oh. Yes sir. How doth the little bumblebee improve each...

Caterpillar: Stop. That is not spoken correcticly. It goes: How doth the little crocodile improve his shining tail. And pour the waters of the Nile, on every golden scale. How cheerfully he seems to grin, how neatly spreads his claws. And welcomes little fishes in, with gently smiling jaws.

Alice: Well, I must say, I've never heard it that way before.

Caterpillar: I know. I have improoooved it. (Carroll 1865)

The dictionary doesn't have an entry for improooove. A possible definition would be that an improooovement is an attempt to improve things that doesn't actually bring into being a more desirable or excellent condition (the dictionary tells us this is what defines an improvement). Humans have a strong tendency to want to improve things, though sometimes the outcome is an improooovement. So it is with cave management.

The root of the problem is twofold. First, caves are complex natural systems of which our understanding will always be imperfect. It follows that tampering with them while seeking to improve certain aspects can have

unforeseen environmental consequences. Second, show caves have historically been promoted primarily as an aesthetic experience, and often still are. This entails scope for pandering to the faddish and ephemeral.

The pitfalls facing the cave manager are well illustrated with regard to events surrounding the Pink Terraces and certain other features at Marakoopa Cave, Tasmania (Figure 1). The Pink Terraces is a series of large rimstone dams that create an impressive sequence of tiered ponds several metres wide and tens of metres in length (Plate 1). Originally, the ponds took up most or all of the width of the passage at this point, presenting

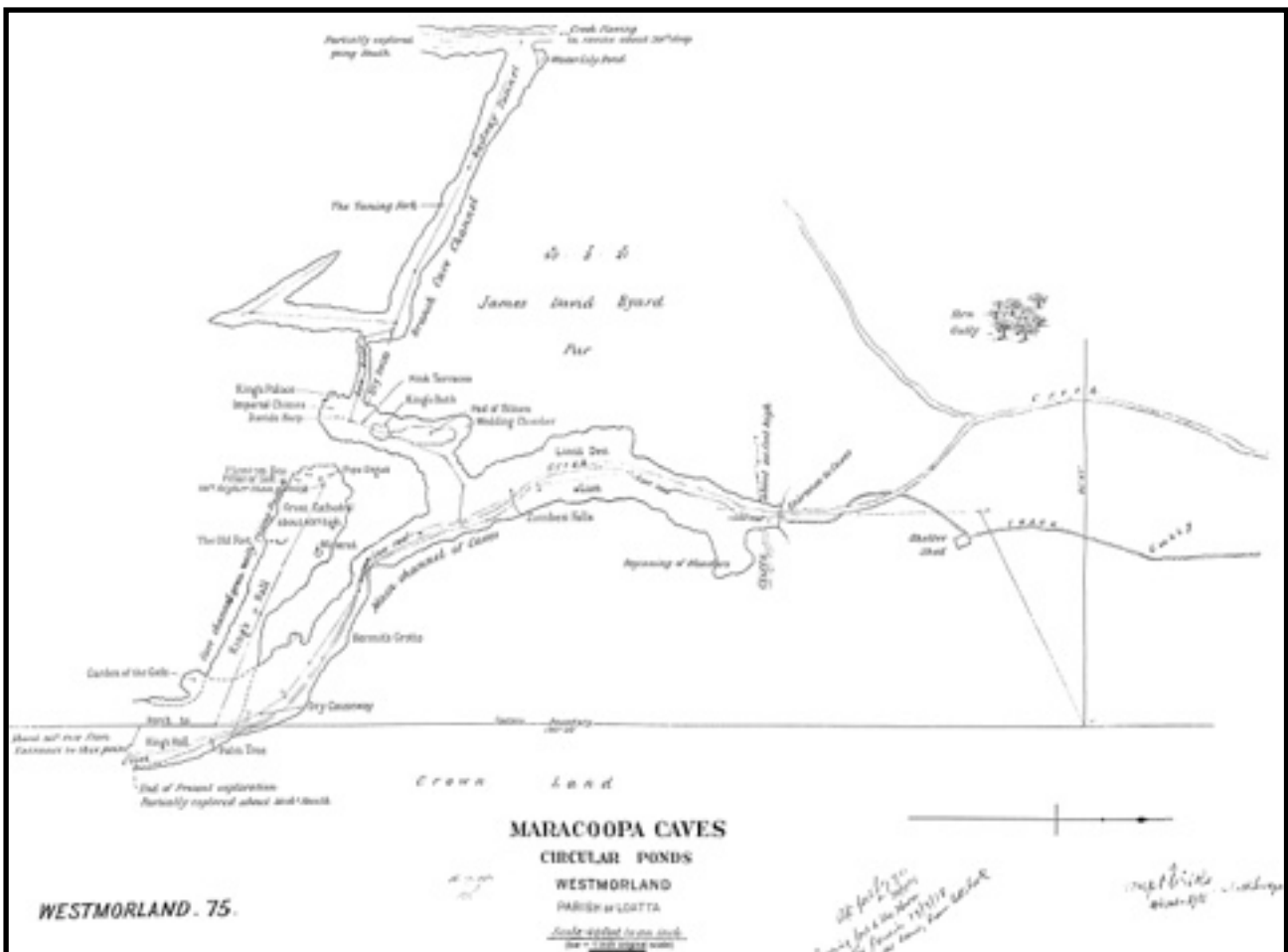


Figure 1: Surveyed plan of Marakoopa Cave dated 1918, by Joseph Wilks, District Surveyor. The feature marked 'WaterLily Pond' is now known as the Lily Pond.



Plate 1: Rimstone barriers towards the upstream end of the Pink Terraces. The pathway on the side was established in the late 1930s; prior to this, parties may have walked directly on the flowstone or the rimstone barriers. Photo: Paul Flood

something of an obstacle for parties proceeding deeper into the cave. In this situation visitors would naturally attempt to stay out of the shin-deep water by stepping on the tops of rimstone barriers or crossing the adjacent flowstone. Some damage may have resulted. ‘Spark’, who visited Marakoopa around the time of its opening in 1911, had this to say: ‘The floor of the cave in many parts is beautiful in the extreme. It seems a sacrilege to walk over it and destroy the artistic patterning of the terra cotta, pink, and white tracing...’ (Dyer 1911).

At some stage the rimstone barriers were modified by cutting notches into them, releasing impounded water

and reducing their depth, presumably helping tourists keep their feet dry. Improvement or improooovement? Higher in the same cave, a long flight of steps was chopped into the massive flowstone cascade that extends the length of Kings Hall. By today’s standards these actions seem heavy handed if not vandalism. At the time they were evidently regarded as improvements – cost-effective solutions to practical problems in cave presentation.

It is unclear whether breaching the Pink Terraces was entirely effective in achieving dry feet. In any event, by the mid-20th century concrete had become the product of choice and in due course a raised path was constructed along the side of the Pink Terraces. This created a dry, graded access for viewing the terraces and accessing passages beyond. In 1938 David Lowry reported that ‘there will be a first class track and step from cave entrance right through to the Lily Pound [sic]’ (quotation supplied by Nic Haygarth).

Electric lighting was installed around the same time, replacing earlier hand held acetylene lamps and allowing greater control and flexibility in visual effects. Crystal-lined ponds were obvious targets for creative scene-setting (Plate 2). In this way the Pink Terraces and the Lily Pond came to be regarded as centrepieces of the Marakoopa Cave experience.

In the mid-1980s Chester Shaw (Parks and Wildlife Service) and others made further modifications to the infrastructure. In doing so they attempted to remedy some of the effects of what they considered to be bad past management practices, such as the breaches in the Pink Terraces. They did this by back filling with concrete the sections that had been cut away (Shaw 1991) – one of few Tasmanian examples of repairs to broken speleothems. For similar reasons Chester et al re-aligned



Plate 2: The Lily Pond – looking good following cleaning and restoration of the natural hydrology (cf. Plate 4). Photo: Paul Flood

the route through Kings Hall via a pathway along the side of the passage, off the main part of the flowstone.

Thus resurrected, the Pink Terraces were available to provide pleasing reflections for admiring tourists. That is, until it was noticed that the terraces had a tendency to dry out with increasing frequency and duration, as did the Lily Pond. Some years these features were reported to dry out in summer and not refill until well into winter or spring, if at all. The timeframe over which this occurred is unclear. Such an effect would be consistent with climate change modelling, which predicts that Mole Creek is one of the few Tasmania karsts likely to experience a net annual reduction in precipitation (Sharples 2011); on the other hand, an episodic event such as an extended drought could produce a similar result over a different timescale. For the purpose of this story the important point is that there was a perception that the ponds were behaving differently from the way they had in the past. This was considered to detract from the quality of the cave tours, to the extent that it was feared that visitors would be less inclined to go there.

Under natural conditions the source water at both sites is derived entirely from percolation flows (i.e. drip water). This could not be controlled; however, it could be supplemented by diverting water from other sources, such as perennial streams elsewhere in the same cave. This was deemed an appropriate thing to do. Accordingly, the following solution was engineered: (1) install inside the cave one 16,000 litre holding tank, comprising a plastic liner supported in a steel frame resting on a treated pine base, (2) pump water from creek into holding tank, regulated by a float valve at the tank, and (3) gravity feed water from the tank to the Pink Terraces and Lily Pond as required, controlled manually via a gate valve. These works were completed and the system operational sometime in the 1990s (Plate 3). The holding tank was located in an undeveloped section of the cave above Short Creek, the source of the water, and was not visible to those participating in tours.



Plate 3: 16,000 litre holding tank in upper level of Short Creek passage.

For a period the new arrangement appeared to be successful – that is, water levels in the ponds could be maintained during dry periods – but new problems became apparent. Short Creek originates from a surface stream rising high on the slopes of Western Bluff. It is derived mainly as runoff from non-carbonate rocks, has a flashy hydrological regime, and carries a variable load of organic material and sediment. It was found that water pumped into the holding tank contained suspended material that settled out in the tank, the Lily Pond and the Pink Terraces. Attempts were made to fix this by periodically vacuuming the base of the tank using a device for cleaning swimming pools. Despite this, sediment continued to accumulate, giving in the Lily Pond and the Pink Terraces a dull sludgy appearance (Plate 4).



Plate 4: The Lily Pond in April 2007. The dark material on the base of the pond is sediment from Short Creek (cf. Plate 2).

I became aware of the water diversion during an assessment of aspects of the environment at Marakoopa Cave in 2004. My first thought was that this practice might be having an adverse effect on the rimstone barriers and associated crystalline deposits. Theoretically, replacing or diluting alkaline percolation water with potentially acidic stream water could slow or reverse the precipitation of carbonate minerals. In other words, the diverted water might be gradually dissolving away the very features it was intended to enhance (improve)! I was also concerned that leachate from the CCA-treated pine base of the holding tank might be contaminating the cave.

Close inspection of the Pink Terraces revealed that although parts of the rimstone barriers were composed of hard crystalline material, as would be expected of actively depositing features, other parts were quite porous and even pitted with fist-sized holes. It was tempting to jump to the conclusion that this was due to solutional attack by aggressive water. In fact it had to be acknowledged that there were other possible explanations, such as physical damage sustained during a century of activity by tourists and cave guides. More compelling evidence was required, as the arrangement

had not long been in place, was considered to significantly improve the quality of tours, and would not be a trivial exercise to dismantle. If indeed the hypothesis stood up to further testing.

Cave manager Paul Flood had inherited the set up described above and was supportive of further investigations. Consideration was given to using chemical data to model the state of saturation of the water with regard to carbonate minerals. This was not pursued for a variety of reasons. Instead, an approach was adopted that harks back to 1970s' experiments to quantify rates of erosion in different environments, using standardised blocks of precisely-weighed limestone. At Marakoopa the principal question was whether speleothems in the ponds were being eroded or deposited – quantifying the rate at which this was occurring was not critical. For our experiment we used small pieces of crystalline calcite cut into rectangular tablets weighing 4-5 g each. These were ultrasonically cleaned, dried at low temperature and weighed to four decimal places. The tablets were then encased in plastic mesh envelopes and suspended in the ponds at the Pink Terraces, Lily Pond and a few other places in Marakoopa Cave (Plate 5).

The tablets were retrieved after 12 months, removed from the mesh envelopes, cleaned, dried and weighed. Results are presented at Table 1. A negative change in weight was interpreted as evidence of erosive reduction; a positive change was interpreted as evidence of depositional accretion. Strictly speaking, results cannot be compared quantitatively between tablets, as their dimensions, and hence surface areas available for erosion or accretion, were not strictly standardised. Even so, they can be considered as qualitatively indicative of the relative intensity of erosion or accretion at the different sites.

Five of the tablets showed a reduction in weight. This was most significant in the case of the Short Creek tablet (#2), which lost 7.7% of its original weight. The holding tank (#1) and Lily Pond (#3) tablets lost 2.1% and 1.7% of their original weights respectively, while the most



Plate 5: Calcite tablet in mesh envelope.

upstream of four Pink Terraces tablets (#4) lost 1.1% of its original weight. The Short Creek result may be due to the effects of solution, physical abrasion by water-transported particles (corrasion), or a combination of these processes. The influence of corrasion can be discounted at the other sites.

The remainder of the Pink Terraces tablets experienced negligible or slightly positive weight changes. Of these, the most significant change was recorded at the middle to lower end of the Pink Terraces (#6), where the tablet increased in weight by 0.3%. A similar result was obtained from a tablet immersed in a nearby pool fed entirely by dripwater (#8). The weight of this tablet increased by 0.5%. These changes are consistent with accretion due to deposition of carbonate minerals, as would be expected under natural conditions in pools fed by water percolating through limestone. Interestingly, the weight of the most downstream tablet (#7) remained virtually stable. A transition from conditions of net annual erosion at the upstream end of the Pink Terraces, to one of stability or net annual deposition in the downstream direction, is implied.

Sample Id.	Location	Initial weight (g) 17/3/2005	Final weight (g) 7/4/2006	Difference (g)
1	Holding tank	4.6541	4.5556	-0.0985
2	Short Creek	4.7440	4.3783	-0.3657
3	Lily Pond	4.8279	4.7441	-0.0837
4	Pink Terraces	5.0935	5.0345	-0.0590
5	Pink Terraces	5.9641	5.9619	-0.0022
6	Pink Terraces	5.1567	5.1707	+0.0140
7	Pink Terraces	5.8026	5.8027	+0.0001
8	Dripwater pool	4.6410	4.6659	+0.0249
9	Long Creek	5.5221	-	-
10 (control)	(not deployed)	4.4841	4.4819	-0.0022

Table 1: Results of calcite tablet immersion experiment. Tablet 9 was swept away in a flood.

Lab. No.	Date	Arsenic (µg/L)	Chromium (µg/L)	Copper (µg/L)
68165	22/12/2004	69	18	9
80566	04/10/2005	96	54	23
84728	15/12/2005	26	14	7
88559	23/03/2006	32	3	11.9

Table 2: Dissolved metals in standing water under the holding tank (analysis by Analytical Services Tasmania).

We interpreted the above results as evidence that the practice of diverting water from Short Creek into the Pink Terraces and Lily Pond was affecting chemical processes within the ponds. Specifically, the results suggested that deposition of subaqueous crystalline deposits had been impeded and in places reversed. We did not have any data from prior to the diversion; nor have we continued the experiment after the diversion ceased. We also acknowledge that our results do not imply a necessary connection between the stream diversion and the observed pitting at Pink Terraces, although we suspect that these things may be related. Despite these limitations, a prima facie case that the diversion was probably harming the cave had been established.

For reasons not fully understood at present, rimstone barriers at another Mole Creek Cave – the iconic Croesus Cave – do show evidence of advanced erosion in places. Unlike the Pink Terraces, there is no obvious cause for this, beyond the rather nebulous one of disturbance due to forest operations within the catchment. Eroding rimstone barriers at Croesus Cave exhibit characteristics ranging from subtle muting of forms compared to ‘healthy’ barriers, to more substantial signs of erosional reduction, such as crater-like holes and entrenched channels cutting into their surfaces. The rimstone barriers in Marakoopa do not show a comparable degree of modification, presumably because of the short duration of their exposure to the allogenic water.

Regarding the possibility of contamination due to leachate from the CCA-treated pine base of the tank, water samples were collected from a shallow pool of standing water beneath it. These were analysed for dissolved arsenic, chromium and copper – active

ingredients in CCA-treated pine (Table 2). All samples showed elevated results for these metals compared to other sites around Mole Creek, where earlier sampling had returned results mostly below detection limits (Eberhard & Houshold 2002). Leachate from the pine beams was clearly implicated.

The results of these investigations, and a recommendation that ‘the appropriate response is to cease diverting water into the [Pink Terraces and Lily Pond] and to remove the associated infrastructure’, provided the ammunition Paul Flood needed to obtain support for shutting down the diversion. Removing the tank itself was no trivial task, as the structure had first to be dismantled and then ferried piecemeal across a 10 m deep canyon above Short Creek. This task was coordinated by Parks and Reserves Manager Chris Emms and completed in July 2010 (Plate 6).

The moral of this story could be that despite best intentions, some improvements turn out to be improoovements. How can cave managers minimise their legacy in this regard? Using the Pink Terraces as a case study, the following may be useful starters: rigorously question the basis for actions that may result in permanent changes to natural features and processes; be sceptical of assumptions or untested predictions about how the environment will respond when component variables are manipulated; and, be mindful that the sensibilities of generations to come will differ from those of today – they may judge us harshly if our decisions restrict their choices in matters of aesthetics and the environment. In this way we can strive to do things correctically (with apologies to The Caterpillar).

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Plate 6: Dismantling and removing the holding tank, June 2010. Photos: Rolan Eberhard



Marakoopa Cave. Photo: Paul Flood

A MEANDER THROUGH SEVERAL SHOW CAVES in PENNSYLVANIA and VIRGINIA, USA

John Brush

During a visit to the Appalachian area of eastern USA in October 2011, Marjorie Coggan and I made time to visit several show caves. There are many show caves in the area to choose from and the ones we visited were selected almost at random, generally being those that were close to our intended route. However, we did make a special trip to Luray Caverns, a place that has been on our “must do” list for some time.

Each of the four caves had its own unique features and most offered a full package of attractions, only some of which had anything to do with caves or karst.

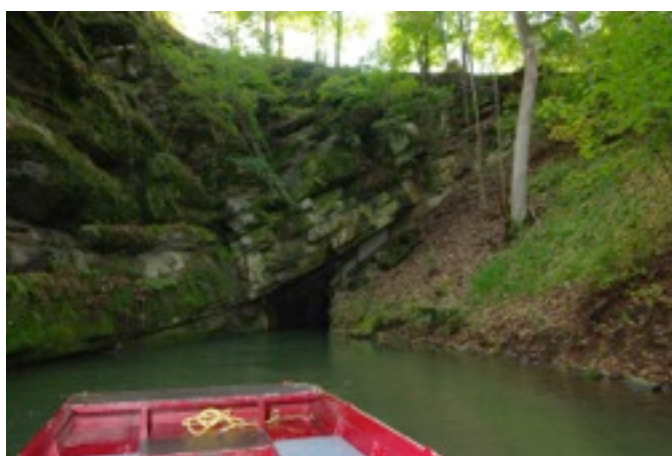
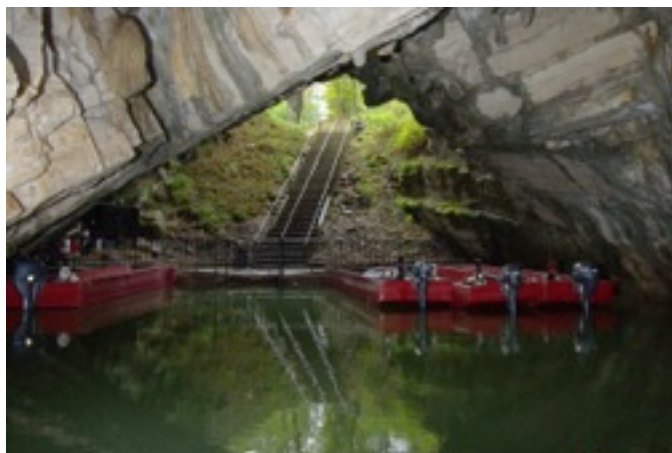
Penn’s Cave

Penn’s Cave in central Pennsylvania is billed as “America’s only all-water cavern and wildlife park”. We ignored the wildlife park and bought tickets for the last cave tour of the day. Pushing past the extensive range of merchandise in the gift shop, we wandered down into the entrance doline. Perhaps because it was last tour of the day, there were just 5 of us who descended the flight of steps to water level where we met our young guide. Once we were all seated in the motorised punt, the guide coaxed the wheezing outboard into life and we were off. At first I wondered why the boat was heading along the large river in reverse but later, on the return trip to be precise, I came to realise that by going backwards, the exhaust fumes were carried into the cave ahead of us, so we had fresh air, at least on the outwards trip. We were the only boat in the cave, but judging from the 4 or 5 moored at the entrance, it must be much busier at times. On such occasions, the exhaust fumes from the two-stroke outboards must be awful.

The spacious stream passage is generally 5-15 metres wide and varies in height from less than 2 metres up to an estimated 20 metres. In places stalactites dangle above the water. About two thirds of the way along the river there is a huge chamber, perhaps as much as 30m high, with an inclined bedding plane roof. We were told there is a side entrance into this chamber and it was not unknown for people to see a puma wandering about. Well, so the guide said.

Beyond the large chamber, the stream passage narrows to a boat-sized tunnel that was dug by the cave owners in the 1920s to bypass a sump and so increase water flow into their reservoir for power generation purposes. Today, the tunnel adds to the boat trip experience and also allows the exhaust fumes to drain from the cave.

The cave has some massive decoration, mostly in the large chamber and in high meander niches above the river, but none of it is particularly stunning. However, it is the boat trip along the large stream passage that is the star attraction.



Top: Main entrance to Penn’s Cave.

Middle: Punting along the streamway in Penn’s Cave.

Bottom: Artificial outflow entrance to Penn’s Cave, dating from the 1920s.

Lincoln Caverns and Whisper Rocks, Pennsylvania

Lincoln Caverns offers two caves for the price of one. It also offers a range of programs for students, junior cave explorers and cave photographers and there is an interesting self-guiding (and free) karst walk. In addition, each Halloween, Lincoln offers special Ghosts and Goblins tours where one of the caves is turned into a virtual haunted house complete with witches, dismembered bodies, huge spiders, snakes, evil-looking bats, a tangle of synthetic cobwebs, and of course ghosts. We were just a few days too early for this special tour, but did get to see all of the paraphernalia set up in the cave. It apparently takes 2 weeks of solid work to set up everything – and presumably days more to remove it all again a few weeks later. For all the effort involved, the special trips must be a real money spinner. Hidden behind all the polyester gossamer, it appeared that the cave is essentially a joint-controlled phreatic fissure system. As there is not a lot of decoration, it would not be surprising if some visitors felt a little disappointed if they were to see the cave outside the ghosts and goblins season. The second part of the tour is to Whisper Rocks Cave. This appears to be a separate upper level part of the Lincoln Caverns System and contains some clean, active and attractive decoration displays. It was discovered by Myron Dunlavy, the father of the current owner, in 1941 and opened to the public 20 years later.

After our visit, Anne Dunlavy, the cave owner and current President of the US National Caves Association, mentioned a recent visit by “some guy from Australia” who offers tours through “his cave” in the Klingon language. She found this quite intriguing. Your fame spreads far and wide, Dan!

What Lincoln Caverns lacked (?) in terms of the ancillary surface attractions that are commonly bolted on to many

show cave operations in eastern USA, it made up for with its range of educational and special interest programs. However, it still boasted the largest gift shop in the area.



Top right: Upset the guide at your peril in Lincoln Caverns

Bottom left: Huge carnivorous bats, deformed humans and entangling spiders' webs, all part of the ghosts and goblins experience in Lincoln Caverns.

Bottom right: The fortune-telling room in Lincoln Caverns.

Natural Bridge of Virginia

The impressive Natural Bridge is some 70m high and 30 metres wide and has long been a dramatic natural landmark in Virginia. It claims a number of historic associations including that it was once owned by Thomas Jefferson, that it was surveyed by a young George Washington, and that it was crossed by Civil War soldiers. Today, US Highway 18 runs over the top of the bridge but thick vegetation and tall paling fences block the views. In any case, the bridge is best viewed from below. It is just a short (150 metre) downhill walk from the car park and visitor centre, but if that is too arduous, there are regular shuttle buses.

The operator claims the bridge was “shaped by Mother Nature over hundreds of years” perhaps in deference to local creationist beliefs.

Once an attraction in its own right, today the bridge is just a small part of the full ‘attraction package’ which includes a butterfly house, a wax museum, a toy museum, a nature trail and a reconstructed Indian village, not to mention an immense gift shop, a hotel, a conference centre and a cave.

The cave, or “The Natural Bridge Caverns” as it is impressively named is located about 1km north of the bridge. The operator claims the caverns are “the deepest caves on the east coast” and this seems to be their main claim to fame. The ticket office and modest gift shop are housed in a small log cabin, which, as we discovered, has a very leaky roof when it rains. Compared with the imposing two storey visitor centre and museum buildings at the bridge just down the road, this gives the impression of being the poor sibling of the operation. From the cabin, a wooden ‘tunnel’ leads into the hillside where a lengthy excavated tunnel provides easy access to the cave. There is a reasonable amount of decoration in the cave and there are some nice passages, but the feature that struck us most was the extensive lampenflora ‘gardens’. It seems that many of the floodlights in the cave are switched on in the morning



and not switched off again until after the last tour of the day. At least the lampenflora added a bit of colour to the cave. On the positive side, our guide gave the best interpretive commentary that we have yet experienced in a privately owned show cave in America.



*Top right: Flowstone cascade in Whispering Rocks cave.
Bottom left: The imposing Visitor Centre and gift shop building at the Natural Bridge of Virginia.
Bottom right: The Natural Bridge of Virginia.*

Luray Caverns, Virginia

Luray is another well-known natural landmark in Virginia and it has been raved about in countless books and magazines over the years. So what a disappointment it was to actually go there. Luray is yet another privately owned show cave operation offering a full range of attractions and activities. Too bad if you just want to see the cave, as the only ticket on sale covers access to the cave, a local history museum, a car museum and a garden maze. There are also shops, restaurants and a golf club.

In theory, cave tours start every few minutes. Just buy your ticket as you enter the gift shop and queue in front of the doorway into the cave and wait. Supposedly there is a limit of 20 or so visitors on each tour, so with all those people milling around, we were guaranteed of just a short wait. Or so we thought. For some unknown reason we waited and waited. After about 30 minutes, the waiting throng of 50-60 people was let loose into the cave. In the first chamber there was some jockeying for position and a foreign tour group of 20 or so, who appeared not to understand simple directions such as “move up closer”, “keep moving”, “do not touch the decorations” and “stay on the path” caused some stress to concerned people towards the rear of the group. Up front, the young guide was unaware of, or just turned a blind eye to, all of this. We were stuck near the back of the group, which is normally not such a bad thing, but on this tour it meant that we heard almost nothing of the commentary and at one point were left in complete darkness when the lights, probably on a timer, switched off and left half a dozen of us in complete darkness. Gee honey, it really is dark in these caves.

Ignoring the crowd around us, we tried to admire the cave. However, it was difficult. While there was plenty of decoration and from a distance some of it looked impressive, but up close much of it was dry, dull and exfoliating.

A unique feature of the cave is its “stalacpipe” organ which was installed in the large and appropriately

named Cathedral Chamber in 1957. At first glance, it looks like a fairly ordinary organ console with a bank of four keyboards. However, what makes it special is that each key controls a strategically placed solenoid that dongs a small hammer onto a stalactite hanging somewhere in the chamber. It was designed and built by Leland W Sprinkle Senior, who apparently took years to grind or snap each stalactite to play the desired note. According to the Luray website, only two stalactites were found to be in tune naturally and “it took Mr Sprinkle 36 years of frustrating research, design and experimentation to bring his dream to its present state of perfection”. One hopes the organ doesn’t need retuning very often.

All too soon, we were ushered out of the cave and free to wander about in the various Luray gift shops and museums. All in all, Luray was quite an experience, but not the one that we had imagined.



Luray Caverns

Above: The Totem Pole Room.

Below left: Our tour group was way too large.

Below centre: The Saracens Tent drapery.

Below right: The Double Column.



15th INTERNATIONAL SYMPOSIUM on VULCANOSPELEOLOGY AMMAN, JORDAN.

John Brush

A small and dedicated group of lava tube enthusiasts* met in Jordan during March this year for the 15th International Symposium on Vulcanospeleology.

There were just 14 foreigners who took part in all the formal symposium sessions and excursion activities but they were supported by a strong contingent of locals. Australia was well represented with 4 participants (Julia James, Greg Middleton, Marjorie Coggan and John Brush).

Despite initial communication headaches – and even concerns about whether the Symposium would actually take place, participants were somewhat relieved to discover upon arrival in Jordan that there was indeed a symposium, that there would be a day excursion to northern Jordan, that the promised four day field trip had been organised, that superb meals were covered by the registration fee and that accommodation bookings had been made, even if wasn't at the location or price that had been agreed on a couple of weeks earlier. Putting aside a few frustrations, everyone appeared to have an interesting and enjoyable time and just about everything that the organisers said would happen, eventually did - and then some.

The Symposium venue was on the campus of the Hashemite University near the city of Zarqa to the northeast of Amman and a 40 minute journey from our accommodation in Amman. Over the 3 days of presentations, participants gained new insights into lava caves - and their use by humans and other animals - from areas as diverse as Jordan and other Middle Eastern countries, Hawaii, Kamchatka, Japan, Korea and continental USA. There were also a couple of interesting papers on the Yarmouk-Decapolis water supply tunnels of northern Jordan. The tunnels, totalling some 140km in length, were excavated by the Romans about 2000 years ago to supply a number of cities in the area.

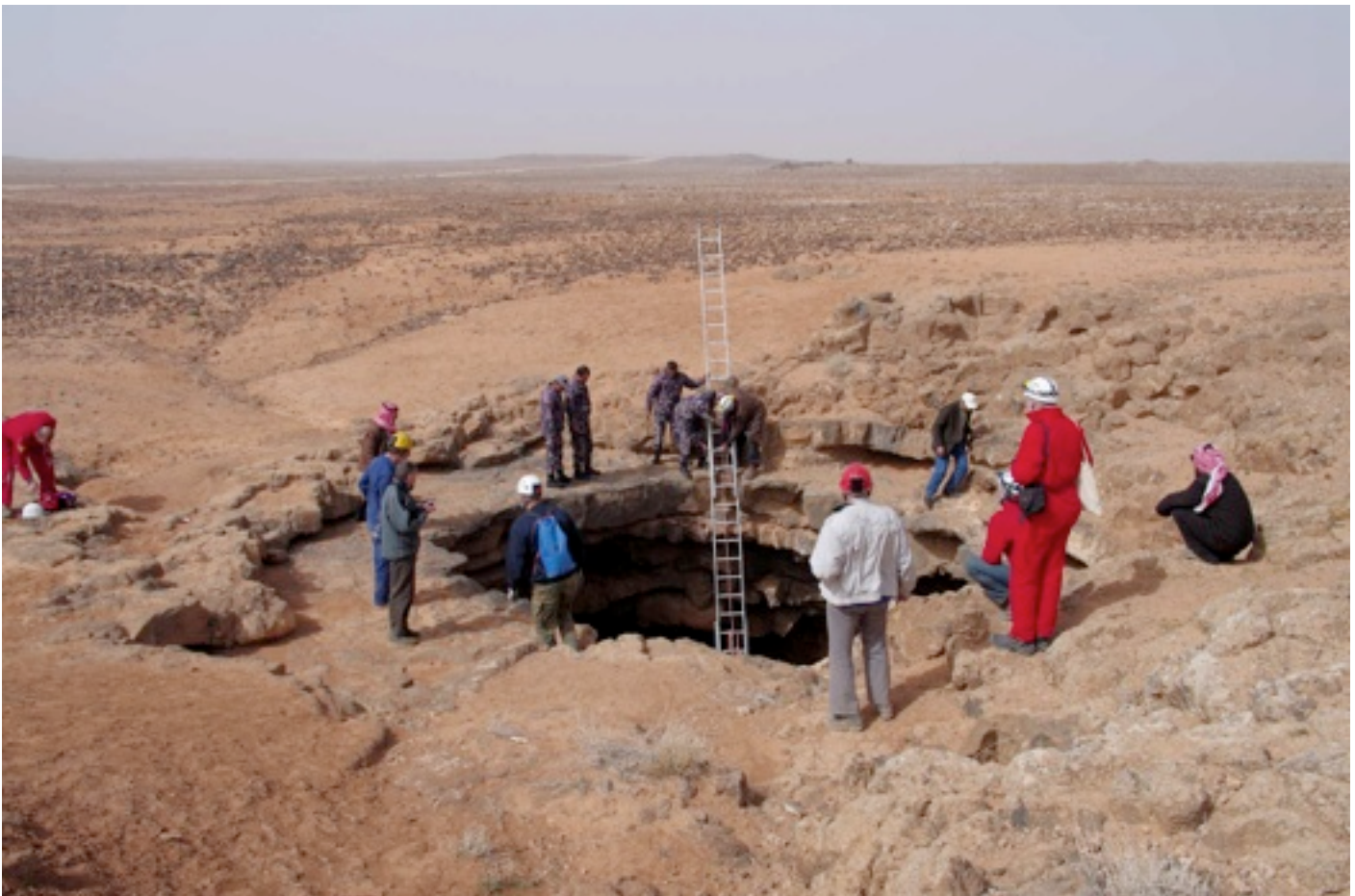


Left: Auditorium filling for opening session of Symposium.

Right top & bottom: Harry Marinakis (USA) in the Roman-built Yarmouk-Decapolis water tunnel system.

Each day the formal sessions ended with a (very) late lunch and afterwards, everyone hopped onto the bus for some late afternoon/ early evening sightseeing en-route to dinner or our hotel. The day excursion to northern Jordan provided an opportunity to explore a short section of the Yarmouk-Decapolis water supply tunnel system. These tunnels were excavated through chalk and soft limestone and originally had inclined access shafts every 30 to 100 metres. Many of the access shafts are now blocked, or have collapsed, thus breaking the system into sections and in places damming seepage waters to create long lakes. The tunnels contour around valley sides 5 to 15 metres below the surface and are generally 1-1.5 metres wide and 2-2.5 metres high. In cross section, the shape of the tunnel varies frequently, apparently reflecting the preferences or whims of the original digging teams. Their pick marks remain to this day on the roof and walls. In the section of tunnel we visited, secondary calcite speleothems are common and range from small straws, stalactites and flowstone wall coatings deposited sub-aerially to layers of crystalline calcite that precipitated from the water as it flowed along the tunnel.

For the four day field trip we squeezed into five twin-cab 4WD utes and bounced around in the rocky lava deserts of the Harrat in eastern Jordan. The Jordanian Harrat covers an area of approximately 12,000km² and makes up roughly 25% of the Harrat Al-Shaam, the largest volcanic plateau on the northwest Arabian plate, which extends from Syria across Jordan and into Saudi Arabia. The lavas apparently result from three major volcanic events dating back to the Oligocene (26 Million years - Ma). The most recent event (7 Ma - 0.4Ma) is the one of most interest to vulcanospeleologists. To date, 23 lava tubes (or pyroducts, as some would prefer to call them) have been explored, the longest of which is about 1 km. During the field trip, participants visited about 6 caves, including the three longest. Most of the caves that we visited contained significant amounts of sediment – the result of loess (wind-blown silt) being washed into the caves. This meant that exploration often involved a lot of crawling along low, dusty passages. In only one cave (Hashemite University Cave) did we see extensive areas of the original lava floor. On the other hand, small lava speleothems were reasonably common, and in two caves, there were deposits of secondary calcite and gypsum.



Local Civil Defence staff using their long extension ladder to help delegates gain access to Al Badia Cave.



*Clockwise from above:
Enduring the dust in Azzam Cave.
Ambling along in Al Badia Cave, the second longest and most spacious lava tube in Jordan.
Max Dornseif (Germany) admiring calcite and gypsum encrustations in Kempe Cave
Walking across the barren basaltic landscape of the Jordanian Harrat.
Marjorie Coggan with a selection of camel bones in Al Fahda Cave.
A high-roofed section of low passage in Al Fahda Cave, the longest known lava tube in Jordan.*



In our first cave we were given a practical demonstration on how to use a “Bedouin light” which we were informed is commonly used by the locals. Step 1, from the rubbish in the cave, select a convenient length of black polythene irrigation pipe; Step 2, apply heat to one end of the pipe from the cigarette lighter that is always in your pocket; Step 3, upon ignition, hold the pipe aloft making sure it is angled to avoid molten plastic dropping onto your hand; Step 4, cough your way into the cave as you peer through the acrid cloud of black smoke.



Many of the caves in Jordan have been modified by human activity or by animals. Some caves are used by Bedouin shepherds for storage or as shelter for sheep and goats. One cave contains what appears to be an ancient monument, or perhaps an altar. However, perhaps the most striking modification of the caves has been by hyenas (the Arabian Striped Hyena, *Hyena*



hyena, which is now quite uncommon in Jordan). In one cave (Al Fahda) we saw hyena dens, or sleeping hollows, excavated into the silt floor and at one end of the cave it looked like hyenas had burrowed into the silt fill as if attempting to extend the length of the cave. At that point it is about 300m of low crawling from the nearest entrance. Mammal bones, and especially camel bones, are common and most of these are thought to result from hyenas dragging food into caves so that they could consume it at their leisure. The number of camel skulls, leg bones and vertebrae lying a considerable distance along low passages was quite astounding. The thought of a small hyena dragging a dead camel along a 40-50cm high passage is mind boggling, and only slightly less so if one thinks in terms of the camel carcass first being chomped into pieces. Hyenas also appear to navigate their way across boulder piles in complete darkness as we saw scent marking stains at regular intervals across the rocks. Perhaps it could be claimed that hyenas are the supreme cavers of the animal world.

Back on the surface, we found the time to look at Jawa, the ruins of a bronze-age city built from large basalt boulders; Qasr Burqu, the most easterly known Roman

fort, constructed from expertly shaped basalt blocks; and at a 'desert kite'.

Kites are long converging lines of piled stones with circular stone structures at or near the convergent end. They were first observed from aircraft in 1925 and have in recent times been studied in detail by a number of archaeologists and also by eminent German geological researcher and keen vulcanospeleologist, Professor Stephan Kempe, who was one of the participants in the Jordanian symposium. The structures have been called kites because when observed from above, they look like kites with a long tails. Using Google Earth, Stephen has identified well over 500 kites in the Jordanian Harrat, plus a couple hundred more in Saudi Arabia. A further 400-odd were recently identified in Syria by another researcher. Most kites are oriented so that the narrow end, or apex, is to the northwest and many kites appear to be linked across the landscape. They are thought to be animal herding and trapping structures. Stephen postulates that they were most likely built in early Neolithic times to intercept gazelle as they migrated north towards Syria and the Mediterranean coast. A typical kite has several guiding walls each several hundred metres long and a circular structure at the apex 50-150m across. He has estimated the total length of wall structures in Jordan as being as much as 3780 km, representing a stone volume equal to about half that of the pyramid of Cheops, and in aggregate, making them one of the largest ever man-made structures.

After the field trip we returned to Amman and the following day most delegates made their way to the justifiably-famous Petra and a few of us then went on to the superb desert landscapes of Wadi Rum in southern Jordan. It was a fitting end to our brief Jordanian sojourn.

* Read members and supporters of the International Union of Speleology Commission on Volcanic Caves



Top: Google Earth Image of a desert kite.

Bottom: View along the remains of a wall of a desert kite.

SPELEOTHEM SCIENCE: FROM PROCESSES to PAST ENVIRONMENTS by IAN J FAIRCHILD and ANDY BAKER

reviewed by Andy Spate

Ian Fairchild is Professor of Geosystems at the University of Birmingham. Andy Baker is an ACKMA member who arrived a few years back from a distinguished research background in the United Kingdom to head up the Australian National Centre for Groundwater Research and Training at the University of New South Wales. Ian and Andy have collaborated in much cave-related research and in the production of this excellent book.

Most ACKMA members have not had the privilege and pleasure of meeting Andy but we hope to see him at future ACKMA meetings - starting in Waitomo next year. I had the distinct honour of meeting Ian Fairchild at Yarrangobilly last December. They told me there about their forthcoming book - it sounded great! I was immediately intrigued and started salivating ...

In March this year I was at Margaret River assisting Pauline Treble in her researches in Golgotha Cave on past climates and environments as revealed in drip water chemistry and stalagmites. Andy was there and showed me one of the two extant copies of the book - I was hooked!

I have reviewed and or recommended a number of books over the years in the ACKMA Journal - this new book trumps all the others with the exception of Paulo Forti and Carol Hill's *Cave Minerals of the World* - they are companion volumes ...

Fairchild and Baker's book is different in that it is cave-oriented. Books such as Gillieson's *Caves: Processes Management and Development*, Ford and Williams' *Karst Hydrology and Geomorphology* and Palmer's *Cave Geology* which are largely karstic in approach. *Speleothem Science* builds significantly beyond those texts.

I am tempted - as I usually do - to quote at length from the authors. But it would be better for you - and for me - to examine things more closely.

Chapter 1 goes straight to the chase asking why speleothems are useful for understanding past climates. This sets the scene for the whole book and how it is organized. It also looks at how speleothems can answer our questions about the past

Chapter 2 is more like the conventional texts mentioned above - carbonate rocks, their diagenesis and the development of karst systems.

Chapter 3 relates karst to climate, soils and vegetation. Very importantly it firmly places the role of climate - and climate change - in karst processes.

Part II, Chapters 4, 5 and 6 may be more hard-going for lay readers - but worth persevering with. They deal with the processes operating within caves - many of them we don't ordinarily think about such as heat fluxes from the bedrock - and inorganic water chemistry. Chapter 6 goes on to discuss biogeochemistry of karst environments - again a subject we tend to skate over.

It goes on! Part 3 gets to the bit that so excited me! I have felt for a long time that the standard texts - including Hill and Forti - have not told me enough about what Fairchild and Baker term 'Speleothem Architecture'. Speleothem architecture and mineralogy dominate Chapter 7 leading onto Chapter 8 on the geochemistry of speleothems. This leads inevitably to the dating of speleothems in Chapter 9 - a difficult subject for cave managers - we want to understand all we can about our caves but are we getting value from stalagmite harvesting? Interestingly, and importantly, the book includes an appendix on archiving speleothems and speleothem data.

This is an important issue and one that we must address in Australia (and internationally) given the numbers of speleothems that are being sampled by many different researchers - often without resultant publications. We need to account for research projects that didn't work as well as the ones that do, so as to avoid further harvesting in sites where, for one reason or another, dating or palaeoclimate techniques and analysis have not worked.

Back to the book. In Section 4, Palaeoenvironments, we get to the guts of this book. What do speleothems tell us about the past? Chapter 10 reviews methodologies and case studies on what speleothems can tell us and asks the questions that previous studies have addressed - or not.

Chapters 11 and 12 discuss happenings in the Holocene (the last 12,000 years to today) and the Pleistocene (2.6 million to 11,700 years ago) respectively. These chapters are preceded by a review of approaches and methodologies for deriving environmental relationships. As with the rest of the book, these final three chapters have plenty of case studies and examples of environmental proxies such as the timing of 'ice ages', changes in the patterns of monsoon, sea level changes and so on.

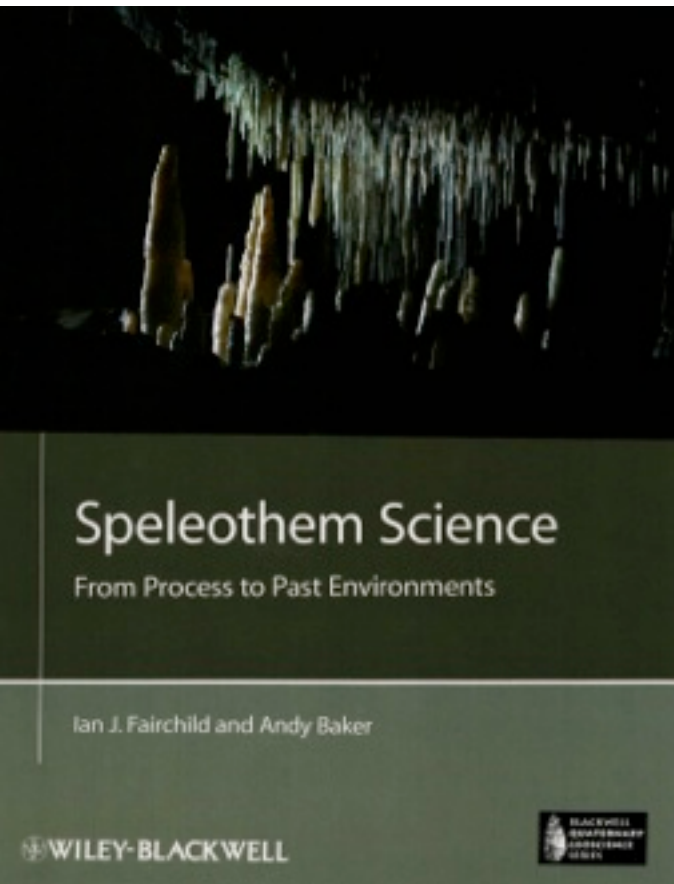
The book concludes with the short, but important, appendix titled "Archiving speleothems and speleothem data". This is followed by a very extensive reference list of an estimated 1,400 citations and a comprehensive index.

A further wonderful asset is that the book has a companion website: www.wiley.com/go/fairchild/speleothem. On this site you will find the Figures and Tables from the book as PowerPoint slides and PDFs, respectively, for downloading. Wiley states that you are free to download the material on this site for your own use and teaching purposes.

This is an excellent book – some readers, me included, will find some parts heavy going – but for the most part it is written in simple English - sometimes very expressive phrases such as “One view of geological history, emphasizing the chemical changes, is that of a great titration experiment between rocks and acidic volcanic gases” (30).

The authors invite readers to alert the authors to errors that can be corrected online or in future editions. When I was spruiking the book at the ACKMA AGM at Wee Jasper someone spotted a minor error in the index and I have spotted another very minor typo in the web address

for the companion site. But these do not detract from the book’s immense contribution to cave and karst science. As we know from discussions on the ACKMA email list, the book can be obtained at substantially less than the RRP quoted above. At whatever price it is very well worthwhile having on your shelves.



Speleothem Science: From Processes to Past Environments, Ian J Fairchild and Andy Baker, 2012, Wiley-Blackwell, 432 pp. RRP \$87.95.

Pauline Treble’s speleothem research in Alexandra Cave (top) and Victoria Fossil Cave (middle and bottom), Naracoorte.
Photos: Steve Bourne

NEW INTERPRETATION at TANTANOOLA CAVES CONSERVATION PARK

Steve Bourne

Tantanoola Caves Conservation Park is a small park containing two caves; Tantanoola Cave which is developed as a show cave, and Lake Cave which is a restricted access cave. The park lies halfway between the towns of Mount Gambier and Millicent in the south east of South Australia on the Princes Highway, a major tourist route. Despite its seemingly ideal location, visitation has dropped from over 40,000 visitors in 1980 to fewer than 13,000 in 2007. A review at this time identified a number of opportunities to reverse this trend and the cave moved to a hosted style of presentation rather than a structured tour time table. There was little interpretation for visitors and a project was initiated to develop panels to interpret the cave, its contents and the landscape in which it sits. This has at last been completed and the new interpretation panels have recently been installed.

Work on this interpretation began in 2007, when a consultant, Kirsty Hawkes, was engaged to undertake the project. The brief for Kirsty asked for interpretation that would capture children's attention and imagination, and provide a high level of detail for visitors who wanted more information than could be provided in the hosted tour format. I especially wanted to explore good interpretation of helictites, probably the most difficult aspect of caves for site interpreters to explain. Kirsty sourced information from Dr Susan White, Ken Grimes, Dr Liz Reed and a host of resources we provided. Kirsty conceived the idea of a children's

self exploration adventure seeking answers to a quiz, with a wizard character at the centre of the concept. This concept bears more than a passing resemblance to the Harry Potter series. I suspect the volume of information that Kirsty was provided overwhelmed her, especially with the difficult concepts we were asking her to develop interpretation.

Unfortunately, we reached a point where the project funds were expended and we did not have completed information for interpretation panels, let alone the panels themselves. The Department took over the project internally and an interpretation officer worked on the information in head office. I then left the department and Deborah Carden took over as Manager at Naracoorte and Tantanoola Caves and finally brought the project to completion. With so many people involved over such a long period, and so many different ideas, there was a huge risk of producing something that did not work. I am sure it is not perfect, but on a visit to the cave, Andy Eavis, President of International Union of Speleology, gave it the "thumbs up."

The interpretation panels are designed to give visitors an introduction to what they can expect to see in Tantanoola Cave, and also assist them in understanding and interpreting for themselves after their visit. Early indications are they are achieving the original objectives.



Tantanoola Caves host Lisa Boguta with the new interpretation panels at Tantanoola Caves.

WHAT THE HECK IS A HELICTITE?

Helictites defy gravity. The word 'helictite' comes from 'helix' as in spiral, but these formations can grow any which way. No-one knows for sure why helictites grow the way they do, but certain natural laws apply.

Push!

The birth of a helictite occurs when calcite-rich water is pushed out of a pore in the cave wall or out from an existing speleothem. This process is known as hydrostatic pressure - the volume of water in one area increases so much that it is forced into another area. Carbon dioxide is lost as the water enters the cave, causing the calcite to re-solidify and form a thin rim round the pore. As water continues to push through the wall, a minuscule central canal is formed. Water now travels along this canal by capillary action.



Power of attraction

Capillary action is the movement of water in tubes or through materials. It is the result of water being attracted to solid surfaces. Every day examples include rising damp in walls, water movement in soil and paper towels absorbing water. Helictite growth relies on capillary action as it allows water to move against gravity.

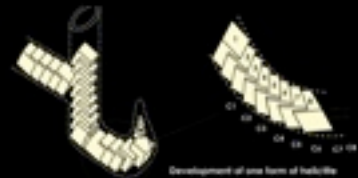


Size matters

Size is much more crucial when it comes to the formation of a helictite rather than a stalactite. The straw of a fledgling stalactite is much bigger than the central canal of a helictite. A straw might be as big as a drinking straw, but the central canal of a helictite may be only the width of a pencil line. Capillary action increases as the width of the canal decreases. If the drip rate increases, gravity may become the dominant force and the helictite will start to behave like a stalactite.

Crystal clear?

Like stalactites and stalagmites, helictites are made from calcite crystals. In some helictites, crystals may start to grow faster on one face than another, causing the helictite to change direction. The growth of a helictite can be influenced by air currents, impurities in the crystals, structure of the crystals, deposition of particles from the air, and osmosis.

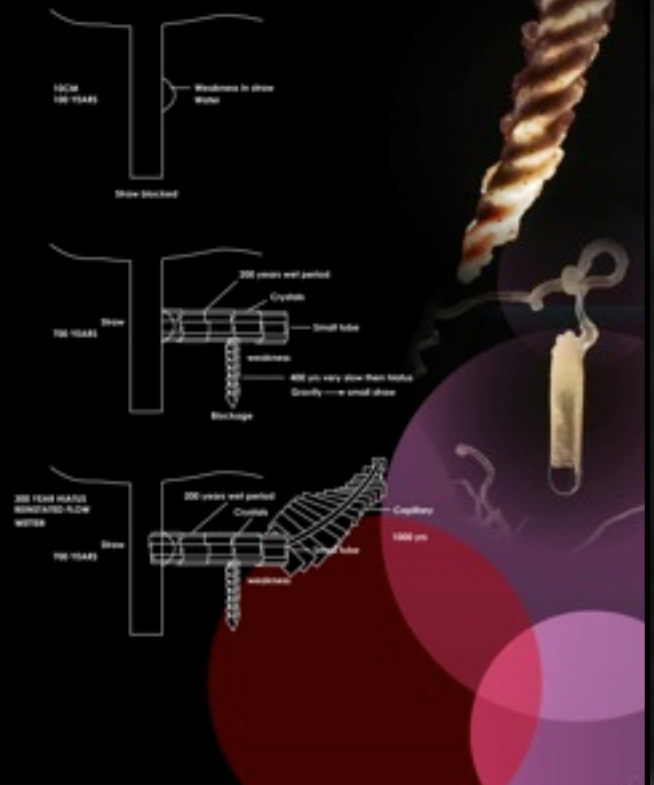


The wizardry of Oz

Australia's climate of wet and dry periods encourages erratic growth in helictites. In dry periods, crystals clog the central canal and the helictite stops growing. When the wet weather returns and water starts to seep into the cave again, it has to find another outlet from the helictite. This irregular growth causes branching and other twisted shapes.

Diary of a Tantanoola Helictite

Every helictite has formed according to a number of different and varied influences. Each tells a unique story. Imagine a hypothetical life for one of the Tantanoola helictites.



Panels interpreting helictites for visitors to Tantanoola Caves. Courtesy Department of Environment and Natural Resources

