2023 Tipan (PH) Expedition

Final Report

By Patrick van den Berg

March 1 until March 20 2023 a group of Dutch and Belgian cavers took part in a caving expedition to the Tipan area, part of the Naga municipality in the province of Zamboanga Sibugay on the island of Mindanao in the Philippines. The expedition site is part of the newly declared Protected Area in the Philippines-the Naga-Kabasalan Protected Landscape proclaimed under Republic Act 11686 on April 8, 2022. The group explored and surveyed the Tipan cave system and other caves in the surrounding area with permission from the Protected Area Management Board. This report describes the expedition objectives and end results.

Previous expeditions

This was the fifth caving expedition to the Zamboanga peninsula, and the first fully devoted to the Tipan area. In 2014 Marc Mentens, a Belgian expat living in Zamboanga, wrote an article in Belgian caving magazine *Spelerpes* about the caving possibilities in Zamboanga, and made an open invitation for cavers to come over for initial explorations of the area. Both Belgian cavers from the *Verbond van Vlaamse Speleologen* (VVS) and Dutch cavers from *Speleo Nederland* responded. This resulted in two Belgian and two Dutch expeditions, and finally this fifth expedition jointly organized by both Dutch and Belgian cavers:

1. **2015-01:** VVS (Kurt Garrez and Raf van Staeyen)
2. **2016-03:** Speleo Nederland (Arjan van Waardenburg, Erik Birkhoff, Pauline Barendse, Jan Matthesius, and Patrick van den Berg)
3. **2016-10:** VVS (Kurt Garrez and Raf van Staeyen)
4. **2020-03:** Speleo Nederland (Marion Gijbels, Saskia Klerk, and René Haemers); ended prematurely because of COVID-19 lockdown
5. **2023-03:** Speleo Nederland (Erik Birkhoff, Lisette de Graauw, René Haemers, and Patrick van den Berg), and VVS (Erik Claes and Pascal Reenaers)

Expedition team members

The core of the expedition team were Erik Birkhoff (NL), Lisette de Graauw (NL), René Haemers (NL), Patrick van den Berg (NL), Erik Claes (NL), Pascal Reenaers (NL), and of course Marc and Bing Mentens as our local liaisons (BE/PH). Three scientists also joined during a part of the expedition: Daniel Husana (*University of the Philippines Los Baños*, PH), Eugene Logatoc (*University of the Philippines Los Baños*, PH), and Jhonnie Villareal, (*Geology, University of Guam*, US).

Figure 1: Sort-of complete expedition team. Photo by restaurant employee.

Apart from these core team members, also many Filipinos took part (Figure 1), most of them being employees of the *Department of Environmental and Natural Resources* (DENR) and local guides. A complete list of attending DENR employees can be found in the “Thanks” section of this document. Behind the scenes the team also received a lot of support from Governor Dr. Ann K. Hofer (Figure 2) who

graciously provided us with security details, transportation (Figure 3), base camp facilities and catering.

Figure 2: Visit to governor Dr. Ann K. Hofer. Photo by governor's staff.

Additional base camp facilities and catering were provided by the mayor of Naga, Rino O. Delos Reyes. Caving support and guides were provided by Dante Oporto, DENR Assistant Regional Director for Management Services.

Figure 3: Transport from basecamp to caves. Photo by Erik Claes.

Basecamp

After arrival in Zamboanga City, the team first met up with Marc and Bing Mentens. The day after the team left for Ipil to meet Governor Dr. Ann K. Hofer and do a briefing at the DENR provincial office with various DENR officials. In the afternoon we left to set up our basecamp in the *Ibog-Ibog sa Tilubog* family park in barangay Tilubog, in the municipality of Naga (Figure 4).

Figure 4: Basecamp at Ibog-Ibog sa Tilubog. Photo by Erik Claes.

The *Ibog-Ibog sa Tilubog* family park had a great view, good restaurant, and some nice spots to camp. The restaurant area was of course used for eating and drinking, but also for briefings and data processing (Figure 5), and sometimes karaoke... The lower terraces were used for camping and equipment storage.

Figure 5: Briefing at the basecamp with a stunning tropical sunset and mountain scenery in the background. Photo by Erik Claes.

Expedition objectives

The 2023 expedition set the following objectives:

1. Finish all survey work in the Tipan cave system;
2. Identify and explore other caves in the area;
3. Assist with academic research;
4. Photo documenting all surveyed caves;
5. Support local organizations and caving infrastructure;
6. Setting up an infrastructure for a multi-year project.

All objectives were met and described in the following sections.

Finish Tipan cave survey

During the first three expeditions several different karst areas in Zamboanga Peninsula were visited, in search for promising systems, and various caves were surveyed. The Tipan cave system was the most promising by far (Figure 6).

Figure 6: Tipan cave entrance. Photo by Erik Claes.

The goal of the fourth expedition therefore was to focus solely on this system. Unfortunately during this expedition after only two days of surveying COVID-19 happened and the Philippines went into lock-down and the team had to leave the area in a hurry.

The main goal of the 2023 expedition was to finally finish what was started in 2015: completing the survey of the Tipan cave system!

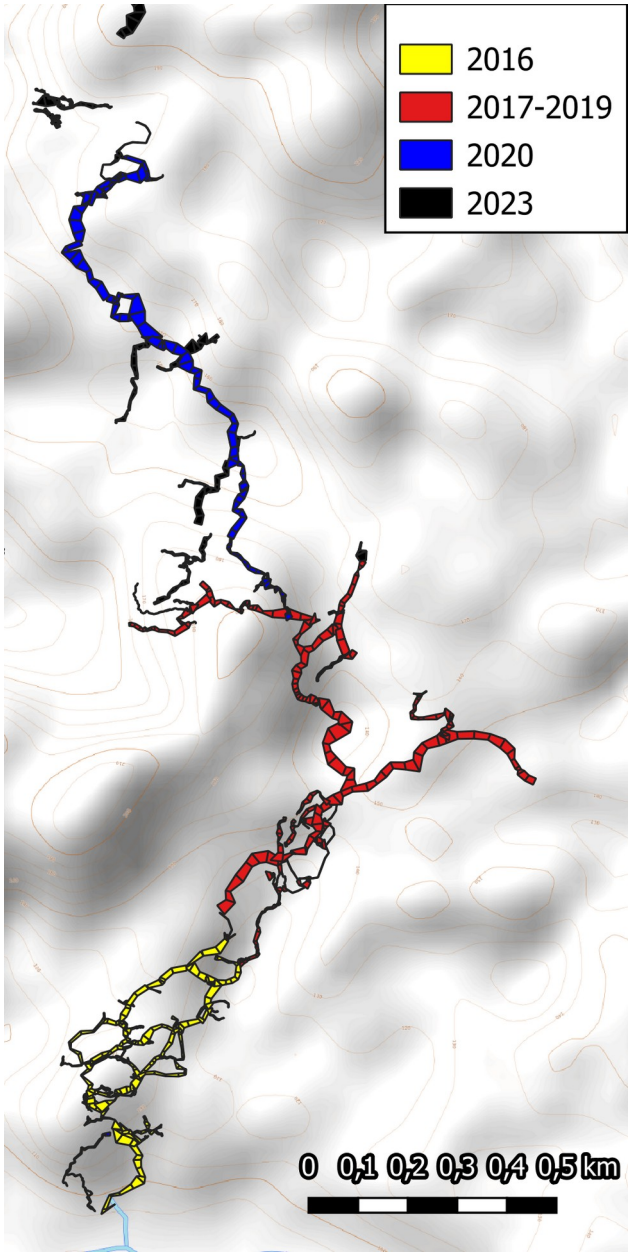


Figure 7: Completed survey of the Tipan cave after the 2023 expedition. Created by Erik Birkhoff.

During the first two expeditions a total of 6 km of cave passage was explored and surveyed. In 2016 combined with some additional exploration by Marc Mentens, this was expanded to a total of 9 km with big passages going on and on. Given the size of the river and several other cave openings in its extension, the

team had high hopes of greatly expanding the distance surveyed passages in this cave! Unfortunately, in this year's expedition we found out the last survey station of the 2016 exploration was only 200 meters away from the end sump, resulting in a bit of an anti-climax! However, there was still plenty of surveying to do. Not only were there about two dozen of question marks and possible leads left to survey, also large parts had to be re-surveyed because of lost sketches.

On March 11, the survey of Tipan cave was finally complete (Figure 7)! Some statistics:

- Total length of surveyed passages: 11171 m.
- Number of stations: 1139
- Average leg: 10.5 m.
- Average leg: 41.8 m.
- Longest leg: 41.8 m.
- Shortest leg: 0.4 m.

The final map including all cave details will be published at a later date in the Belgian *Spelerpes* caving magazine, accompanied with an extensive report. Note that many surveyed passages ended in sumps. These still have to be explored and will be surveyed in future expeditions.

Identify and explore other caves in the Tipan area

The Tipan cave area spans three adjacent *barangays* (small villages all part of the Naga municipality):

1. Tipan
2. Tilubog
3. Sandayong

In 2015 only two adjacent entrances of the Tipan cave were known. In 2020 a total of 12 cave entrances had been reported to DENR by local guides. By creating additional awareness the total number of identified cave entrances had been expanded to 48 at the end of the 2023 expedition (Figure 8).

From the 48 known caves, a total of 17 caves were surveyed at the end of the expedition. This resulted to a total distance of 17912 m of surveyed cave passages in the Tipan area (Figure 9).

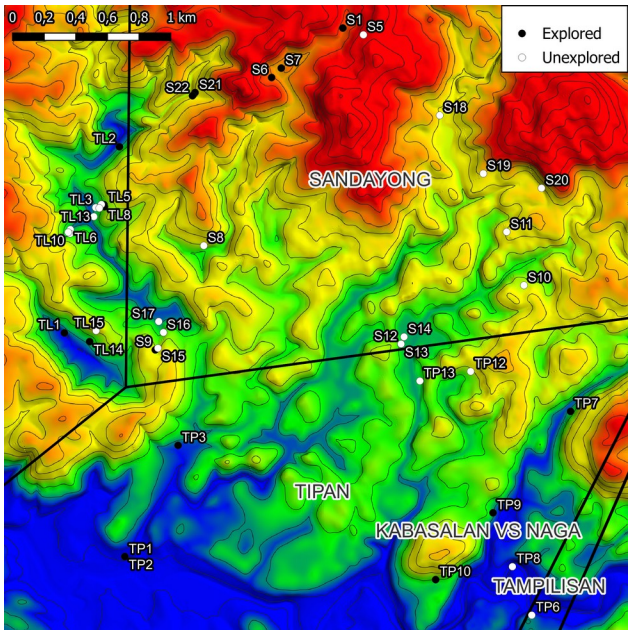


Figure 8: Known cave entrances at the end of 2023 expedition. Map by Erik Birkhoff.

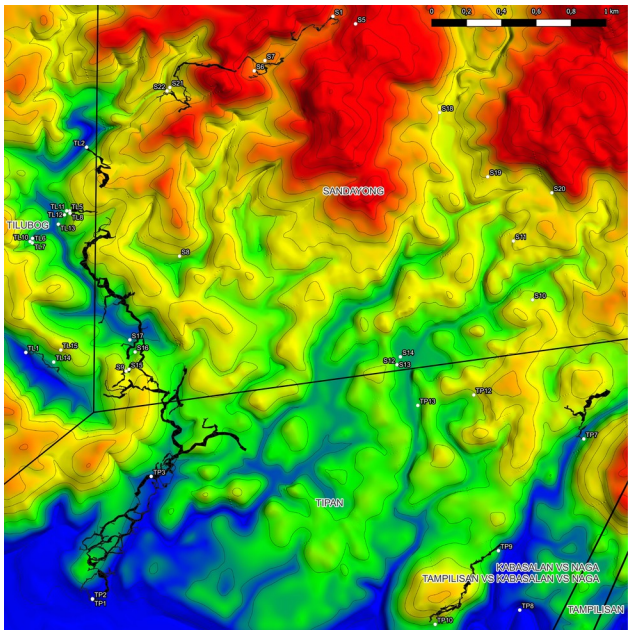


Figure 9: All surveyed caves in Tipan area. Map by Erik Birkhoff.

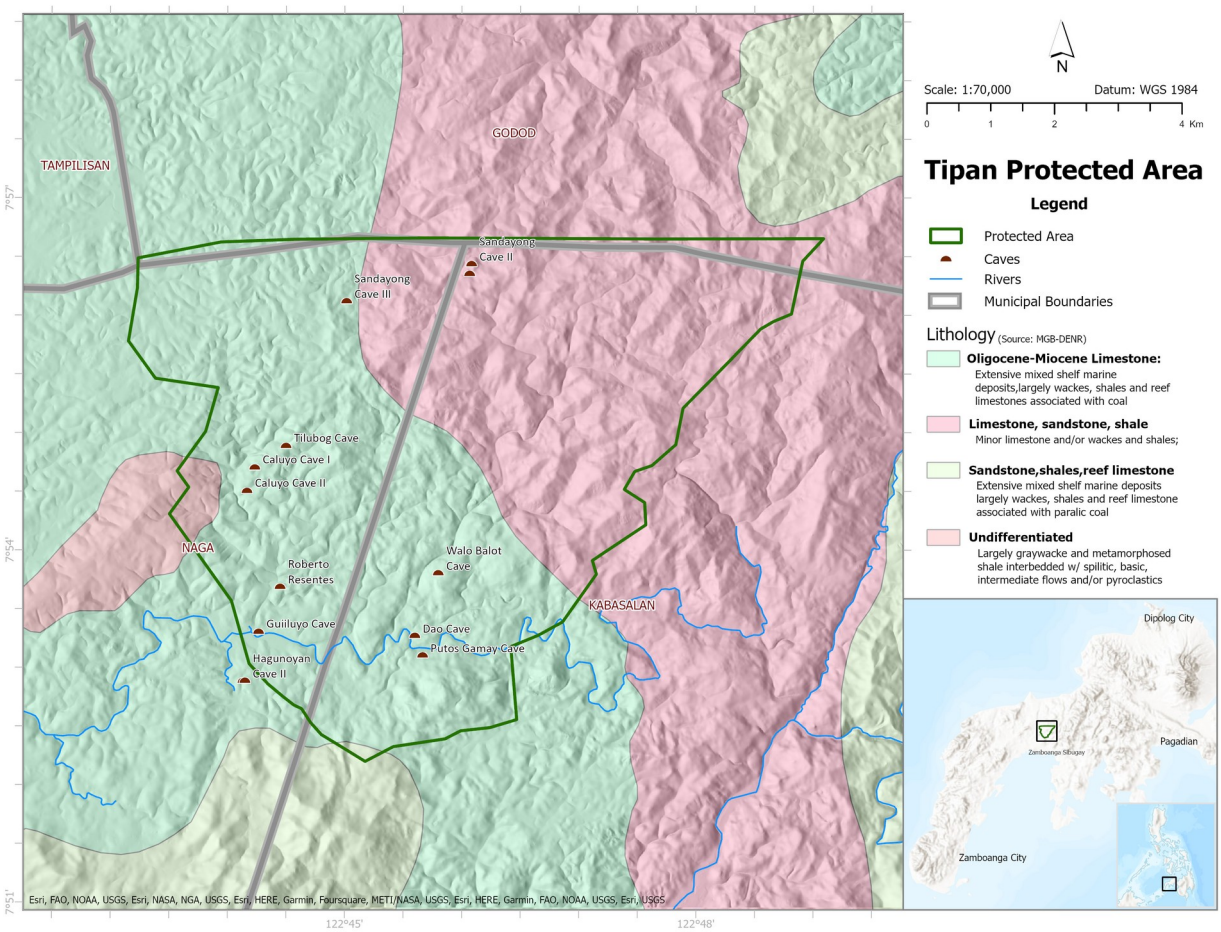


Figure 10: Geological map of the Tipan area.

Assist with academic research

Three scientists were invited to participate in the Tipan 2023 expedition:

- D.E. (Dan) Husana, PhD. (*Professor of Natural Environment Studies, University of the Philippines Los Baños*)
- E.L.R. (Eugene) Logatoc, MSc. (*Assist. Professor Plant Ecology, University of the Philippines Los Baños*)
- M.J. (Jhonnie) Villareal, MSc. (*Geology, University of Guam*)

Dan's objective was to do research on cave fauna, especially cave fish. Eugene studies Bryophyta (non-vascular land plants, e.g. moss) and was interested in populations in and around cave entrances. Jhonnie is specialized in karst geology and spring systems.

Geological findings

Unfortunately only two days into the expedition, Jhonnie fell ill (other expedition team members followed later on...) and was only able to do an initial reconnaissance. She did notice fault indications in the cave and some passages developing along structural features. The occurrence of volcanic and *ophiolitic* rocks nearby was also worth noting; the cave floor has a lot of it, which adds to why this cave is so unique. She wishes to return on the next expedition to do further research. She also provided us with a geological map of the area (Figure 10).

Bryophyta findings

Eugene's (Figure 11) specialization is Bryophyta s.l. which are a botanical taxonomic division containing three groups of non-vascular

land plants: liverworts, hornworts and mosses. Note that Bryophyta are not related to lichen.

A total of 1318 Bryophyte species are known to exist in the Philippines, but no prior research had been done in Zamboanga Sibugay. Also, cave entrances are known to have a micro climate which differs from the surrounding area which may have an effect on Bryophyte populations. This has not been researched before in the Philippines and therefore was the focus of Eugene's research.

Figure 11: Eugene Logatoc doing field research. Photo by Erik Claes.

At the end of the expedition 37 different Bryophyte species had been identified, with more to follow as specimens are further examined in the laboratory. Noteworthy was the fact that species were identified in cave entrances between 100 and 200 m which normally only grow at 1000+ m. In addition, the abundance of species growing on leaves of vascular plants was notable. These observations are likely due to the micro climate at the cave entrances and their vicinity. Details on all identified Bryophyta will be published in a dedicated scientific publication at a later date.

Aquatic cave fauna

Dr. Daniel Edison Husana (Figure 12) is a professor of natural environmental studies. He has a wide range of research interest but his main focus is on cave and aquatic ecology. Dan, as his friends and colleagues call him, is also a crab and cave fish taxonomist with over 29 years of experience exploring and studying the karst and caves in the Indo-West Pacific region.

Figure 12: Labeling of fish in Tipan cave by Dr. Daniel Edison Husana. Photo by Erik Claes.

In this expedition, his main research subject initially were the cave fishes and later expanded to the extremophiles of the thermal spring.

Two macro crustaceans were identified on different sites in the Tipan system:

1. *Macrobrachium* sp. (Family Palaemonidae) (Figure 13);
2. *Isolapotamon* sp. (Family Potamidae) (Figure 14).

Figure 13: Macrobrachium *sp. Photo by Erik Claes.*

Figure 14: Isolapotamon *sp. Photo by Erik Claes.*

Also several fish species were identified on different sites in the Tipan system. Notably:

1. *Bostrychus* sp. (Family Eleotridae) (Figure 15);
2. *Silurid* sp. (a catfish from Family Siluridae) (Figure 16);
3. *Barbodes* n. sp. (Family Cyprinidae) (Figure 17).

Figure 15: Bostrychus sp. Photo by Lisette de Graauw.

Noteworthy observations on the Barbodes samples:

1. Black spots sometimes found on Barbodes seem to darken when the fish is under stress;
2. There probably are several sub-spieces of Barbodes found in Tipan, including new ones; but this needs to be researched further;
3. There seems to be a hybrid species of cave Barbodes with features of fish normally found on the surface streams in some parts of South East Asia; again further research is necessary to verify this hybridization and come up with a theory of its origin.

All samples were preserved for in depth research at the University of the Philippines Los Baños. It will be deposited afterwards at the National Museum of the Philippines and other repository institutions abroad for long term storage and future research work. Tissue samples were also taken for future genetic research.

Figure 16: Silurid *sp. Photo by Lisette de Graauw.*

Figure 17: Barbodes *n. sp. Photo by Erik Claes.*

Subterranean spring with biofilm

Just after Daniel Husana had finished his week of field research and was back in Manilla again, the expedition team found a subterranean spring in one of the caves in the Tipan area (Figure 18). After seeing footage of the spring that was forwarded to him by Marc, he immediately decided to return to the site! This was because he noticed the biofilm growing right where the water flows out, probably indicating the presence of chemosynthetic archaeans ("proto-bacteria") which thus far have not been identified in any other caves in the Philippines.

Figure 18: Pascal and Dan observing and documenting the biofilm on the cave floor before collecting samples. Photo by Erik Claes.

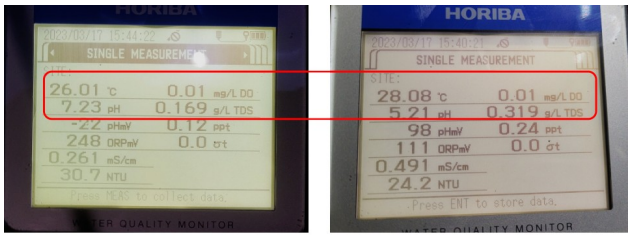
Upon his investigation, he duly noted the following observations.

A. The spring had several distinctive properties:

    1. the spring discharged from a mound approximately 1.5 m above the adjacent subterranean stream;
    2. there was biofilm in the stream discharging from the spring;
    3. the temperature of the spring water was clearly warmer than the river flowing through the cave;
    4. there was a faint smell of sulfur gas (similar to a rotten egg) around the spring area.

B. The water quality was determined to compare the characteristics of the subterranean spring and the subterranean river flowing next to it. A *Horiba water quality checker* was used to measure various physico-chemical parameters (Figure 19). Noteworthy are the following results:

    1. the spring was more than 2 degrees Celsius warmer than the river and the cave air temperature (making it a thermal spring in the category "warm");
    2. the spring was more acidic (pH was lower by 2) than the river;
    3. the spring contained twice the amount of dissolved solids such as minerals than the river.



Subterranean river | Thermal spring

Figure 19: Comparison of water measurements between subterranean river and spring. Photo by Dan Husana.

All these observations suggest that the sources of the river and spring were indeed different, and that the spring was definitely not coming from the surface water. Combining the measured parameters and the smell of sulfur gas strengthens the idea of the presence of chemosynthetic archaeans in the biofilm. However, to prove this hypothesis, samples of biofilms have been collected to extract and sequence the DNA in the laboratory to identify the species of archaeans (if really present) and other microorganisms in the thermal spring. The presence of this microbial film is very interesting because of its important role in the ecology of the cave. The outcome of this research will be published in a scientific journal at a later date.

Photo documentation

Erik Claes (Figure 20) was the cave photographer during our expedition.

Figure 20: Erik Claes at work at the Tipan main entrance. Photo by Lisette de Graauw.

Erik is a very experienced cave photographer and it was his job to photo document as much of the Tipan cave system and surrounding caves as possible. Several Canon cameras and lenses were used, as well as an array of flashes and stands (Figure 21).

DENR supplied the manpower to carry all the equipment into the caves and help with the technical setup to make the photos possible. Various employees also acted as models in different photos.

Figure 21: Flashes used for photography. Photo by Erik Claes.

All important features in the Tipan cave system were photographed (Figure 22), as well as in most adjacent surveyed caves. In total several thousand photos were taken. A copy of all photos was given to DENR to help them with their cave assessments.

Figure 22: Example of one photo documented passages in the Tipan system. Photo by Erik Claes.

An effort to catalog each photo is underway.

Support local organizations and caving infrastructure

Zamboanga is one of the poorest areas in the Philippines and, apart from a few individuals around Marc Mentens, there are no caving clubs. However, thanks to years of cave promotion by Marc Mentens, a Belgian expat living in Zamboanga, awareness and interest in caves has grown. First only with a limited number of DENR employees whose job it was to assess and classify caves for protection and

conservation purposes, but now it has already a much wider interest. Not only within DENR, but also within different other government agencies which want to raise local awareness on their cave eco-systems, or see this as a potential for eco-tourism which needs to be researched.

Although interest is slowly growing, actual knowledge about caves and caving is still very limited. Because of very limited financial resources in the area, availability of caving equipment is also very limited, further prohibiting cave exploration and safety while caving.

To enable Marc to train the local population on caving, and to enable them to start caving in a safe manner, this expedition has made several donations in caving equipment, just like the previous editions. Thanks to sponsorship by Aventure Verticale six 25L kit bags were donated and grants by Speleo Nederland and EuroSpeleo Projects were used to buy and donate six watertight 6L kegs, 30m of dyneema and 4 refurbished Android tablets for cave surveying purposes. As on previous expeditions, Marc was contacted beforehand to establish what equipment currently is most useful.

In addition to this the expedition team, just like on all previous expeditions, also made sure to advance the knowledge of the support team members on cave ecology and caving safety. The support teams also learned about the basics of cave surveying (Figure 23).

Figure 23: Explaining some caving basics. Photo by Erik Claes.

With knowledge on caving slowly growing in the Zamboanga area, we hope capable locals eventually will join Marc in organizing expeditions, give cave training, and raise further awareness on cave ecology.

Setting up an infrastructure for a multi-year project

Because a great number of caves still remain unexplored in both the Tipan area and the Zamboanga peninsula in general, and the potential for the Tipan cave system is still huge (sump diving!), continuing the exploration in the future is obvious for all parties involved.

To make sure future explorations will be at least as successful as this one, the team has invested in people, processes, and technology.

People

Local people are needed for both organizational and operational support. Investing in both groups is essential.

Figure 24: Meeting with DENR officials to prepare for the expedition. Photo by Bing Mentens.

Close collaboration with the Zamboanga Sibugay governor, various DENR officials, municipality and barangay officials, as well as local guides, is essential for organizational support. This is why contacts with these groups will remain through-out the year, and during the expedition there are always briefings,

debriefings, and final reporting with all involved and with a vested interest (Figure 24).

To maximize the expedition output, a multi-skilled team of cavers is necessary. As many cavers as possible need to be able to cave autonomously, be confident in exploration, competent in vertical caving, and capable of surveying. This means the skill set of the local operational support teams also needs to grow to be able to join on more demanding explorations (Figure 25).

Figure 25: One of the DENR support teams. Photo by Erik Claes.

The first few exploration years saw many locals coming and going. Luckily, as caving awareness and interest got more ingrained in DENR, the last few years the expeditions see many returning faces. This creates the opportunity to introduce actual training programs for those most involved in cave assessment or other relevant functions or interests. Marc Mentens therefore has agreed to train returning support team members on vertical caving prior to the next expedition. Additional training will be arranged on a need-to basis.

Last but not least, not only local support, but also prospective team members need to be invested in. This not only involves prospecting for a new generation of cavers, but also engaging academia. The group will therefore stay in close contact with both Daniel Husana and Jhonnie Villareal to try and keep them on-board, as well as to try and interest other academics through their networks in the fields of both cave biology and cave geology (Figure 26).

Figure 26: Jhonnie explaining geological characteristics of the Tipan area. Photo by Erik Claes.

Processes

For multi-year projects it is essential to be able to combine data from all the different expeditions. This seems trivial with only two or three expeditions, but can become much of an effort in multi-year project when no standardized protocols or processes are used. Problems we encountered were differing GPS location notations, cave names belonging to different entrances depending on who you talk to, missing data fields in surveys, differing detail levels in surveys, missing cave and access descriptions, missing magnetic deviation, etc.

For this expedition we made the following improvements in our work processes and protocols:

- survey protocol;
- database of entrances with standardized fields;
- coding system for caves;
- standardized software workflow;
- data back-up protocol.

Technology

The first expeditions used pen-and-paper surveying in combined with Disto-X technology

(using PocketTopo software was deemed not reliable enough after several trials). The 2020 expedition was the first to trial the TopoDroid software combined with the Disto-X2, and to great success. This year's expedition built on the experiences of the 2020 expedition using this technology. Training weekends were organized before the expedition to familiarize all expedition members with the TopoDroid software and surveying techniques (Figure 27).

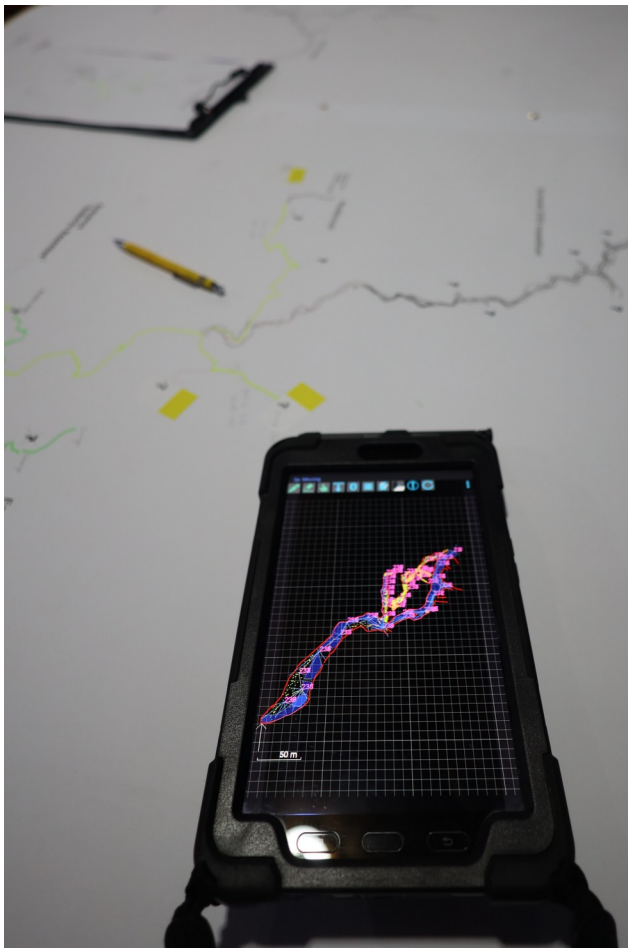


Figure 27: Working with TopoDroid on an Android tablet. Photo by Erik Claes.

The calibration of the Disto-X2 was also improved by introducing 3D-printed calibration cubes (Figure 28). This cube is designed by Patrick Robertson and its 3D files can be downloaded from the Thingiverse website. The cubes made the calibrations easier, quicker to perform, and resulted in a more precise calibration (lower calibration efficient).

Managing all cave surveys is done using Compass software. Compass is easy to learn and makes it easy to export to a multitude of data formats. The Inkscape drawing software is used to draw the actual cave maps based on TopoDroid SVG exports (survey and sketch).

Figure 28: Calibration of a Disto-X2 using a 3D-printed calibration cube. Photo by Erik Claes.

Four refurbished rugged Android tablets and a calibration cube were donated to enable training in Zamboanga in the use of TopoDroid (three Disto-X2 devices were already present).

Future plans

Many unknowns from the previous expeditions have been clarified, but in the process we discovered many more caves and questions to be answered. This however, opens up good opportunities for future explorations and collaborations.

The expedition team has plans to return in 2024 already. Four objectives have been devised so far:

1. further expand the north branch;
2. start exploring the east branch;
3. further explore fossil Tipan passages;
4. connecting caves through sump diving.

Each objective will be briefly discussed.

Further expand the north branch

Many cave entrances still need to be explored which lie in line with the Tipan north branch. Also there are still some significant gaps between the already surveyed caves in this area. Probably there are some caves in between which are not yet found. Further prospecting in these areas therefore is also planned (Figure 29).

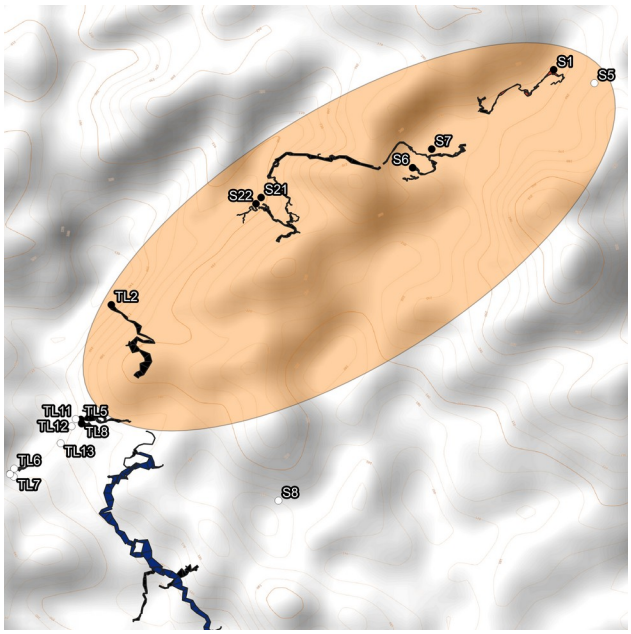


Figure 29: North branch area to be explored further. Map by Erik Birhoff.

Explore the east branch

Two thirds of the water flowing from Tipan caves, emanates from the east branch. No further cave entrances are known in that area as of yet. This specific area therefore also needs some serious prospecting. The caves further in the east (TP13, S12, S13, and S14) also need to be surveyed (Figure 30).

Explore fossil Tipan passages

A cave with only fossil passages has been found right above an active Tipan cave passage on the very last day of the expedition. (Figure 31). Surveying of this cave has not yet completed, but very likely it is connected to the active system below since many bats and swiftlets were observed in that particular Tipan passage and no other entrances were nearby.

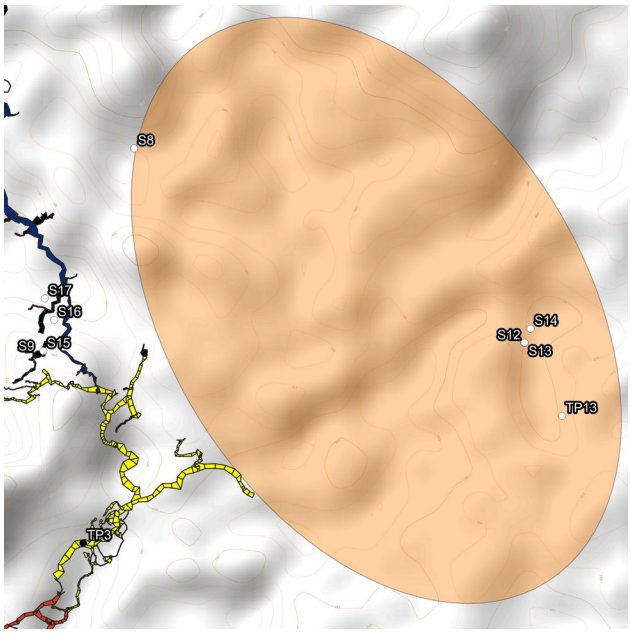


Figure 30: Eastern Tipan area to be further explored. Map by Erik Birhoff.

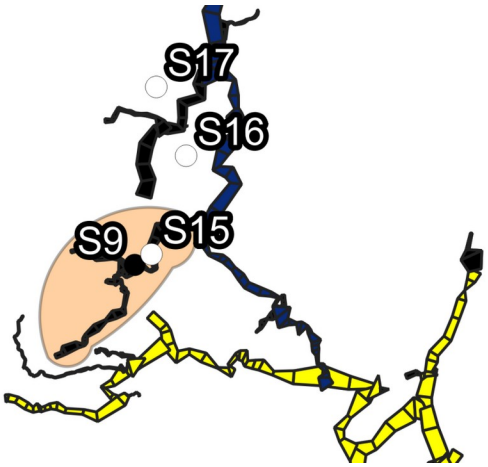


Figure 31: Fossil passages to be explored further. Map by Erik Birhoff.

The existence of this fossil level may also mean the sump(s) at the end of the north branch can be bypassed and therefore is of high interest to the team.

Connecting caves through sump diving

Flooded passages will also need to be explored. However, this will probably be done in a separate expedition dedicated to sump diving.

Knowing all entries and exit points in the area will improve safety greatly and also make planning a lot easier. Planning sump dives after the 2024 is finished therefore makes more sense.

Financial report

Training weekends before the expedition, as well as travel costs to and from Zamboanga differ greatly between team members and therefore are excluded from this report.

Item	Cost
3x Gifts for organizers	€ 19.50
5x Water-tight kegs	€ 95.60
30m Beal Dyneema	€ 134.70
6x Nail Polish	€ 21.00
3x Correction Fluid	€ 19.70
3D Printing calibration cube:	€ 25.00
Petzl Tam Tam hammer	€ 65.00
4x Noaks bags	€ 15.80
Pack of water resistant paper	€ 48.85
4x Refurbished Samsung Galaxy	€ 319.96
4x Stylus for Samsung Galaxy	€ 5.28
4x Case for Samsung Galaxy	€ 22.99
Cave map printing costs	€ 41.75
Additional food costs	€ 600.00
Additional guide costs	€ 50.00
Total:	€ 1485.13

Thanks!

The caving team would like to thank Governor Dr. Ann K. Hofer for her generous support for this expedition, her warm welcome and hospitality. Without her support, this expedition would not have been possible. We would also like to thank DENR Region IX Assistant Director Dante Oporto for his support and hospitality throughout the expedition and beyond. Also a big thank you to all other DENR Region IX officials working tirelessly behind the scenes making the expedition possible, both before and during the expedition: Edgardo P. Montojo (Provincial Environment and Natural Resources Officer, Officer in Charge), Dennis Catalan (Community Environment and Natural Resources Officer, Officer in Charge), Michael F. Dela Cruz (Provincial Environment and Natural Resources Officer, Technical Services Division Chief), Georgina Fernandez (Conservation Development Section Chief), and Reynaldo Cuaresma (Community Environment and Natural Resources Officer, Deputy).

Figure 32: Support team carrying equipment. Photo by Erik Claes.

In basecamp we were welcomed by the mayor of Naga, Rino O. Delos Reyes, who made sure we never got hungry or thirsty, and could discover all the nice things the Zamboanga cuisine had to offer. A big thank you to him and his officials as well!

Of course we are also very grateful for all the other DENR people helping us throughout in operational support. From the Provincial Environment and Natural Resources Office Sibugay these were: Edgardo P. Montojo, Michael F. Dela Cruz, Georgina L. Fernandez, Edmarie F. Cagan, Therence Gomera, Aldren Turcolas, Jino Salvador, and Kevin Flores. From the Community Environment and Natural Resources Office Kabasalan the following people participated: Dennis N. Catalan, Reynaldo C. Cuaresma, Darwin Gapor, Sergie Africa, Jessica L. Molas, Jose Raymundo Academia, Rhomelie Jalaron, Jeniffer Egos, Kzhia Mae Cabusas, Jubail Fernandez, Vinzur Halasan, Ajenabone Endong, Ronilo Blanco, Charlie Gablinez, Jonmar Salibay, Ariel Paradero, and Jay lualhati. Helping carrying bags with photography equipment (Figure 32), helping with set-up, and helping out with surveying, these people were indispensible. Special thanks also to the Philippine National Police particularly to the 2nd provincial mobile force and Naga Municipal police station. You are all greatly appreciated!

And last but not least we are also greatly appreciative of our supporters back in Europe: Speleo Nederland, EuroSpeleo Projects and Aventure Verticale, thank you so much for your generous contributions!

Figure 33: Tipan water passage. Photo by Erik Claes.