ABSTRACT

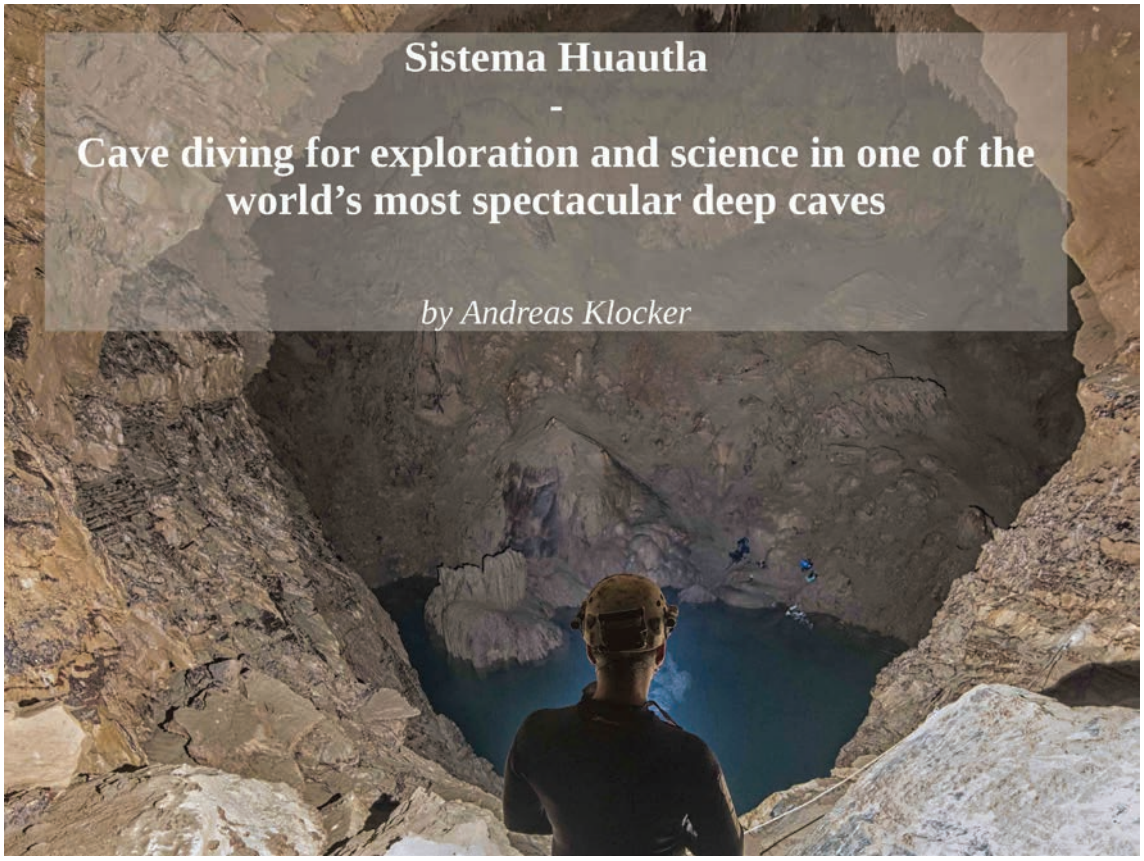
## Huautla — cave diving for exploration and science in one of the world's most spectacular deep caves

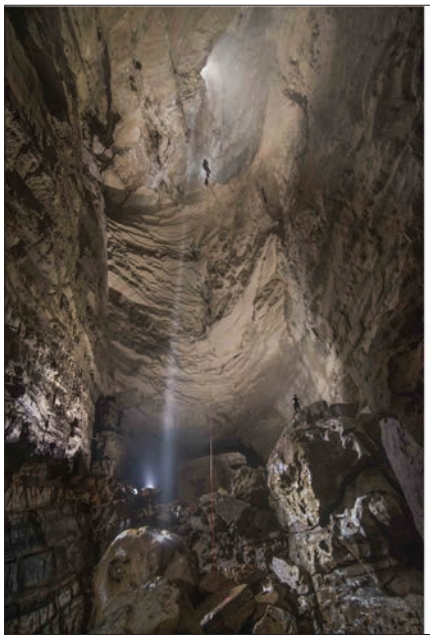
ANDREAS KLOCKER PhD, Southern Tasmanian Caverneers

Since 2016 I have been leading cave diving expeditions to Sistema Huautla, one of the world's deepest cave systems located in the southern Mexican state of Oaxaca. The goal of these expeditions is to connect Sistema Huautla with its resurgence in the 10-kilometre distant Santo Domingo Canyon. The successful connection of Sistema Huautla with its resurgence would result in the world's deepest and most spectacular cave traverse.

In this talk, I will focus in particular on the two-month long expedition in 2018 which was one of the most ambitious and challenging cave diving projects ever attempted. We pushed two months to surpass the previous limit of exploration reached in 1984, some five kilometres into the mountain, beyond six sumps, to continue the exploration of Sump 7 with the hope it will lead us to the underground river connecting Sistema Huautla with its resurgence.

It was during one of these long exploration trips to the end of the cave when unexpected rainfall started filling up the cave we were exploring, trapping myself and five others for three days. All we had was one space blanket, four granola bars, and the wetsuits we were wearing.

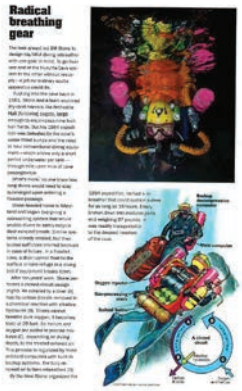




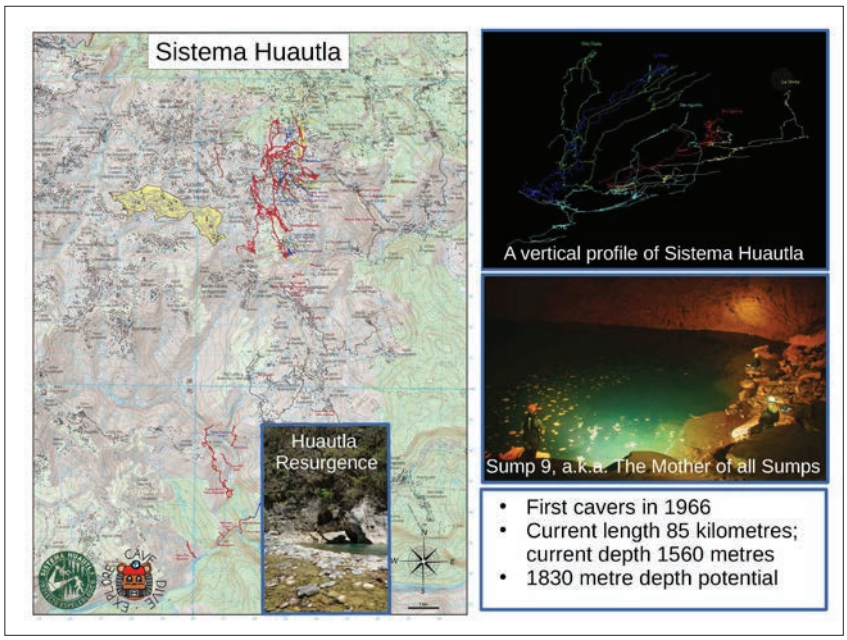
## Outline

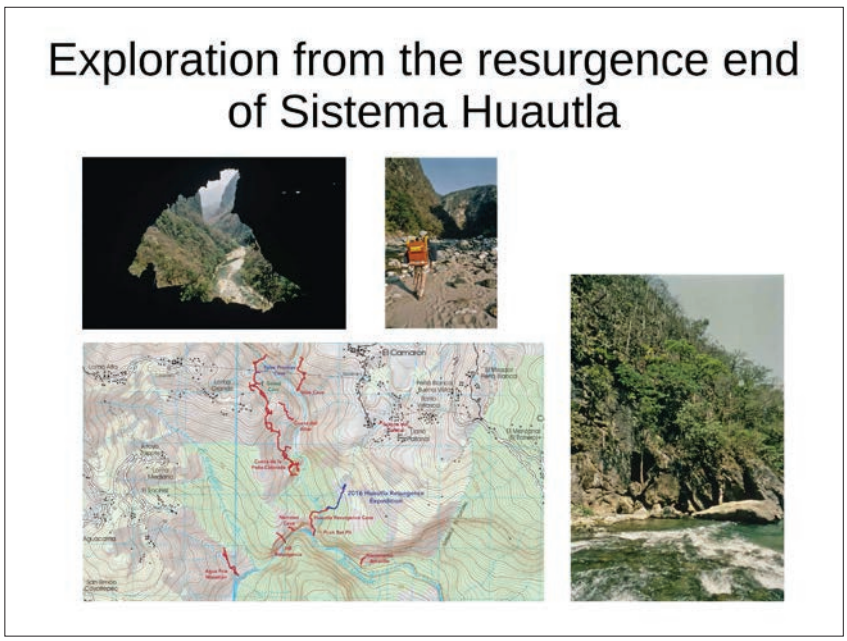
- A bit of history – a summary of the major expeditions in the past, pushing towards the connection of Sistema Huautla with its resurgence.
- The beginning of an obsession – a summary of our 2016 and 2017 expeditions to the Huautla Resurgence.
- The big one – exploration of the Cueva de la Peña Colorada - diving one of the most remote sumps on Earth.

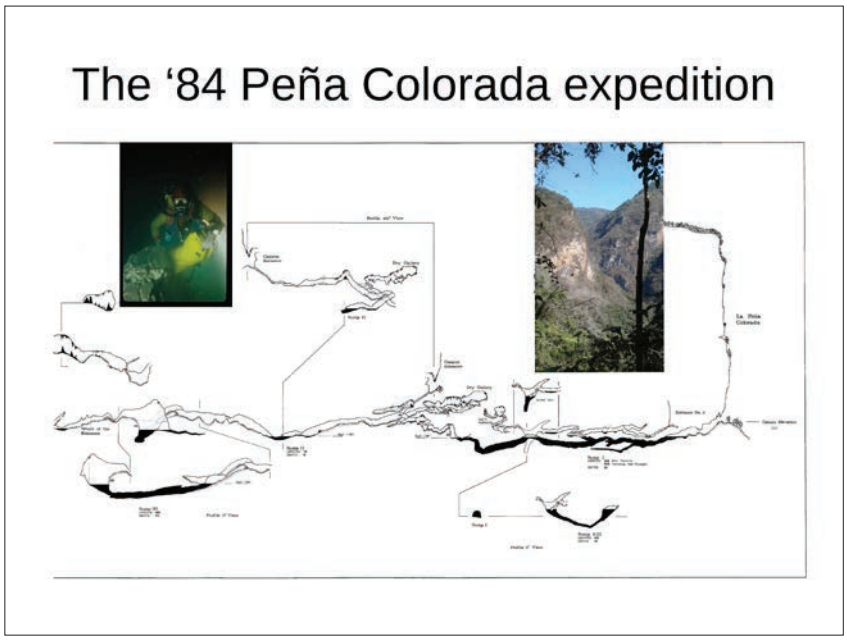
## A bit of background and history on cave exploration in Sistema Huautla

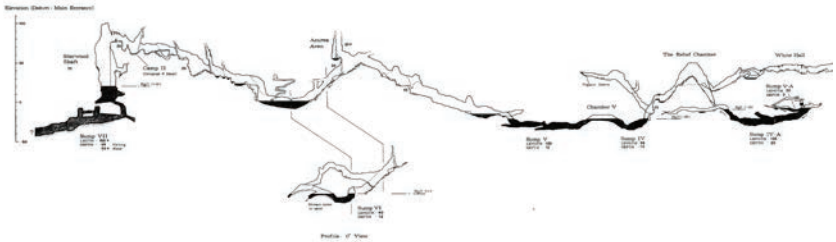

## Huautla de Jimenez, Oaxaca, Mexico

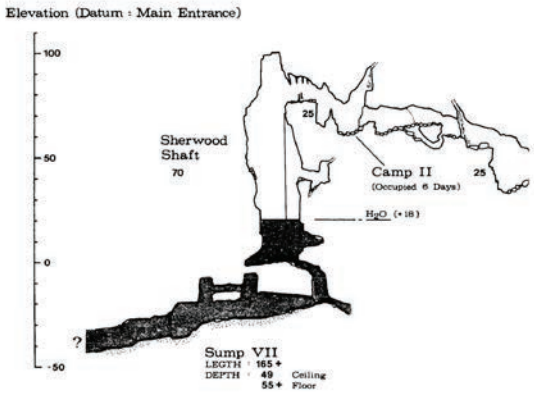

Sistema Huautla
Huautla Resurgence
A vertical profile of Sistema Huautla
Sump 9, a.k.a. The Mother of all Sumps
• First cavers in 1966
• Current length 85 kilometres; current depth 1560 metres
• 1830 metre depth potential


Exploration from the resurgence end of Sistema Huautla


The ‘84 Peña Colorada expedition

# The ‘84 Peña Colorada expedition

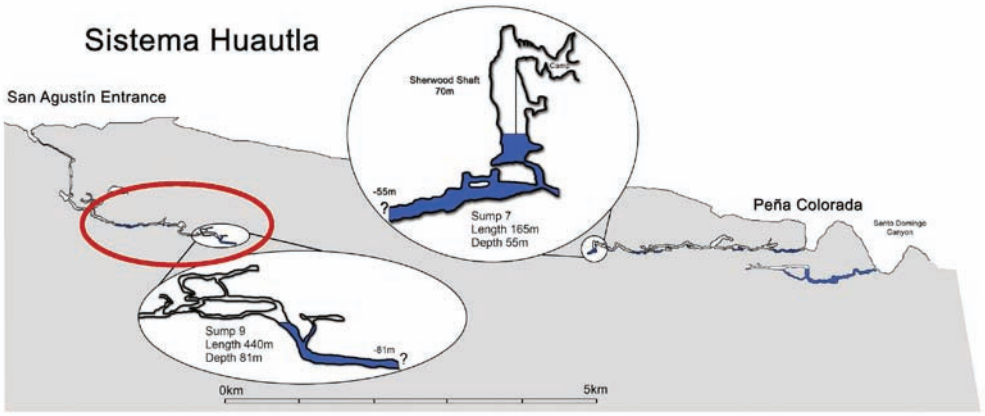





A total of 7.8 kilometres of virgin territory leading into the plateau were surveyed on this expedition with 1.4 kilometres of this distance totally underwater, comprising 7 sumps, the longest of which was 524m in length. The expedition established the first subterranean camp set beyond an underwater tunnel. The logistics of apparatus transport (a pyramid supply system) and problems with nitrogen narcosis in the final underwater corridor led to a decision to retreat.

# The development of the CIS-Lunar rebreather

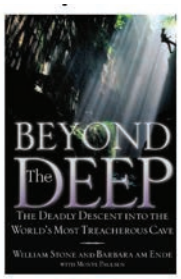
# The ‘94 San Agustín expedition

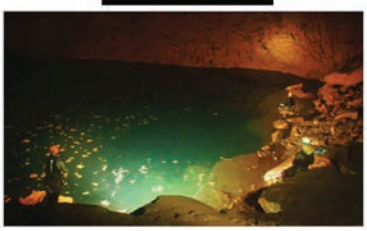



For 17 years, since its discovery in 1977, the flooded tunnel marking the deepest point in Sistema Huautla, Oaxaca, México - a remote place known as the San Agustín Sump - remained unexplored. Cave diving efforts using traditional Scuba in 1979 and 1981 failed to pass the underwater tunnel due to the logistics of transporting sufficient cave diving equipment down 92 vertical pitches and tension traverses. The sump lies at a depth of 1325 meters and requires the use of multiple, staged underground camps in order to reach it. The focus of the 1994 expedition was to use modern closed cycle life support systems (rebreathers) to allow for protracted underwater exploration at the San Agustín Sump and, hopefully, to reach air filled galleries beyond the sump that led into the heart of the Huautla Plateau.

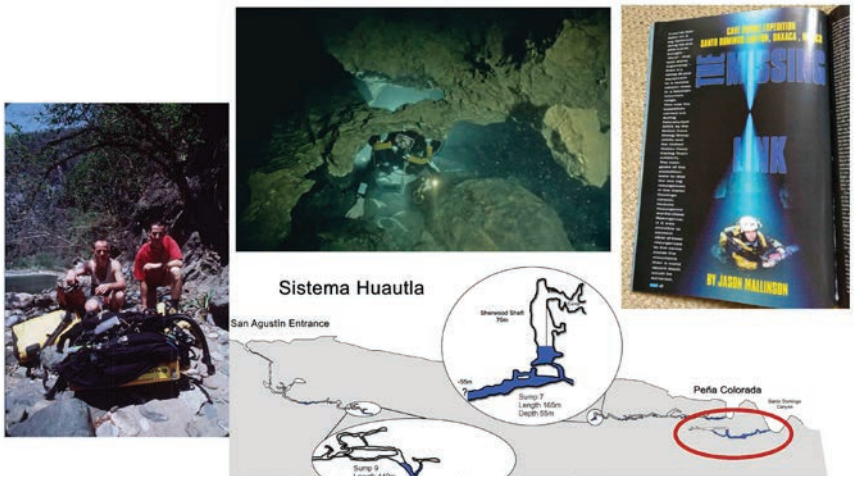
- The team used the newly developed rebreathers to crack Sump 1, which proved to be 430 meters long to a small airbell, followed by another sump of 170 metres length.
- The expedition was to be, this success was marred by the death of cave diver Ian Rolland during the exploration.

- After a 6 day body recovery exercise the exploration resumed and some weeks later Dr. Bill Stone and Barbara am Ende dived through both the sumps, finding a total of 3.3 kilometers of new passage
- They were halted at another sump which they called - sump 9, aka "The Mother of all Sumps"!

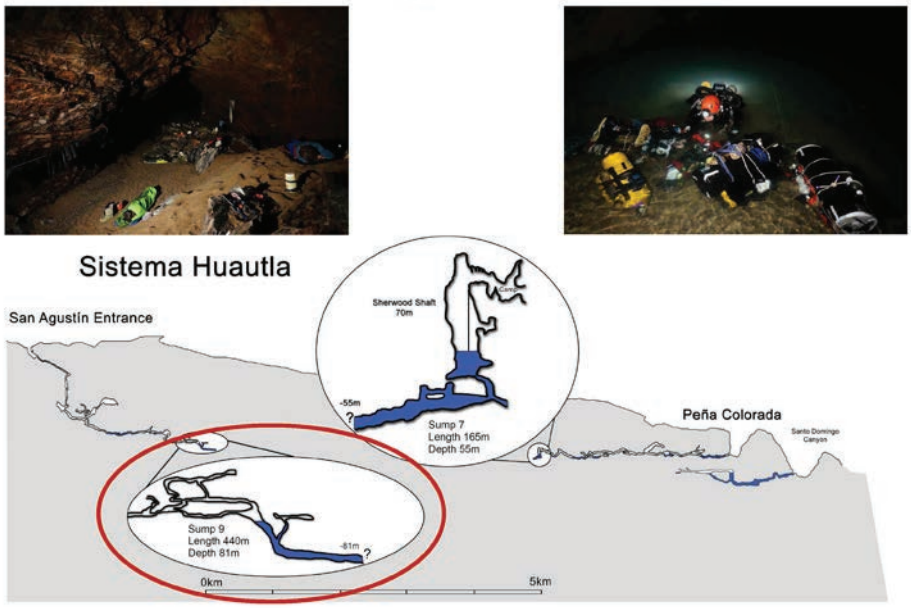


# The ‘95 & ‘01 Huautla Resurgence expeditions



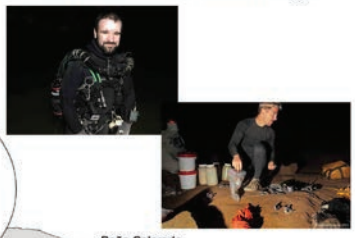

# The ‘13 San Agustín expedition

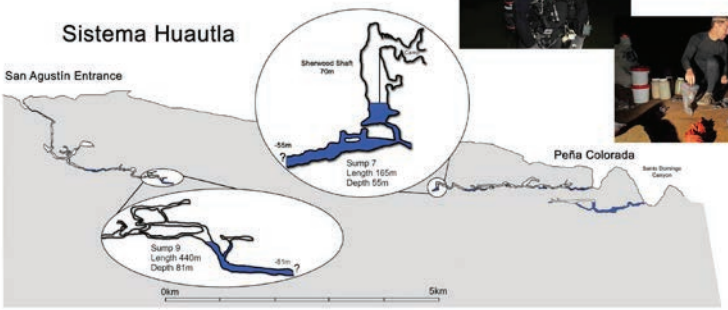



- Over 6 weeks, 40 cavers supported 2 push divers, Jason Mallinson and Chris Jewell, so they could push Sump 9.
- On the final dive, Jason Mallinson pushed the sump to a distance of 440m and a depth of 81m. The passage continued big, with Jason estimating it to quickly reach a depth of over 100m.
- This expedition renewed interest in the exploration in Sistema Huautla.

# Beyond the Sump Expeditions

- The goal: A sustained effort of an international team of cavers and cave divers to push towards the connection of Sistema Huautla with its resurgence in the Santo Domingo Canyon.






# Beyond the Sump Expeditions Huautla Resurgence 2016/17

## Our support team:

Bill Stone (USA)

Alejandra "Alex" Mendoza (MEX)

Alma Rodríguez (MEX)

Ernie Garza (USA)

Fernando Hernandez (MEX)

## The rest of the 2016/2017 team:

Andreas Klocker (AUS/AUT)

Zeb Lilly (USA)

Chris Jewell (UK)

Connor Roe (UK)

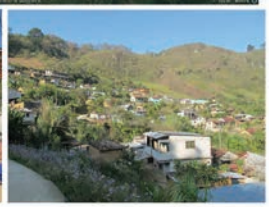
Gilly Elor (USA/ISR)

Max Fisher (UK)

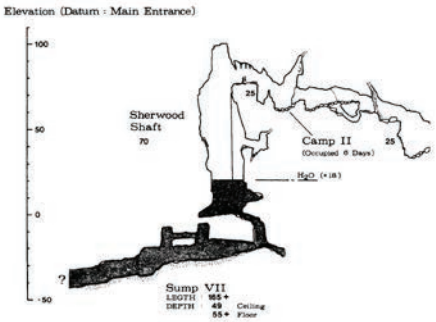
Dave Bardi & Sandy Varin (AUS)

Matt Vinzant (USA)

# Beyond the Sump Expeditions Huautla Resurgence 2016/17


# Return to the Peña Colorada - 34 years later...




- The goal: Continue the exploration of Sump 7, and push towards Sistema Huautla.
- 


- We will make use of the latest in dive gear technology, including mixed gases, dual rebreathers, Lithium-powered scooters, and habitats.

# Return to the Peña Colorada - the team

- Adam Haydock (USA)
- Adam Walker (CAN)
- Alejandra Mendoza (MEX)
- Andreas Klocker (AUS/AUT)
- Andrew Atkinson (GBR)
- Charlie Roberson (USA)
- Chris Jewell (GBR)
- Connor Roe (GBR)
- Dane Motty (USA)
- Dave Watts (GBR)
- Fernando Hernandez (MEX)
- Gareth Davies (GBR)
- Gilly Elor (ISR/USA)
- Jim Warny (IRL)
- Josh Bratchley (GBR)
- Katie Graham (CAN)
- Kyle Moshell (USA)
- Matt Jenkinson (GBR)
- Matt Vinzant (USA)
- Maxwell Fisher (GBR)
- Michael Waterworth (GBR)
- Mirek Kopertowski (POL)
- Teddy Garlock (USA)
- Tomasz Kochanowicz (POL/CAN)
- Zeb Lilly (USA)

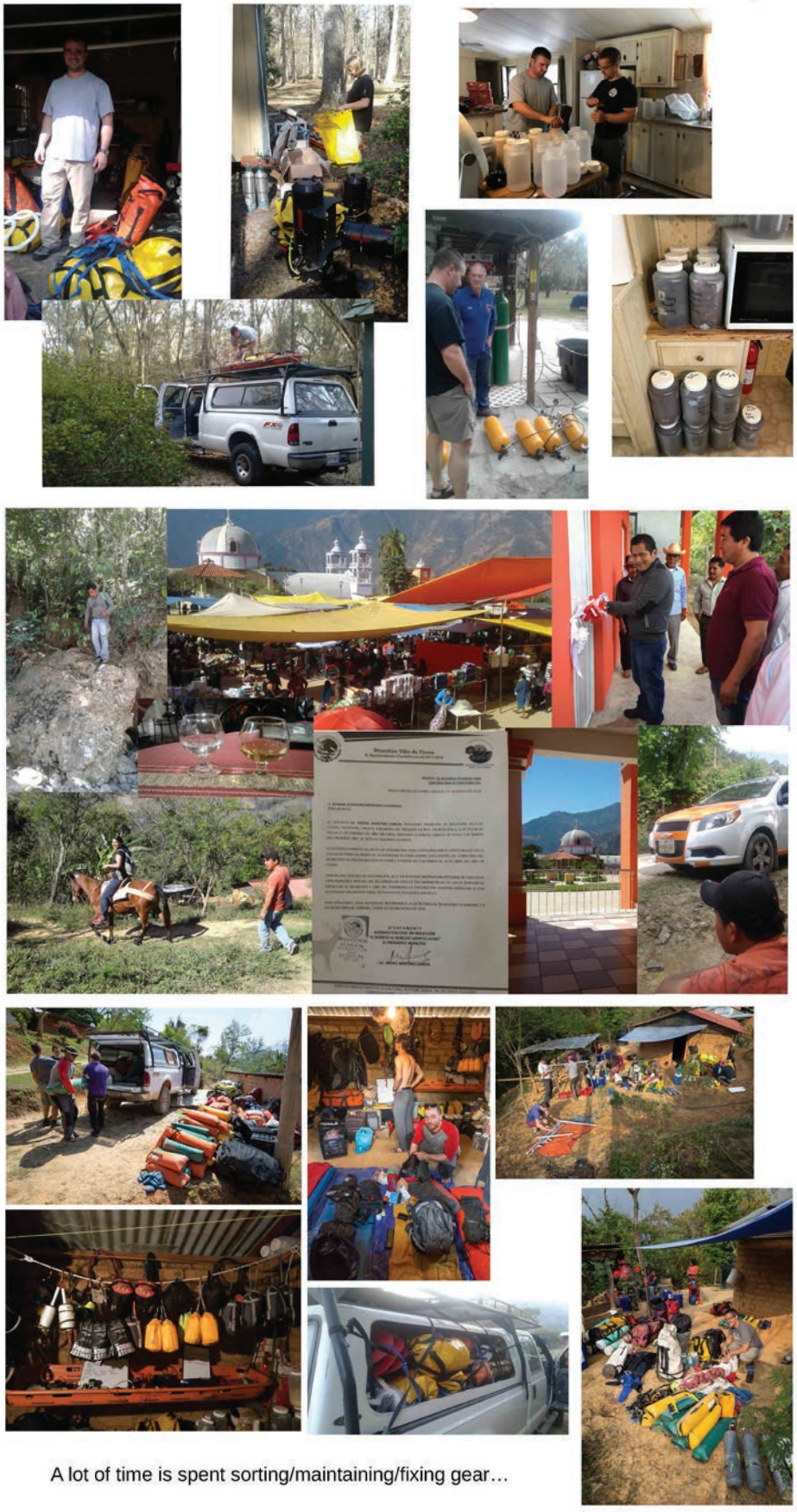



Cutting-edge rebreather technology...

...carbon fibre tanks filled with Trimix...

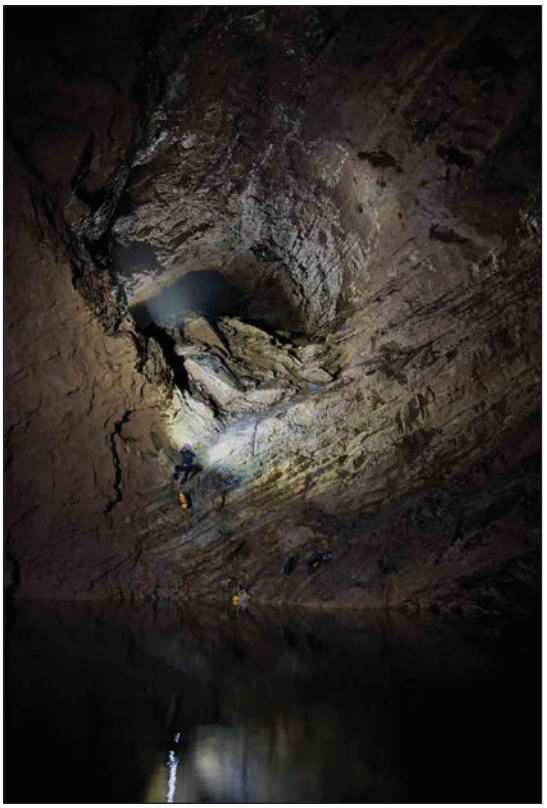
...long-range scooters and dry tubes.


# Return to the Peña Colorada



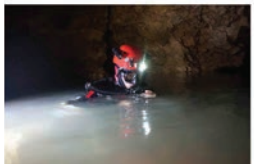
A lot of time is spent sorting/maintaining/fixing gear…

# Return to the Peña Colorada

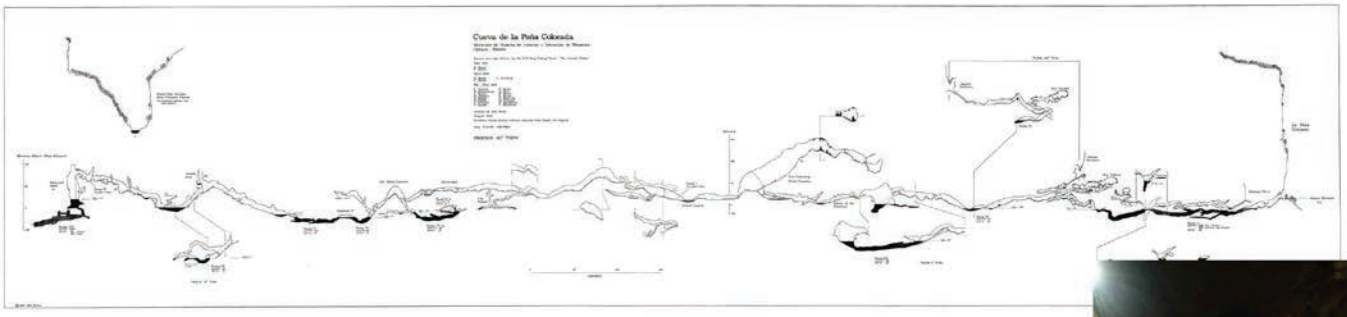



2018
1984



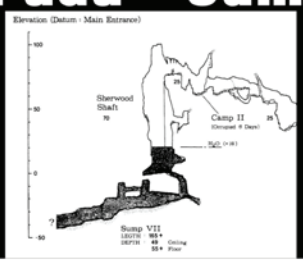

The beginning of a long trip...



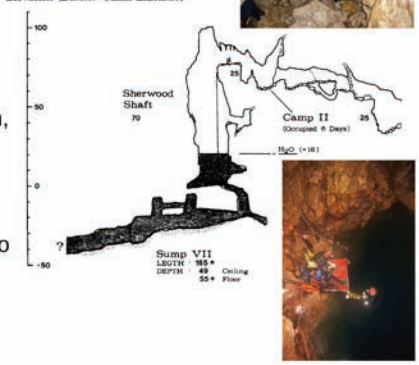

Cueva de Peña Colorada
Mpios. Huautla de Jiménez and Mazatlan
Oaxaca
AMCS Activities Newsletter no. 14, follows p. 54, 1984

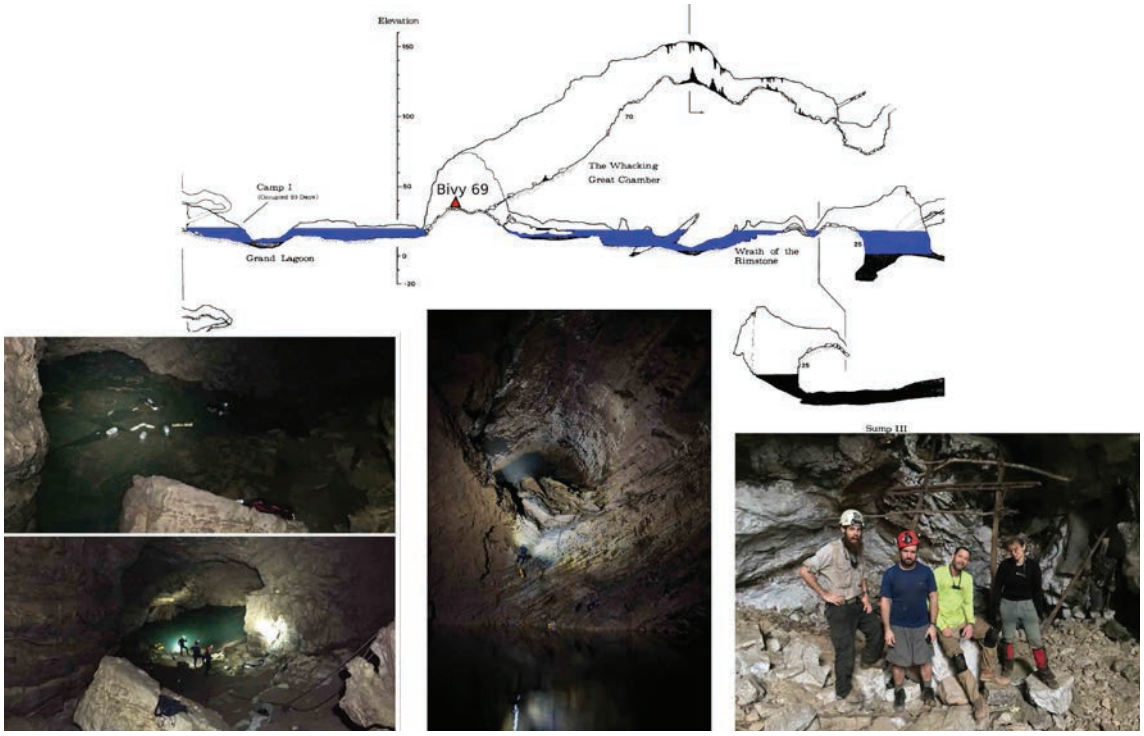


# Cueva de la Peña Colorada - Sump VII




- After 3 weeks we started diving Sump 7.
- Sadly, only a few tens of metres beyond the previous end of exploration, a rock pile stopped progress
- As opposed to the '84 expedition, no flow was observed.
- After 4 dives, without finding a way on, we started to retreat.
- We dumped a dye into Sump 7 to see if there is any connection to the resurgences in the Santo Domingo canyon.


Elevation
Camp I
Bivy 69
The Whacking Great Chamber
Grand Lagoon
Wrath of the Rimstone
Sump III


Beyond the Sump Expeditions - the Future
Habitat?
Autonomous Underwater Vehicles (AUVs)?
Sistema Huautla
Sump 9
Dual Rebreathers?


CAVE • DIVE • EXPLORE
Exploration
BEYOND THE SUMPS OF
Sistema Huautla
MEXICO
https://www.beyondthesump.org
https://www.facebook.com/cavedive

ABSTRACT

## Slaying the Beast — mapping Kubla Khan

ALAN JACKSON, Southern Tasmanian Caverneers

Kubla Khan in Tasmania's Mole Creek karst area is considered Australia's most spectacular cave by many in the caving community. Massive chambers, acres of flowstone and an abundance of exquisite speleothems draw visitors from around the world. Despite its grandeur, and no doubt in part because of it, a thorough survey and detailed map didn't exist until 2017.

Maps produced during the principle exploration period (circa 1967–1973) were relatively low on detail and didn't include all known passages. The sheer size of the cave made the amount of time (and paper!) required to produce a map at anything better than ~1:1000 a mammoth task. In the 1980s, as management of the cave became a key concern by the then National Parks and Wildlife Service, it became obvious a good map of the cave was required.

The Southern Caving Society were commissioned by NPWS to complete such a survey but despite accurate surveying of >80% of the cave's known passages, the project stalled at the usual hurdle — collection of detailed in cave sketches and final map drafting. The idea would sit dormant for over twenty years until a box containing the 1980s data was discovered and the seed was sown.

Liberal applications of water and fertiliser by key personnel during 2013 saw that seed germinate and the first underground survey trip took place in January 2014. Three and a half years (and over 700 person-hours) later a 'final' map was produced which (hopefully!) included all known passages at the scale of 1:250.

This presentation will provide a synopsis of the methods employed to collect and collate in-cave data and create a final digitally drafted map and identify the keys ingredient to success.

# Slaying the Beast — mapping Kubla Khan

**Alan Jackson**

Kubla Khan in Tasmania's Mole Creek karst area is considered Australia's most spectacular cave by many in the caving community. Massive chambers, acres of flowstone and an abundance of exquisite speleothems draw visitors from around the world. Despite its grandeur, and no doubt in part because of it, a thorough survey and detailed map didn't exist until 2017.

Maps produced during the principle exploration period (circa 1967–1973) were relatively low on detail and didn't include all known passages. Some were even hilariously inaccurate. The sheer size of the cave made the amount of time (and paper!) required to produce a map at anything better than ~1:1000 a mammoth task. In the 1980s, as management of the cave

became a key concern by the Parks and Wildlife Service, it became obvious a good map of the cave was required. The Southern Caving Society were commissioned by PWS to complete said survey but despite accurate surveying of >80% of the cave's known passages by Jeff Butt and co, the project stalled at the usual hurdle — collection of detailed in cave sketches and final map drafting. The idea would sit dormant for over twenty years until a box containing the 1980s data was discovered and the seed was sown. Liberal applications of water and fertiliser by key personnel during 2013 saw that seed germinate and the first underground survey trip took place in January 2014. Three and a half years (and over 700 person hours) later a 'final' map was produced which (hopefully!) included all known passages at the scale of 1:250.

Step 1 was sorting the paperwork. Rolan Eberhard (DPIPWE) and the Mole Creek Parks and Wildlife Service made all this happen (it's no coincidence that Parks' abbreviations (PWS) is also an abbreviation of 'Paper Work Service').

With a gold-pass permit and cave key issued the collection of underground data commenced. An initial sweep of the standard tourist trip route was undertaken with a DistoX and PDA. This allowed us to quickly obtain the backbone of the cave and confirm the new data matched the historic SCS dataset (which we believed to be very accurate, since that was Jeff Butt's forte). Every survey station on this backbone had a labelled pink tape attached for the life of the project.

Highly sensitive sections of the cave (e.g. Dulcimer) were only allowed to be visited once so synchronous shot data and sketch collection was conducted. Data was plotted by hand (pencil and paper) and sketching done to scale.

Lower sensitivity areas had shot data collected first (leaving labelled stations), the data was reduced electronically and its accuracy checked, then in-cave sketching was completed on a subsequent trip using a printed line plot (pencil and paper again). Personally I am not a fan of PDA sketching, particularly for projects requiring high detail collection. Significant detail (large speleothems, rocks, other features) were located with DistoX devices and plotted to scale on numerous occasions — otherwise it was very easy to get 'lost in space' even with a printed line plot.

In large passages multiple data lines were collected to allow more accurate positioning of floor detail during the sketch phase (a single centre line plot down the middle of 60 m wide passage simply doesn't cut it).

A large number of strategically placed survey stations were photographed (close up and at a distance) to allow for easy relocation in the future for rectifying errors, tying in future discoveries etc. once the pink tapes were removed at the end of the project.

Some small and or complicated passages (e.g. Helictite Dungeons) were surveyed and sketched simultaneously to rough scale and re-sketched out of the cave following data entry and line plot printing.

Once all shot data and sketches were collected the sketch sheets were digitally scanned and stitched together in Adobe Illustrator (AI), a scalable vector graphics (SVG) drawing software. Some of the 'sketch to scale in the cave' sheets were 'morphed' in Compass 'Sketch Editor' software prior to stitching (note that this only works on fairly accurate sketches as poorly 'to scale' sketches result in too much distortion for the detail to be useful). The sketches were then digitised in AI.

The AI file was broken into multiple layers (e.g. passage outline, floor substrate, water arrows, slope indicator, pretties, rocks, edges and ledges etc.) and many layers were further broken into sublayers (e.g. the 'pretties' layer was divided into straws, stalagmites, stalactites, helictites, shawls, flowstone etc.). While this was tedious to implement it paid enormous dividends later on when producing different maps at different scales as you can selectively remove or add particular features throughout the entire map with the check of