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Commission on Volcanic Caves  
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<http://www.uis-speleo.org/>



<http://www.vulcanospeleology.org/>

The Commission on Volcanic Caves Newsletter has been published regularly since December 22, 1993. The Newsletter is available free of charge to all members of the commission, and to others who are interested in Volcanic caves.



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### MISSION STATEMENT

The UIS Commission on Volcanic Caves encourages exploration and scientific investigation of volcanic caves, and hosts the International Symposium on Vulcanospeleology about every two years



### COVER PHOTO

Dr Chris Wood in Cueva  
Ferrocarril during the 12<sup>th</sup>  
International Symposium on  
Vulcanospeleology in Mexico  
2006

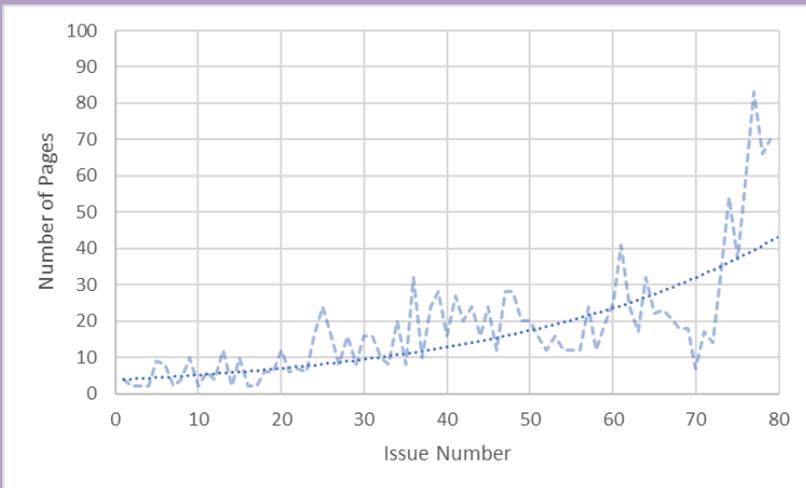
By Ed Waters

# UIS Commission on Volcanic Caves Newsletter No.79

## Editorial

Dear Vucanospeleologists,

Welcome to Issue No.79 of the Newsletter of the International Union of Speleology's Commission on Volcanic Caves. From the humble beginnings of Issue No.1 back in December 1993 to keep the members of the Commission in touch with each other, this publication has grown to incorporate a substantial wealth of information about volcanic caves as well. This is well shown by the growth in content over those years shown in the graph below.



This issue contains a wide variety of material, and as such I hope that everyone finds at least something of interest in these pages. Certainly I am blessed as editor with the quantity and variety of content provided by the authors of the articles contained within this edition – many thanks to all of you.

It is my intention to issue No.80 towards the end of 2022, and I am eager to start receiving material related, no matter how tenuously, to caves and volcanoes as of now. Please feel free to contact me (email address on the previous page) with any queries or offers for articles.

All the best,

Ed Waters, May 2022

# UIS Commission on Volcanic Caves Newsletter No.79

## Message from the Chairman

Fellow members

It is hard to believe six months have passed since the last issue of the newsletter. So much has happened since last October. And not all of it has been positive. Covid, grave international issues and extreme weather events are continuing to impact on many of us.

Here in southeastern Australia, it has been a cool and very wet 'summer'. This has been of immense benefit to areas that have been ravaged by drought and bushfires in recent years. However, severe storms have caused widespread flooding that has resulted in the tragic loss of human life. Many homes and businesses have been destroyed and there have been significant losses of livestock and personal property. Compared to these impacts, the difficulties some have had in accessing their caves pale into insignificance.

Looking ahead, I know some of you are planning to attend the International Congress of Speleology in France in July.

I also look forward to seeing many of you at the next International Symposium on Vulcanospeleology. This will be held in the area of the Dak Nong Global Geopark in Vietnam towards the end of November this year. Planning for the ISV is progressing well and you can read more about what is being planned elsewhere in this issue.

You can also read more about the important archaeological work that is taking place in the caves of the Dak Nong area.

I am also pleased to see that Ed has decided to celebrate the life of Chris Wood in this issue. Chris was a leading member of the Commission who sadly passed away a decade ago. His contributions to vulcanospeleological research deserve wider recognition.

All the best.

John Brush

Chairman / President, Commission on Volcanic Caves, International Union of Speleology.



## WELCOME MESSAGE

**Dear Friends,**

On behalf of Dak Nong Provincial Leaders, I am pleased to invite you to **the 20th International Symposium on Vulcanospeleology (ISV20)**, which is under the joint auspices of the UIS Commission on Volcanic Caves and UNESCO Global Geoparks Network and will take place in the Dak Nong UNESCO Global Geopark, Dak Nong Province, Vietnam from November 22nd to November 26th 2022. The theme of ISV20 is: "Conservation and sustainable use of volcanoes and volcanic caves".

As you may know, Dak Nong UNESCO Global Geopark owns 5 young but beautifully-shaped volcanoes. It also features the longest and largest lava tube cave system in Southeast Asia with a total length of over 10km. From 2014 to present, cave explorers have discovered and measured about 50 caves within the geopark's area. Significantly, many caves have been used as shelter of prehistoric people since at least 6,000-10,000 years ago. Furthermore, volcanic activities about tens of thousands of years ago have also left in Dak Nong majestic waterfall system and other beautiful sceneries.

Being part of the "Central Highlands Gong Culture Space" - a UNESCO's Masterpiece of Oral and Intangible Cultural Heritage since 2005, Dak Nong also became known for the first discovery in Vietnam, and in the world, of the lithophone - one of the oldest of mankind's musical instruments.

Hosting ISV20, Dak Nong UNESCO Global Geopark is dedicated to offering all participants great opportunities not only to participate, sharing latest research and development results but also to enjoy the beauty of Dak Nong UNESCO Global Geopark's landscape and experience unique local traditions through a wide range of interactive sessions, field trips and activities.

We look forward to welcoming you to the ISV20 and hope to see you all in the Dak Nong UNESCO Global Geopark!



A handwritten signature in black ink, appearing to read 'Ton Thi Ngoc Hanh'.

**Ton Thi Ngoc Hanh**  
**Vice Chairwoman of Dak Nong Province**  
**Director of Dak Nong UNESCO Global Geopark**

## Memories of Chris

**By Ed Waters**

Dr Christopher Wood was a true giant in the world of Vulcanospeleology, and many of the members of the commission will remember his many exploratory feats, immense written contribution to the science and above all his friendship over decades of association with lava tube caves. Many of you will have shared my shock at the news of Chris' untimely death in early 2012, and I am sure just as many of you will find it hard to believe that a decade has passed since then.



**Chris Modelling His New Caving suit! Lanzarote, 2006  
[Photo: Ed Waters]**

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This anniversary seemed like a good opportunity to record some of my personal memories of Chris, and hopefully to introduce some of Chris's amazing achievements to newer members of the commission who did not share the privilege of knowing the man that I was fortunate to call my friend.

I first met Chris in the summer of 1999, somewhat ironically this was in one of the world's great conventional caving areas<sup>1</sup>, the classical Karst of Slovenia. This was on the occasion of the 50<sup>th</sup> Anniversary of the Shepton Mallet caving club, of which Chris had been a member in times past and I was a member at the time. Although I remember Chris well from that adventure, I don't remember going underground with him on that trip, though we did discover that we lived only about 30 miles (50km) apart in southern England.

By this time, Chris was already something of a legend with respect to his expertise in lava tube caves<sup>2</sup> which stretched back over 25 years to the early 1970s. Chris was first introduced to Lava Tube Caves on the 1971 Shepton Mallet Caving Club expedition to Iceland, the major objective of which was to survey Raufarhólshellir to around 1.3km in length.

This success was followed by a series of expeditions all over the world during the following decade, including claiming the world's longest lava tube cave twice in Cueva del Viento on Tenerife (somewhat controversially) and then with the earliest exploration of parts of Kazumura Cave on Hawai'i. As well as exploring and surveying many significant lava tube caves, Chris also started to become interested in the mechanisms of their formation. As such he wrote many important scholarly articles on the subject, many of which have become part of the foundation of the science of Vulcanospeleogenesis.

Returning to 1999, Chris had been somewhat distanced from the UK caving scene for some time, but in Slovenia told me about an ambitious return to exploratory expeditions. He had in his sights the objective of exploring the extensive lava flows of the Laki Fires in southern Iceland. These lavas, known

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<sup>1</sup> i.e. Limestone karst

<sup>2</sup> I know that some prefer the name "Pyroduct", but Chris was very much in the "Lava Tube" camp.

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as the Eldhraun, represent the output of the largest effusive eruption in recorded history and clearly held the potential to contain extensive lava tube caves. Although I had never been in a volcanic cave, Chris had me hooked and in September 2000 I found myself in Iceland.

A few days later I found myself a long walk from home, in a cave discovered only a few days before. Chris had convinced me that lava tubes would be dry, but somehow the two of us found ourselves paddling, then wading along a stream passage! Everyone else (bar Phil Collett) turned back for fear of getting their feet wet, but the three of us pushed on with the enticing rumble of filling water clearly audible ahead.

What we found was well worth the wetting, the absolutely unique waterfall chamber in lǒrafossar, the roof of the cave lying only a few metres below the bed of Laufbalavatn (a lake) resulting in curtains of water descending from the roof. On one of my first visits to a lava tube I had been very lucky to be involved in the discovery of this special place, which along with Chris' enthusiastic explanation of the unusual (to me at the time) features of the lava tubes had me hooked.



**Chris (foreground) and Phil Collett in the Waterfall Chamber, lǒrafossar, September 2000 [Photo: Ed Waters]**

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The two Laki Underground expeditions (in 2000 and 2001) were ambitious undertakings including a mixture of experienced cavers (including Greg Middleton) along with students, with little or no caving experience, from Bournemouth University (where Chris lectured) and Dundee University. Over the course of these expeditions we mapped over 11km of previously unknown lava tube caves, and Chris and I were awarded the British Cave Research Association's "Arthur Butcher Award", the national award for cave surveying, in 2002.

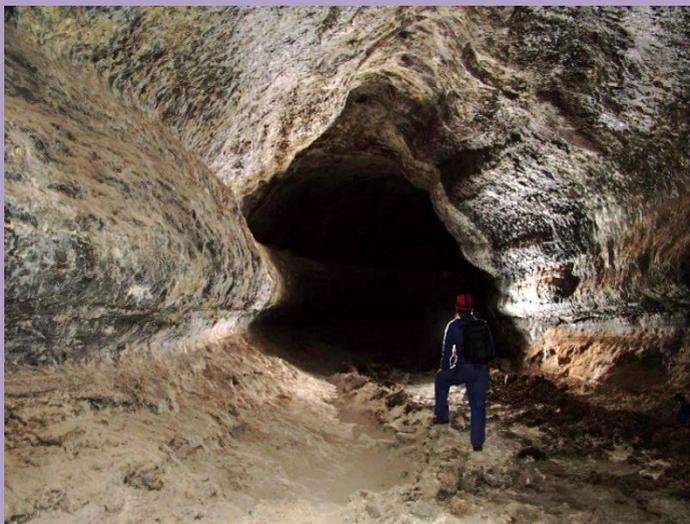
Producing the reports and surveys for the Laki expeditions ensured that Chris and I remained in close contact, and given that we lived relatively close to each other he was a frequent visitor to Hayley and I's house just outside Salisbury. Hayley and I<sup>3</sup> returned to Iceland in 2003, and although Chris did not accompany us, he did supply much information and crucially introduced us to our good friend Björn Hróarsson, and allowed us to explore and survey a large number of caves on the Reykjanes peninsula.

In early 2006, Chris revealed to me his project to write a definitive book on lava tube caves. The idea was that it would be a two volume affair, the first volume dedicated to Vulcanospeleogenesis, exploration techniques and conservation and the second providing a description of some of the most significant lava tube caves in the world. As part of this project he was very keen to visit the lava tubes on Lanzarote, which he had not visited before, so around Easter a small group of us (Chris, Hayley, Terence Fitch, Phil Collett and I) found ourselves on the island with nothing more than a little information from Pedro Oromi and Octavio Fernández Lorenzo.

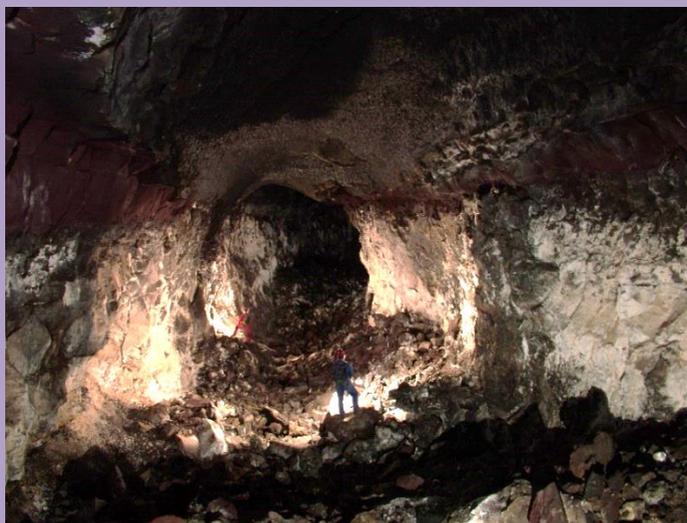
We spent a fabulous week exploring a number of caves on the island, including a full traverse of the Corona system from Jameo Prendes to Puerta Falsa and Cueva de los Naturalistas. Chris was very impressed with the Lanzarote Caves, and I know that the experience on the island helped him refine his theories on lava tube formation, in particular with respect to how the pre-eruption landscape influences speleogenesis and erosion of the lava through pre-existing rocks, which can clearly be seen in the very large Corona system in many places.

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<sup>3</sup> Along with member of the Shepton Mallet Caving Club



**Chris in the Corona Lava Tube System, Lanzarote, April 2006**  
[Photo: Ed Waters]



**Phil Collett (left) and Chris in the Corona Lava Tube System, Lanzarote, April 2006. Note the reddish layer near the roof that Chris believed showed evidence of erosion by the flowing lava**  
[Photo: Ed Waters]

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A few weeks after returning from Lanzarote, a large package arrived unexpectedly at my doorstep. It was a complete collection of recent commission newsletters, and a short letter from Jan Paul van der Pas informing me that I was now a member of the commission. This was somewhat of a surprise to me, and a call to Chris confirmed that this was all his work! During the call Chris also informed me that I should travel with him to the XII Symposium on Volcanic Caves in Mexico later in the year, and added that I should consider submitting a paper on the work I had been involved with in Iceland over the preceding few years.

So in July I found myself ensconced in the decaying car of an off-duty taxi driver with an uncanny resemblance to Saddam Hussein with Chris, Stephan Kempe and Horst Voekel-Henschel. We were travelling from the airport in Mexico City to the symposium venue in Tepoztlan in darkness in the early hours of the morning. Despite the warnings of possible abductions, we were not in an official taxi, as Chris had decided that these were too expensive, and we had taken the offer of the taxi driver as he came off duty. He claimed he knew the way well, but clearly didn't and Chris complained incessantly about cockroaches climbing up his leg for the entire journey.

Once ensconced in Tepoztlan, I was very grateful to Chris for introducing me to such an eclectic collection of people! In addition to attending the symposium, Chris and I joined a few others for all of the post symposium field trips. This was a remarkable experience, superbly organised by Ramón Espinasa, visiting a wide variety of caves, volcanic features and even white water rafting.

Highlights included a descent of the deepest lava tube in the continental Americas (Chimalacatepec), the incredible mazes of Cueva Iglesia and Cueva de Ferrocarril, visiting the recently rediscovered Chinacomoztoc and the steeply descending Cueva Volcancillo, reached via an incredibly exposed climb down the walls of the volcano's crater. In the latter cave Ramón and I lifted Chris up into an unentered passage high on the wall. Chris landed flat out on his belly in a pool of liquid guano, and not best pleased!

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Earlier on the trip I took a tumble in Cueva del Arbol and, wearing only shorts and T shirt, ended up with a number of lacerations<sup>4</sup>. I was feeling very sorry for myself (even after the fine first aid administered by Greg Middleton), but got no sympathy at all from my room-mate (Chris). It was only many years later that Chris admitted that my injuries had been “quite bad”.



**Chris (Left) and Ramón (well camouflaged to the right) in Chinacomoztoc where we battled our way through Killer Bees, Rattlesnakes, Vampire Bats and even Owls! July 2006 [Photo Ed Waters].**

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<sup>4</sup> I still have scars from this event on my right hand today



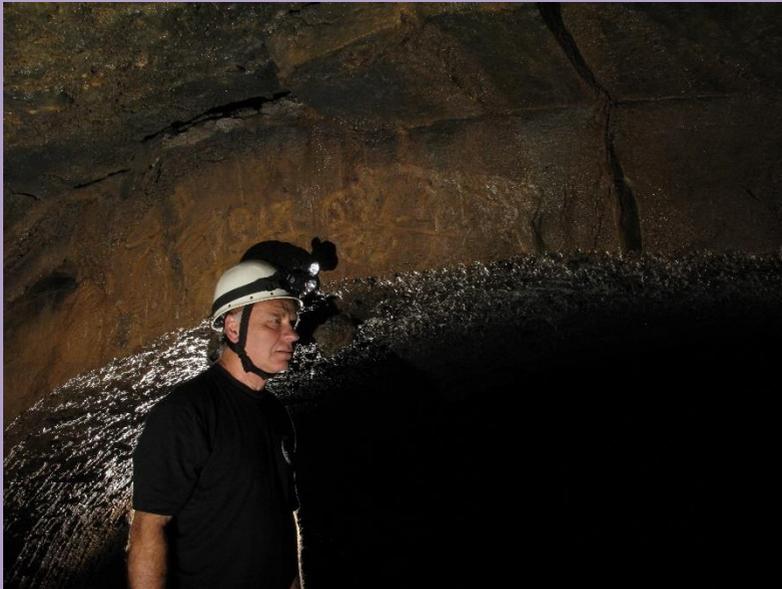
**The Bottom of Chimalacatepec, The Deepest Lava Tube in the Continental Americas. From left to right, Robyn Gary, Dr, Chris Wood, Ramón Espinasa, Jessica Goya and Peter Ruplinger, July 2006 [Photo Ed Waters].**

2007 saw Chris join an expedition I led to the Odaðhraun lavas in central Iceland. Chris was very interested in caves that the previous expedition in 2005, which he had not been part of, had surveyed. The area is physically very remote and one of the major objectives of our expedition involved a very long walk and bivouacking on the slopes of the Lítladyngja volcano. Despite being 60, Chris joined in this escapade, and again his knowledge of lava tube formation aided us immensely in discovering new caves and in understanding the mechanisms that had aided formation of the caves we surveyed in 2005.

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From almost the earliest days that I had known Chris he had waxed lyrical about the lava caves of Jeju Island which lies off the south coast of the Republic of Korea<sup>5</sup>. Chris was intimately familiar with these caves having been central to them attaining World Heritage status. As such I was extremely excited when Jeju was announced as the venue for the XIII Symposium on Vulcanospeleology in 2008. Had I but known it, this was the last time I was to venture underground with Chris.

The caves were all that Chris had enthused about and more. I can vividly remember the first real “wild” caving trip was to Waheul Cave. Chris and I had a quick attempt to push a boulder choke at the end of the cave, which resulted in two very muddy attendees at the formal lunch at a very posh restaurant after the trip!



**Chris with a Particularly Thick Passage Lining in Waheul Cave, Jeju Island, September 2008. Note That The Look on Chris' Face Indicates His Usual Lack of Patience with Cave Photographers!  
[Photo Ed Waters].**

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<sup>5</sup> A.K.A. South Korea.



**Chris in his Favourite Cave, Susangul on Jeju Island, September 2008.  
[Photo Ed Waters].**

Although we met many times after the 2008 Jeju trip, and there were many plans for escapades far and wide, we never did manage to get underground together again. I missed the opportunity to join Chris and some other eminent British cavers on a BBC documentary to the caves of Mount Suswa due to work pressure, though I did watch it of course! Chris was somewhat embarrassed when he was trying to work out why a certain part of the cave wall looked highly polished, only to be told by the locals that it was where the Baboons scratched their bottoms! Chris also provided a great deal of useful information of Hayley and I for a visit to the lava tube caves of Mount Etna in 2009.



**Hayley Clark in Grotta di Lamponi (surveyed by Chris in the 1970s),  
Mount Etna, Sicily, August 2009.  
[Photo Ed Waters].**

A few months after Chris' passing I spent a wonderful couple of weeks exploring the caves of Tenerife, somewhere close to Chris' heart due to this being the location of some of his earliest explorations and his rise to fame, or at least notoriety, in vulcanospeleological circles when he was part of a group that claimed that Cueva del Viento was the world's longest lava tube cave.

The most poignant part was a late-night visit to the Galeria de los Inglese's, discovered by Chris after pursuing an unlikely crawl to a climb down into several kilometers of fine passages. This was somewhere we had always talked of him returning to, and I was pleased to see that this is to my mind by far the best part of this amazing cave. Although we missed Chris' presence tremendously on this trip, this section of cave is without doubt a most fitting tribute to him.



**Alfredo Lainez (left) and Dragan Milenkovic (right) in Galeria de los Ingeleses, Discovered by Chris in the 1970s, Cueva del Viento, Tenerife, June 2012 [Photo: Ed Waters].**

Without Chris I would never have become involved with Vulcanospeleology. I suspect that if I had been introduced to lava tubes by almost anyone else I would not have learned to appreciate them the way that I have through the knowledge and enthusiasm that Chris showed. These memories, ten years after his passing, are simply my memories of a friend and mentor, but that Chris' legacy in Vulcanospeleogy is much greater is in no doubt, as can be seen in the Bibliography compiled by his old friend Martin Mills which follows this article. With over 80 papers covering almost all aspects of lava tube cave formation and exploration across a staggering number of countries, Chris work will remain an inspiration for all of us interested in the volcanic underground for decades to come.

# CHRIS WOOD – A BIBLIOGRAPHY

By Martin Mills

This bibliography is respectfully dedicated to the memory of Chris Wood (1947 – 2012) and has been abstracted from a much larger bibliography covering other aspects, published in July 2013. In May 2012, following his untimely death in January we were invited to go through his office/library which provided a large amount of additional material, there have even been some more recent discoveries which have been included. The eagle-eyed may even note a couple of Anon items included that are considered relevant.

For the avoidance of doubt and clarification of anyone unfamiliar some abbreviations may assist.

Abbreviations used are:

BCRA – British Cave Research Association;

Bull. – Bulletin;

c. – circa;

Cascade Caver – Cascade Grotto, NSS (USA);

CEGEA – Cave Exploration Group of East Africa;

CRG – Cave Research Group of Great Britain;

ed./eds. – editor/editors;

figs. – figures;

Jnl. – Journal;

MS – Manuscript;

n.d. – not dated;

Nltr – Newsletter;

No./Nos. – Number/Numbers;

NSS – National Speleological Society (USA);

p./pp. – page/pages;

pub. – published;

SMCC – Shepton Mallet Caving Club

Speleoetna – notiziario [news] del gruppo grotte Catania [Club Alpino Italiano Sezione dell'Etna];

Trans. – Transactions;

Vol. – Volume.

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March 2022

# The Loss Of Former Explorations Or How Do We Keep Vulnerable Discoveries Known

**By Laurens Smets**

Speleo Nederland/Cave inventory project Lanzarote

In this article I want to show you how easy former explorations get lost and we double or triple the same investigations and explorations .

It is a fact that the reconnaissance in volcanic areas are in danger as a lot of caves are situated in National parks, are forbidden to enter or even in some cases can change as result of collapses, new Volcanic activity or by human influences.

Vulcanic caves are perhaps beside ice caves the most sensitive natural environment on planet earth. Once you enter them microbiological habitats and also the geological and morphological environment is immediately affected. The damage done is unreversible and how more people enter these fragile caves how less the original natural environment will stay in existence.

In fact the best solution for conservation of Vulcanic caves is KEEP OUT, DO NOT ENTER OR EXPLORE THEM.

The problem arises that we are human beings , curious like animals “what’s behind the borderline” .

There is this saying:

***What is not published and not disclosed does not exist.***

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So we have to explore, we have to survey, we have to investigate and we have to publish . That is our Human way of behaviour.

When we agree with this we now have to find a way we do not double investigations or enter the fragile subterranean environment unnecessary. Trying to leave the caves in the best unaffected situation as possible. Or in some situations leave at least parts of the cave in this original natural state so habitats can develop itself in a natural way and geological structures and changes can be observed.

As example of above I want to describe the situation I found on Lanzarote. I started this inventory project of lava caves more than 8 years ago , discovered or rediscovered a lot of caves and found it quite stressing that investigations got lost, caves got lost, explorers got lost and cave locations got lost.

So my first main goal before I even started 8 years ago, was that my findings, my investigations shall not get lost. When they get lost all what has been done was for nothing.

My first 3 years I spent travelling with cavers/ adventurers over the island , they showed me entrances from caves they knew. Knowledge handed over in years by other adventurers or known by rumours. Caves which went from one side of the island to the other side (as locals told us) appeared to be several 100's meter long. Caves as deep as mother earth ended soon in small vaults.

After a while the knowledge from these "first year contacts" became exhausted so I had to go to other contacts with knew fresh knowledge.

Also scientists and former scientists showed up in this list from contacts not all eager to spit out their knowledge about he caves on the island . It took sometimes several years to get their thrust, to convince them this is a voluntary project , not commercial, and no we are not rich. Just enthusiasts, dedicated and perhaps a bit obsessed to complete an inventory of all caves on Lanzarote.

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Several scientists did not respond or were not eager to hand over their findings especially not the surveying they did. Surveying has been developed enormously last 15 years and I got the feeling the scientist were not confident in their surveying they did 30 years ago or were ashamed of the poor (as it was normal in that time) results. They did not want to be named for their former investigations. So all these caves have to be surveyed or located once again.

Even now at this moment still people can be found who know caves that all the others don't know. A specialist in making pictures from entrances of sea caves eroded into the lava layers knew more than 30 entrances. For normal caves these are mostly of no interest but for this guy using drones is an enormous challenge. And, IT ARE CAVES in volcanic areas! So they or at least the bigger ones have to be included in an inventory.

There was another guy who dug out holes somewhere in the middle of the desert, finding a real lava tube. And after our visit closed it off again with rocks and sand!

Well to keep it short. After years and years of exploring with all kinds of people from the island and with help of a lot of foreign cavers we reached the amount of over 160 caves , with a total length of more than 38km. on passages.

Now we got in this situation that information on new caves is scarce. So we started to explore some historical maps. And yes , The map was full of cave names mostly completely disappeared in present time.

We started to look for them. Some caves unknown for the inhabitants hundreds of meters long, others just small abris from nearly 3m. But it where all caves, and caves with a name so should be included in an inventory. In this way we found f.i. names on a map called Barranco de Cueva Segoya, and Cueva de Segoya which appeared to be a collection of small caves max 5m. deep at the start of a dry riverbed.



*Example of old cave names on a topographical map from 2005 (near Playa*

It also appeared that especially these small caves where sometimes of more interest than the bigger ones. Mostly the small ones had an archaeological history. We found bones, Witcher caves, a cave with a lithophonic stone table inside, pottery, man-made stones and so on.

So now we are almost done with the inventory the question arises how do you guarantee that your investigations and explorations are be kept and stored for the future. One thing you have to keep in mind is that most of the caves you found must be visited as little as possible because of their vulnerable environment. A lot of caves are situated in a national park and visits by public are forbidden.

So publication from your inventory, locations of caves and surveys cannot be published for public use. All must be kept secret or only be available to scientists.

In November 2021 we had an international meeting in Lanzarote called:

***Jornadas técnicas sobre Cuevas volcánicas de Lanzarote:  
Un patrimonio científico para proteger y valorizar***

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There was a round table in the end and several ideas were proposed how you can protect lava caves as a scientific environment.

One idea , very practical, was from Prof. Bogdan Onac from the University of South Florida. He promoted and confirmed our Speleological idea that the first step should be surveying and making an inventory. He also claimed that an important next step to keep caves protected is NOT to publish locations and keep caves anonymous.

One of his ideas was to not use cave names, as these easily spread around, but give all caves a number which can be used in future scientific publications.

So I did. All caves got a number based on a proposal in 2003 by Gutiérrez and Fernández (ref. Vulcania 6 2003).



f.i. de well known Cueva de los Naturalistas (Las Palomas) situated on Lanzarote (LZ), township of Tías has become LZ/TS-01

As this was now all clear, all the known and newly explored caves on Lanzarote got a number now as you can see in the attached list of the caves longer than 100m.

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Now on the subject publication of the inventory.

It will be very clear from what I described before that you cannot make the cave information available to the public. One caver or visitor who publishes pictures or information can destroy the cave for ever.

As an example a small anecdote:

*In 2021 and 2022 I caused unintentionally already quite some trouble in existing caves. As result of the COVID restrictions, caves were visited more frequently as you can do in there what you want , and it was a good way to pass time for the inhabitants of Lanzarote. Like a kind of game or challenge inhabitants started to investigate my website information. Looking for resemblances in the landscape from published pictures. Trying to find locations of hidden caves. In the meanwhile Tripadvisor started to automatically index my website [www.lanzarotecaves.com](http://www.lanzarotecaves.com) . Caves like Cuevas de Maguez came out as a preferred place to be visited. A friend of mine lives over there and just had seen a few visitors last 20 years. Now as this was promoted by trip advisor as a popular place to be visited , people who were in the challenge to find entrances put locations on Tripadvisor and the ball started to roll*

*In one week more than 9 groups of visitors came in, on a private ground in a forbidden area, in a geological and biological protected environment.*

*After complains I contacted Tripadvisor that this cave is a private location not allowed to visit. The answer: your complain is not complying to our regulations.*

*The next step I did was closing all relevant information on my website so all links to Tripadvisor would disappear. And yes, after 2 months almost no visits anymore.*

*I had learned my lesson.*

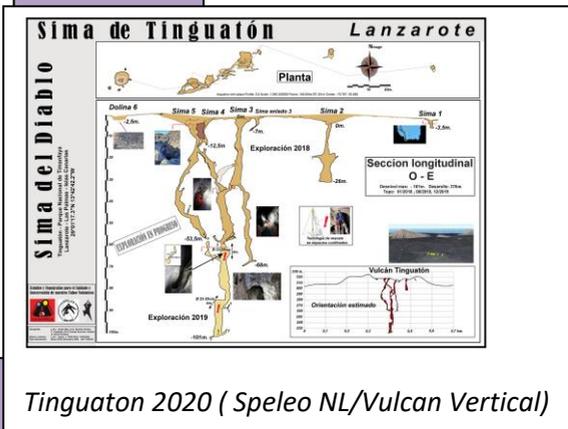
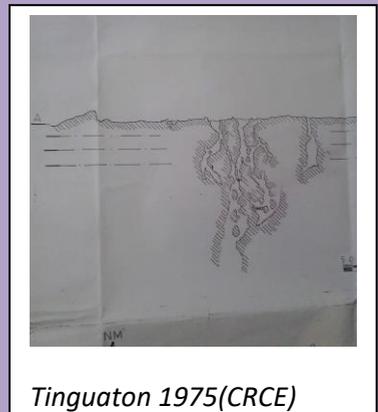
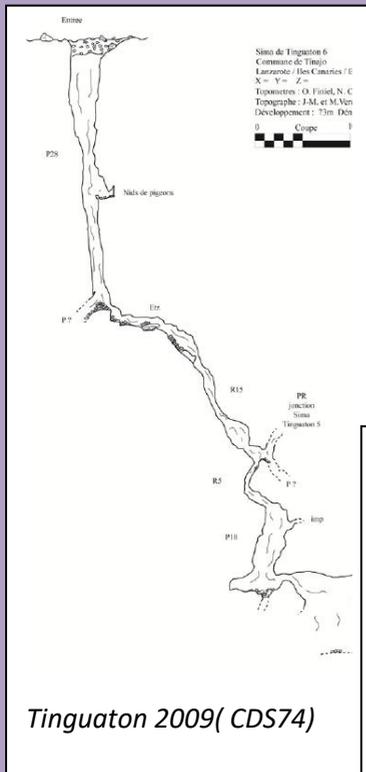
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The idea at this moment to archiving the whole inventory on caves of Lanzarote is to putt all information in a book format and then donate it to several official institutes who are used to protect vulnerable scientific information.

That would be than to University's , Geoparque, the Spanish geological institute and the National Government.

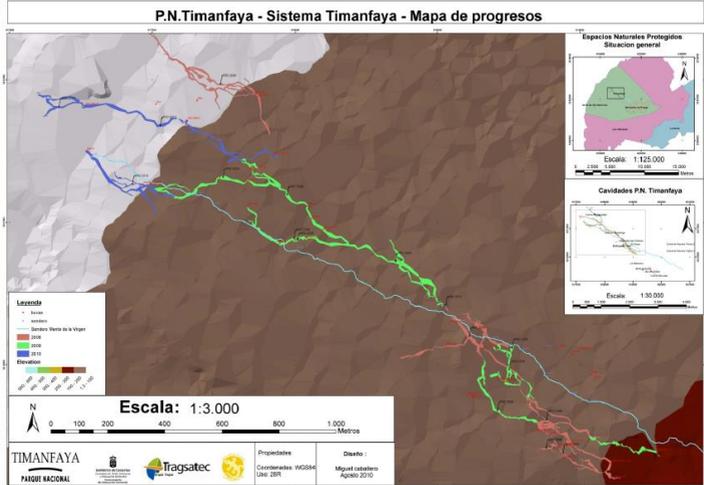
Hopefully the best way to keep all information available in future and well protected against public use. Any other ideas would be very welcome!

## Enclosed an example of doubled surveying



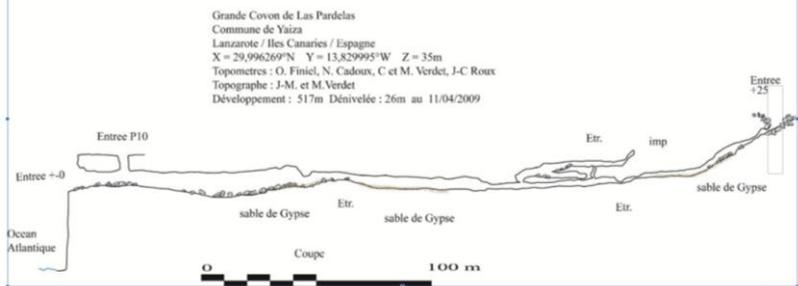
Example of lost surveying:

# Estado de cavidades



ESTUDIO CARTOGRÁFICO E INVENTARIACIÓN DE TUBOS VOLCÁNICOS EN EL PARQUE NACIONAL DE TIMANFAYA (FASE 3) 2009-2010

*Cueva Sin Nombre 11,7km, long and Cueva del Cangrejo 1,9km long.  
Explored from 2008 until 2010 by CDS74 and CDDAL*



*Cueva de Covon, Timanfaya Park. By CDS74. Length 517m. 2009*

## UIS Commission on Volcanic Caves Newsletter No.79

Code	Length (m)	Depth (m)	Municipality	Lava	Type
LZ/YZ-31	11700		Yaiza	Timanfaya	lava tube
LZ/HR-02	6631	173	Haría	Malpais de la Corona	lava tube
LZ/YZ-01	2254	42	Yaiza	Las Breñas	lava tube
LZ/HR-05	1968	64	Haría	Malpais de la Corona	lava tube
LZ/YZ-45	1940		Yaiza	Timanfaya	tubo
LZ/TS-01	1660	17	Tias	Masdache	lava tube
LZ/YZ-33	1176		Yaiza	Timanfaya	lava tube
LZ/HR-03	856	46	Haría	Malpais de la Corona	lava tube
LZ/HR-01a	773	22	Haría	Malpais de Maguez	lava tube
LZ/YZ-35	680		Yaiza	El Golfo	lava tube
LZ/YZ-04	567		Yaiza	Timanfaya	lava tube
LZ/HR-04	540		Haría	Malpais de la Corona	lava tube
LZ/YZ-32	529		Yaiza	Timanfaya	lava tube
LZ/YZ-07	517	26	Yaiza	Timanfaya	lava tube
LZ/TN-02-07	376	101	Tinajo	Tinguaton	Geysir Vent
LZ/YZ-13	350		Yaiza	Timanfaya	
LZ/YZ-34	320		Yaiza	Timanfaya	lava tube
LZ/TG-01c	250		Teguise	Mozaga	lava tube
LZ/TS-02	250		Tias	Masdache	lava tube
LZ/TS-07	230		Tias	Masdache	lava tube
LZ/TS-09	229		Tias	Masdache	lava tube
LZ/YZ-06	201	31	Yaiza	Timanfaya	Volcanic Vent
LZ/TG-02	198	21	Teguise	Tahiche	lava tube
LZ/HR-09	191	18	Haría	Malpais de la Corona	Lava tube
LZ/SB-02	181		San Bartolomé	San Bartolomé	lava tube
LZ/YZ-09	168		Yaiza	Timanfaya	lava tube
LZ/YZ-12	157		Yaiza	Timanfaya	
LZ/HR-08	154	13	Haría	Órzola	lava tube, Anchialine system
LZ/TN-09	150		Tinajo	Timanfaya	
LZ/TN-08	147	22	Tinajo	Tinajo	lava tube
LZ/YZ-05	145	16	Yaiza	El Golfo	Series of explosion chambers near Volcano
LZ/TG-19	142	6	Teguise	El Jable, Mozaga	lava tube
LZ/HR-01b	132	11	Haría	Malpais de Maguez	lava tube
LZ/YZ-02	125	21	Yaiza	Playa Blanca	lava tube
LZ/TN-27	123		Tinajo		
LZ/TG-04	110	5	Teguise	Nazaret	lava tube

# The Doña Otilia Cave Was Recognized As A Natural Monument By The International Union For Conservation Of Nature – IUCN

**By Carlos Benedetto**

## Abstract

*Cueva Doña Otilia, located in the region of Payunia, Mendoza, Argentina, is the longest lava tube in Argentina till now. That importance was increased by the discovery of a new family of troglobitic opilions. Due to the lack of interest shown by the environmental authorities, the Argentinian Federation of Speleology (FAdE) decided to sign an agreement with the private owner of the land, which was supported by the IUCN*

## Resumen

*La Cueva Doña Otilia, ubicada en la región de Payunia, Mendoza, Argentina, es hasta el momento el tubo lávico más extenso de la Argentina. Esa importancia se vio acrecentada por el descubrimiento de una nueva familia de opiliones troglobios. Debido al desinterés mostrado por las autoridades ambientales, la FAdE decidió firmar un convenio con el propietario privado del terreno, el cual fue apoyado por la UICN*

## UIS Commission on Volcanic Caves Newsletter No.79

The poor management that exists in the protected areas of Mendoza can be observed just by taking into account that there are no management plans. It is enough to enter Payunia or Llanquanelo to be able to enjoy more and more numerous oil towers than native fauna. In the case of Las Brujas, it was reopened to tourism, but only in the less touristic sector of the cavity, and it is possible that this restriction is not being complied with in practice.

That is why the FAdE negotiated, in the case of Doña Otilia, the creation of a private reserve.

The respective agreement was signed between FAdE and Dr. Sergio Rostagno, and can be seen scanned at <http://fade.smartnec.com/images/prod/KTZVItN1cJYj3kB5YiYFI3TDLIzWaP.pdf>, in the Payunia section of "Projects" of [www.fade.org.ar](http://www.fade.org.ar), where there are other scientific publications that support the initiative.

Dr. Marcela Peralta, researcher at the Miguel Lillo Foundation, Tucumán, and Honorary Member of the FAdE, was in charge of this great project; we remember what we published a while ago in <https://piramideinformativa.com/2019/10/fabuloso-descubrimiento-cientifico-en-la-payunia-revoluciona-al-mundo-por-carlos-benedetto/>. In Newsletter 77 of the UIS Commission for Volcanic Caves (<http://fade.org.ar/images/prod/XioH0dCqeDgQazCAkal7GSMXev0pkp.pdf>) we explained the relevance of this discovery in that zone. Then, Dr. Peralta published a poster in an Argentinian-chilean meeting for conservation, that is included at the end of this paper.

Until 1986 the world bibliography established that cave fauna was never going to be found in Patagonia, but this was denied that same year when the GEA group discovered an arachnid and from there an entire cave community appeared in the System of Cuchillo Cura, Neuquén. Until now, this was THE biospeleological place par excellence in Argentina, but given that the only Argentine caving association that has specialized biologists on its staff and team of advisers is the FAdE, biodiversity research in Cuchillo Curá has been paralyzed since the First Argentine Expedition. Brazilian Speleology 1991, organized by IN.A.E., a group that today is the backbone of the Federation. On that occasion, Brazilian specialists identified a new genus of beetles, the *Ptomafagus picunche*, whose closest relatives are in the Amazon.

The cave fauna of Argentina, as is known, is generally found in arid zones. But in the humidity of our caves they have survived and evolved, and continue to give surprises, now in Mendoza. Several times we said that in our province things are not being done well at the official level; nor in Neuquén. So, cavers decided an agreement with owners in order to create a private protected area. IUCN supported this decision

According to the IUCN, Category III means “III. Natural Monument or Feature: Areas established to protect a particular natural monument, which may be a landform, seamount, underwater cavern, geological feature such as a cave, or even a living feature such as an ancient grove.” More information on the private reserve system according to the IUCN at [www.fade.org.ar](http://www.fade.org.ar), direct download from

<http://fade.smartnec.com/images/prod/HOQeG2LsRrRpgftOKbAjcXYYpXpLj5.pdf>. A 127-page book to keep in mind. Likewise, at <http://fade.smartnec.com/images/prod/knGuFDJOJCindxPAdKpW9z6CTzaW0Y.pdf>



**Fig 1.** *Otilioleptes marcelae* gen. nov., sp. nov. Paratype male (FML-OPIL 00218), dorsal view. Photo: Abel Pérez-González.

<https://doi.org/10.1371/journal.pone.0223828.g001>

**ASOCIACIÓN AMIGOS DE LOS PARQUES NACIONALES**  
**1943 - 1958 - 2021**

Miembro de la



Unión Internacional para la  
Conservación de la Naturaleza y  
de los Recursos Naturales

78 AÑOS EN DEFENSA DE LA CONSERVACIÓN DE LAS ÁREAS NATURALES

Las áreas protegidas resguardan nuestro patrimonio natural, cultural y social

CABA, Noviembre 9, 2021

Señor Calos Benedetto

Presidente - FAde

Atento a la Documentación enviada por las autoridades de la Federación Argentina de Espeleología:

*Malargüe, Mendoza, 6 de noviembre de 2021*

*Prof. Norberto Ovando y Guardaparque. Adalberto D. Álvarez  
Expertos Comisión Mundial de Áreas Protegidas  
Unión Internacional para la Conservación de la Naturaleza (IUCN)*

*Ref. : Categorización de la Reserva Natural Cueva Doña Otilia*

*De mi consideración: Nos dirigimos a Uds. respecto del tema de la referencia, a fin de precisar los datos que se requieren para avanzar en el tema:*

*Nombre de la reserva: La misma ha sido bautizada "Reserva Natural Cueva Doña Otilia", según convenio firmado en fecha 5 de mayo de 2021, y que en copia se adjunta (3 fojas anexas), y documentación enviada con anterioridad. Allí se resolvió conservar a perpetuidad el área protegida mencionada.....*

Enviamos a usted, la Categorización y aclaraciones correspondientes por las cuales se le otorga la **Categoría Internacional III**, por su característica específica Natural, como área protegida a la "Reserva Natural Cueva Doña Otilia", la que deberá ser manejada según sus objetivos descriptos.  
De no cumplirse con esos objetivos, perderá automáticamente la categoría otorgada.

Cada dos años se realizará una evaluación en la reserva, que estará a cargo de esa Federación Argentina de Espeleología.

Saluda a usted atentamente

Presidente - Prof. Norberto Ovando

Vicepresidente - Gpque. Adalberto Damián Álvarez

Expertos Comisión Mundial de Áreas Protegidas (CMAP)

World Commission on Protected Areas (WCPA)

Grupo de Especialistas en Patrimonio Geográfico (GSG)

Geoheritage Specialist Groa (GSG)

Unión Internacional para la Conservación de la Naturaleza

International Union for Conservation of Nature (IUCN)

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International Union for Conservation of Nature (IUCN)



La IUCN **International Union for Conservation of Nature** (Unión Internacional para la Conservación de la Naturaleza), es la Organización de Conservación más grande a nivel mundial y uno de sus objetivos es asegurar que todo uso de los recursos naturales sea equitativo y ecológicamente sustentable.

La **World Commission on Protected Areas (WCPA)** (Comisión Mundial de Áreas Protegidas (CMAP) es la red de liderazgo mundial de especialistas, que dentro de la misión de la IUCN, es la de promover el establecimiento y gestión eficaz de la red mundial representativa de áreas protegidas terrestres y marinas.

La IUCN define que un área protegida es: **“Un espacio geográfico claramente definido, reconocido, dedicado y gestionado, mediante medios legales u otros tipos de medios eficaces para conseguir la conservación a largo plazo de la naturaleza y de sus servicios ecosistémicos y sus valores culturales asociados”**

Para aplicar el sistema de categorías, el primer paso consiste en determinar si el espacio concreto cumple esta condición, y el segundo en decidir la categoría más adecuada.

Para la IUCN, solo aquellas áreas en las que el principal objetivo es la conservación de la naturaleza pueden considerarse áreas protegidas; en caso de conflicto la conservación de la naturaleza será la prioridad.

**Los objetivos de todas las áreas protegidas deberían ser:**

- Conservar la composición, estructura, función y potencial evolutivo de la biodiversidad;
- Mantener la diversidad de paisajes o hábitats, y de las especies y ecosistemas asociados;
- Ser de un tamaño suficiente como para asegurar la integridad y el mantenimiento a largo plazo de los objetivos de conservación especificados o ser susceptibles de ampliación para alcanzar dicha meta;
- Mantener los valores que le han sido asignados a perpetuidad;
- Funcionar de acuerdo con un plan de gestión y de un programa de monitoreo y evaluación que sirva de apoyo a una gestión adaptativa;
- Contar con un sistema de gobernanza claro y equitativo;
- Conservar rasgos significativos del paisaje, la geomorfología y la geología;
- Conservar áreas naturales o paisajes de importancia nacional e internacional con fines culturales, espirituales o científicos;
- Facilitar las actividades de investigación científica de bajo impacto y el monitoreo ecológico relacionado y consecuente con los valores del área protegida;

## **Categoría III: Monumento o característica natural**

Las áreas protegidas de Categoría III se establecen para proteger un monumento natural concreto, que puede ser una formación terrestre, una montaña submarina, una caverna submarina, **un rasgo geológico como una cueva.**

Las áreas protegidas de Categoría III son normalmente espacios relativamente pequeños que se centran en uno o varios rasgos naturales prominentes y a su ecología asociada.

Las áreas protegidas de Categoría III pueden incluir:

- **Rasgos geológicos y geomorfológicos naturales:** como saltos de agua, acantilados, cráteres, **cuevas**, lechos fluviales fósiles, dunas de arena, formaciones rocosas, valles y elementos marinos como montañas submarinas.
- **Rasgos naturales con influencia cultural:** como asentamientos en **cuevas**.

-Los atributos de conservación natural de las áreas protegidas de categoría III son de dos tipos principales:

- **Biodiversidad relacionada de forma especial con las condiciones ecológicas asociadas al rasgo natural** – como las zonas de caída de agua pulverizada de un salto de agua, las **condiciones ecológicas de cuevas**

Los criterios clave de su inclusión como área protegida serán: (i) valor del lugar como aportación a la conservación a escala más amplia y (ii) priorización de la conservación de la biodiversidad dentro de los planes de gestión.

El objetivo real de la Categoría III es proteger lo inusual más que proporcionar componentes lógicos dentro de un enfoque más amplio de la conservación (por ej., sistemas de cuevas) dichos lugares pueden jugar un papel ecológico clave dentro de planes de conservación.

La Categoría III se ajusta mejor cuando la protección del rasgo natural o fisiográfico es el objetivo único o el predominante.

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## ENCUENTRO BINACIONAL DE CONSERVACIÓN • EBC 2021

II ENCUENTRO BINACIONAL DE CONSERVACIÓN DE HUMEDALES  
 V JORNADAS DE CONSERVACIÓN Y MANEJO DE ÁREAS NATURALES PROTEGIDAS  
 III SEMINARIO DE INICIATIVAS DE CONSERVACIÓN DE LA BIODIVERSIDAD en la ZONA NORTE de CHILE.  
 JORNADA DE GÉNERO Y CONSERVACIÓN.

18, 19, 20 NOVIEMBRE • CHILE - ARGENTINA

### IMPORTANCIA BIOESPELEOLÓGICA DE LOS PROYECTOS "RESERVA NATURAL PRIVADA CUEVA DOÑA OTILIA" Y "CONSERVACIÓN DE LAS CUEVAS POTI MALAL", MENDOZA, ARGENTINA

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#### Introducción

En tiempos en los que el deterioro ambiental en el planeta se acelera, aún existe un alto grado de desconocimiento de la biota de las cuevas. Estos ecosistemas con características ambientales y microclima particulares, albergan organismos llamados "troglóbios" que trascurren en forma obligada y permanente toda su vida en el medio subterráneo (hipogeo). La vulnerabilidad de esta fauna es extrema por sus adaptaciones a las condiciones ambientales especiales del medio hipogeo. Entre los troglóbios existen grupos relictales aislados, de antiguos linajes por lo cual tienen un valor especial desde el punto de vista ecológico, evolutivo y biogeográfico. Mendoza y Neuquén son las provincias de Argentina con mayor cantidad y tipos de cavernas, pero el conocimiento de la biodiversidad hipogea es escaso.

#### Objetivos

- Preservar recursos espeleológicos en las zonas áridas de nor-Patagonia
- Promover estudios científicos y actividades educativas en cavidades
- Asesorar a la comunidad y contribuir a la diversificación de las economías regionales con emprendimientos que no afecten a las cavidades y a su entorno

#### Antecedentes y Estado actual de los proyectos de gestión

##### 1-Reserva Natural Privada CUEVA DE DOÑA OTILIA

Esta cueva está ubicada a 1.926 msnm, en proximidades a la Reserva Total La Payunia, a 70 km al suroeste de Malargüe, en una región árida con promedio anual de precipitaciones de 250-300 mm. Doña Otilia es una cavidad basáltica del Pleistoceno, la más extensa de Argentina, con 830 m de longitud. Entre sus características se destaca que en algunos sectores de la cueva sus paredes de basalto están recubiertas con yeso y el microclima presenta escasa amplitud térmica durante todo el año con una humedad relativa que oscila entre el 40 y 80%. En el interior de este tubo lávico se han observado restos óseos de reptiles, raíces de plantas epígeas (fuente de alimento en el ambiente hipogeo) e invertebrados terrestres (Nematoda, Oligochaeta, Miriápoda, Pseudoscorpiones, Arañas, Colembola, Díptera y Blattodea), entre los que se destaca una especie de opilión (Arachnida) endémico troglóbico: *Otilioleptes marcelae* Acosta, 2019 (1,2). Los estudios filogenéticos desarrollados por Acosta permiten afirmar que *O.marcelae* pertenece a un linaje basal en el conjunto de la superfamilia Gonyleptoidea. Las singularidades de esta especie llevaron al autor a erigir una nueva familia (monotípica) llamada Otilioleptidae siendo, en Sudamérica, el primer registro de Gonyleptoidea en un tubo lávico. Considerando la biología del grupo, y los registros paleoambientales de Payunia, es probable que *O.marcelae*, además de ser un elemento clave en la reconstrucción de la historia evolutiva del grupo, sea un caso de relicto distribucional pues la gran mayoría de opiliones se distribuyen en Argentina en regiones de precipitaciones elevadas y vegetación exuberante (Yungas, Selva de Misiones y bosques de la región andino-patagónica).



Doña Otilia, acceso y techo de la cueva



Doña Otilia sector edáfico



Cueva Doña Otilia, Sección de acceso



Cryptogus sp.



S' de Pakauco



Cueva Doña Otilia



Otilioleptes marcelae Acosta (1,2)



Mapa Reserva Natural Privada (RNP) Cueva Doña Otilia (Autor: E.J. Marzulli)



Cueva Doña Otilia y Valle Poti Malal

Como resultado de gestiones de la FAde en el pasado mes de junio se firmó un convenio con el propietario del campo de Doña Otilia para la creación de una Reserva Natural Privada. Se están realizando las gestiones para la incorporación de este nueva Reserva en la "Red Argentina de Reservas Naturales Privadas"

#### 2-Conservación de las CUEVAS DE POTI MALAL

En 1997 se iniciaron las exploraciones en el Paraje Poti Malal que llevaron al descubrimiento de la cueva "San Agustín". Los resultados de numerosas expediciones, en algunas de las cuales participaron espeleólogos ingleses, posibilitaron el relevamiento de otras diez cuevas en el Valle Poti Malal a ambos márgenes del río Poti Malal tributario del río Grande, casi todas hidroclímicamente activas. El ambiente hipogeo del Valle comprende cavidades en yeso del período Jurásico, una de las cuales, "San Agustín" presenta grandes lagos hipogeos. Las cuevas "Miranda" y "Cangrejos" están recorridas por arroyos internos. Los estudios biológicos de la fauna subterránea apenas se iniciaron (3) entre los que destacamos el hallazgo de crustáceos *Aegla* en la cueva de los Cangrejos. Otras cavidades importantes son: "Federación", "Doña Palmira", "Sima de Leiva", "La Butrera" y "de la Gotera". En el ambiente epigeo del Valle se observan numerosos arroyos que emergen de los potentes macizos yesosos (de hasta 300 metros de espesor) sin haberse encontrado, hasta el momento, las cavidades respectivas ni las redes de drenaje subterráneo de la región.

Desde 2016, la FADE propone la creación de un área protegida en el Valle Poti Malal dada su importancia espeleológica. El Proyecto de Conservación actual (4) involucra tanto al ambiente epigeo como a las cavernas y prima la propuesta de autogestión por parte de los mismos puesteros conjuntamente con los espeleólogos. Actualmente el Proyecto está en trámite parlamentario en la Cámara de Diputados de Mendoza. De esta manera, además de proteger la integridad de las cavidades en extremo vulnerables y su entorno, se pretende contribuir a la diversificación de la economía de ganadería trashumante desarrollada por los puesteros del Valle y promover actividades educativas y científicas espeleológicas.

Cabe mencionar que, a nivel regional la protección de estas cavidades y su biota implica también un aporte significativo para la conservación de la biodiversidad de la estepa y monte de Patagonia de Argentina que, en general, ha recibido, en relación con otros ambientes, escasa atención por parte de dirigentes políticos y organizaciones de conservación (5).



Mapa Proyecto Conservación de las Cuevas de Poti Malal (6)

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- 11) <http://www.ambiente.gov.ar/temas/conservacion-de-areas-naturales-protegidas>
- 12) <http://www.ambiente.gov.ar/temas/conservacion-de-areas-naturales-protegidas>

# Discovery Of The T66 Lava Cave In Krongno, Dak Nong UNESCO Global Geopark, Vietnam

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*(2) Phu Gia Phat - HCM Investment Joint Stock Company;*

*(3) Graduate University of Science and Technology, VAST;*

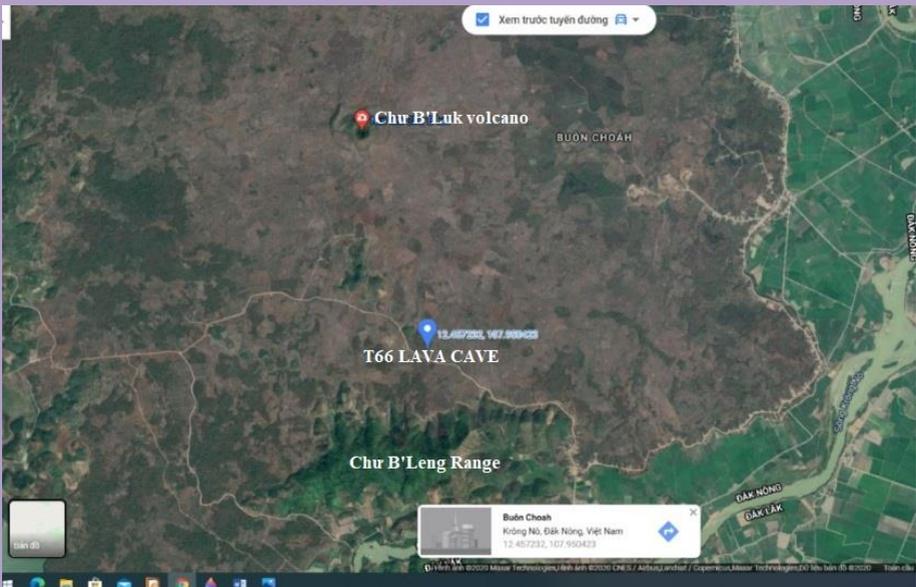
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**Fig.1. Patterns of drainback on the floor of T66 lava cave. Photo: La The Phuc.**

## 1. Introduction:

The Krongno lava cave system was formed by eruption of Chu B'Luk volcano, located in the northeast of Dak Nong UNESCO Global Geopark (Dak Nong UGGp) in The Central Highlands, Vietnam [3;4;5;6;7;8;13;14;19;21;22;23]. So far, in this system, there has been a total of 50 lava caves discovered and surveyed by La The Phuc and his colleagues (both Vietnamese and Japanese), and T66 is the 50th – the latest one [15;17;18;19;21;27;28,31]. T66 lava cave was discovered, surveyed and sketched by La The Phuc, Luong Thi Tuat and Nguyen Thanh Tung in June 2020. The cave is located approximately 2,300m south-southeast (169°) of Chu B'Luk volcano, at an elevation of 460m (Fig.2); Coordinates: 12.457094°N; 107.950482°E. Although T66 lava cave is average in size, it is a typical lava cave, contains many amazing, attractive lava formations, including some quite distinctive lava features in comparison to other lava caves in the area.



**Fig.2. T66 cave (blue mark) located in the south-southeast of Chu B'Luk volcano (red mark).**

The lava cave was named "T66" after the first letter "T" in the Vietnamese word: "Tuyệt vời!" (it describes a sense of GREAT/EXCELLENT) and the great date we firstly went there (6th June: 66). Also, "T66 lava cave" is a beautiful name according to the Vietnamese conception because it refers to "a double gift from The God". Maybe, the beautiful name "T66" should be used for geotourism in the Dak Nong UGGp in the future.

### **2. Related geological formations and the cave forming age:**

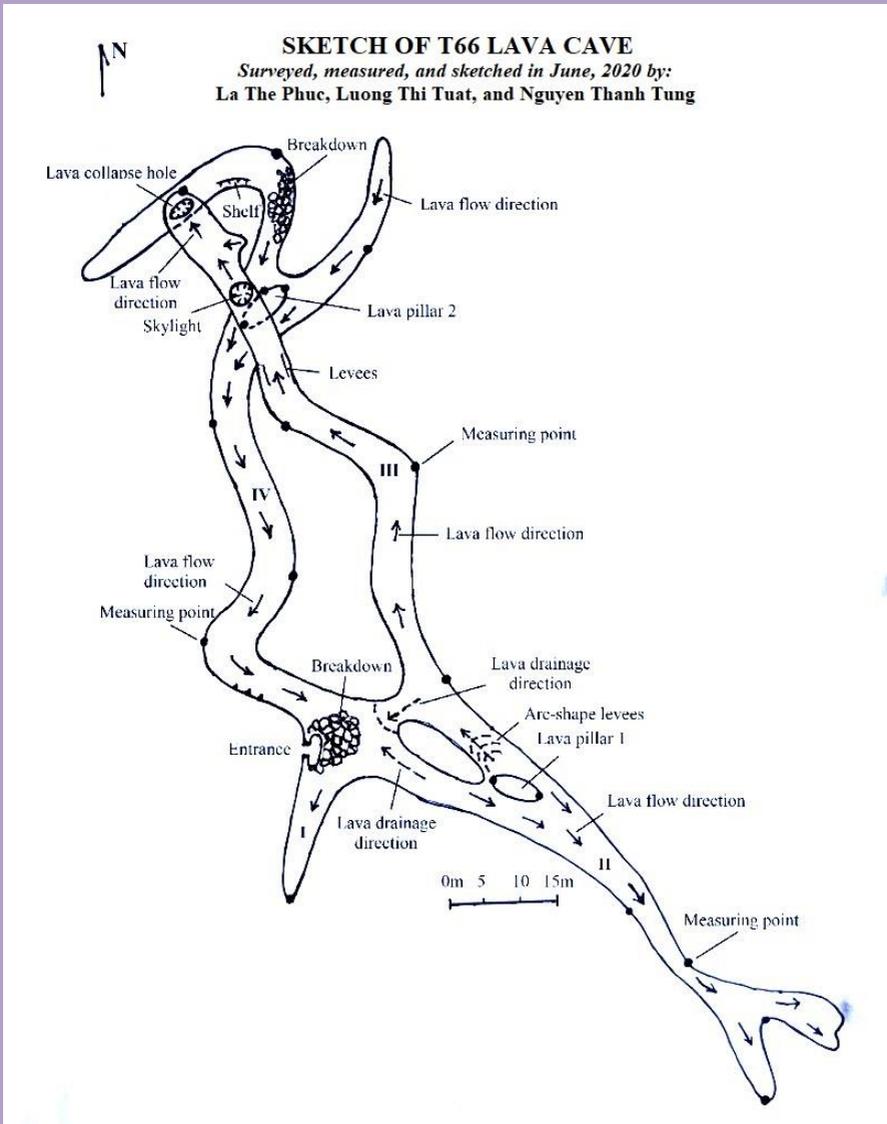
The Krongno lava cave system, including T66 lava cave, was product of multi-phase eruptions of Chu B'Luk volcano. These volcanic eruption products belong to the Xuan Loc basaltic formation ( $\beta Q_1^2 x$ ), cover most of the survey area, and show the uncomformable contact with sandstone and siltstone of La Nga formation ( $J_2 In$ ), forming the Chu B'Leng mountain range in the south (Fig.2). The K/Ar isotopic age of the basaltic rock in the Chu B'Luk volcano area is approximately  $0.689 \div 0.199\text{Ma}$  [19;21], which roughly belongs to the Middle Pleistocene ( $Q_1^2$ ). The K/Ar sample KRN1-1 collected at a massive lava layer above the mud-covered volcanic glass and pahoehoe layer in the Ninh Giang village, Buon Choa'h commune, about 3.5km northeast of T66 cave, yields the latest age of  $0.199 \pm 0.02 \text{Ma}$ . of the sample series [9].

### **3. Some features of T66 lava cave:**

**3.1. Geometrical parameters:** The cave was discovered, surveyed and measured by our survey team over two days (6th and 7th June, 2020), during the last field-work trip within the framework of the project TN17/T06, funded by Ministry of Science and Technology of Vietnam. Due to the lack of some modern measuring instruments at that time, our surveying team only used GPS, geological compass and a simple laser distance measurement meter. The surveying and measurement results are shown in the sketch below (Fig.3).

Topographical details of the cave include;

- Total passage length of 352m;
- Ceiling height of 5-10m;
- The cave entrance is elliptical in shape; about 1.5m wide, and 0.8m high;
- The cave is formed on two main levels and a mezzanine;
- The cave consists of four main segments (labelled I, II, III & IV in the survey at Figure 3 below).



**Fig.3. Sketch of T66 lava cave (by Luong Thi Tuat, 2020).**

**3.2. Entrance:** The T66 entrance cave was discovered as a quite small collapse on the rather plane surface of the regional topography. The entrance is about 1.5m wide, and 0.8m high, facing west  $285^{\circ}$  (the direction of the entrance). It was quite easy to access the cave via the entrance, although we had to bend our back to get in (Fig.4).



**Fig.4. The entrance of T66 lava cave on the plane topography.**  
Photo: Luong Thi Tuat.



**Fig.5. A small squeeze ball extruded from fissures of porous basaltic rock at the entrance.** Photo: Luong Thi Tuat.

The area is mainly composed of light grey, cracked, porous basalt, and squeeze balls formed by low-viscosity pahoehoe lava extruded from fissures of the earlier basalt [26]. The T66 cave entrance is secondary type, formed due to a roof collapse event after the cave forming (Fig.5) [21] (Fig.5) [21].

**3.3. Skylight:** T66 cave has a skylight on the upper floor, in the northern passage, about 60m north-northwest of the cave entrance, and 12m southeast of the lava sinkhole (Fig.3). The skylight is about 3m wide; 2m high, with a loose breakdown on the floor (Fig.6). In fact, the skylight is a collapsed hole of the roof because of shrinkage and crack after cooling process.



**Fig.6. Skylight and a loose breakdown on the floor in the north passage of T66 cave. Photo: Luong Thi Tuat.**



**Fig.7. Lava sinkhole in T66 lava cave. Photo: La The Phuc.**

**3.4. Blow-out lava hole:** Blow-out lava hole: A sole lava hole was observed at the end of the upper floor of the northern passage of T66 lava cave. It has an elliptical shape of 2.75m long and 1.9m wide. Rim of the hole shows the traces of gas being blow-out upward, indicating that it is likely after the hole forming, the gas pressure turned higher due to hot melting lava in the lower tube, so gas was escaped from the lower tube to the upper one via the lava hole (?). Besides, the higher level of lava around the wall foot is reliable evidence relating to the lava drainage out of this passage (Fig.7).

**3.5. Lava ball:** A lava ball was discovered in the lower floor in the upper stream of northern part of T66 cave. It was formed from a solid breakdown block, then was rolled along in the hot molten lava flow, re-welded and stuck on the semi-solidified floor (Fig.8) [8;20;21].



**Fig.8. Lava ball on the floor of T66 lava cave. Photo: La The Phuc.**



**Fig.9. Lava levee in the floor of T66 lava cave. Photo: La The Phuc.**

**3.6. Lava levees:** When a hot lava flow moves through an existing lava tube, the two sides tend to cool first, so create a free-standing vertical remnant along the tube edges (bases of wall), meanwhile the main lava flow was still continuously running forward. The earlier lava features mentioned above are called “lava levees”, which were commonly observed along the walls of the T66 lava cave (Fig.9) [1;2].

**3.7. Lava seal:** In the past, during the T66 lava cave forming process, in the upper floor of T66 cave of the north passage, there was a small conduit carrying fluid lava into the main passage of T66 lava cave. Afterwards, the lava source was cut off, then completely drained off. So, the lava conduit was completely sealed by solidified lava to form a lava seal, shown in the Fig.10 [1;2].



**Fig.10. Lava seal in the upper floor of the north passage of T66 lava cave. Photo: Luong Thi Tuat.**



**Fig.11. Semi-floor in the north passage of T66 lava cave. Photo: Nguyen Thanh Tung.**

**3.8. Features of floors and semi-floor:** The T66 lava cave consists of two main floor levels. Besides, there is a semi-floor level distributed in the lower level of the north segment (Fig.3). The semi-level has a fairly large area, so it looks like a mezzanine, dividing the vertical-section into two parts (Fig.11).

**3.9. Evidences of lava flow direction and drainback on the floor:** Lava flow directions in the different passages of T66 cave are quite complicated. However, in several cases, the last flow direction as well as drainback could be recognized thanks to some typical patterns on the floor (Fig.1; Fig.12) [2;29].



**Fig.12. Evidence of different lava flow directions, including drainback on the floor of T66 lava cave. Photo: Luong Thi Tuat.**



**Fig.13. Evidence of the latest lava level on the base of a pillar.**

**Photo: Nguyen Thanh Tung**

**3.10. Evidence of the latest lava level on the foot of lava pillars:** There are 2 lava pillars showed in the sketch of T66 lava cave (Fig.3). The impressive marks of the most recent lava level were found on the base of pillars. Remnants of lava adhered to the base of the lava pillars and remain as persuasive evidence of the latest lava flow, before the lava completely drained off (Fig.13).

**3.11. Typical lava stalactites:** Several types of lava stalactites were observed in T66 lava cave. They reflect their different formation mechanism and origins as well. By the way, we present some typical ones below:

**3.11.1. Drop-shaped stalactites:** This type of stalactite is very common in T66 cave. They look like water-drop shapes, formed due to segregation of re-melt liquid lava below from solidified ceiling above due to gravity (Fig.14) [24;28;30].

**3.11.2. Runner (or dribble):** Many runners were observed on the wall of T66 lava cave (Fig.15). They were formed when molten lava was extruded and segregated from the solidified lava wall, by boiling and escaping gas, then cooling, solidifying and clinging to the cave wall [1;2;20].



**Fig.14. Drop-shaped stalactites on the T66 cave ceiling.**  
Photo: Luong Thi Tuat.



**Fig.15. Runners adhered on the wall of the T66 cave.**  
Photo: Luong Thi Tuat.

**3.11.3. Rib-shape lava:** Generally, this feature is less common than other ones in T66 lava cave. It was formed on the lean wall, covered by a black thin glaze layer, and shown in Fig.16. It is also called “ribbed lava” [20;21;28;30].

**3.11.4. Gas-escaping lava stalactite (or bubble lava stalactite):** This lava stalactite type was observed on the ceiling of the T66 cave. They look like “blow-out pockets” [25] adhered on the ceiling. On the other hand, they look like drop-shape lava stalactites that were cut their top off (Fig.17). It is not difficult to realize that this feature was formed due to gas-escaping process (bubble bursting) on the remelted ceiling [25].



**Fig.16. Rib-shape lava observed in T66 cave.**

**Photo: Luong Thi Tuat.**



***Fig.17. Gas-escaping stalactite observed in T66 lava cave.  
Photo: Luong Thi Tuat***

#### ***4. Biodiversity:***

Biodiversity values have been studied and evaluated in many caves of the Krongno lava cave system, except T66 lava cave, because it is the latest discovered. However, the preliminary survey results on biology show that the T66 lava cave environment is ideal for many species, including: reptiles, insects, spiders, bats, slugs, fungi, etc. (Fig.18) [19;21].



**Fig.18. A species of saprophytic fungi grows in T66 lava cave.  
Photo: Luong Thi Tuat.**

In addition, this cave is also a source of diverse micro-organisms, important objects of scientific research and serving socio-economic development as well. Therefore, intensive studies on biology for T66 lava cave are necessary in the future.

### **5. Prehistoric archaeological remnants:**

Lot of archaeological remnants were collected from one-fifth of the entire 50 lava caves discovered in Krongno. Among them, two lava caves (C6.1 and C6') were excavated, but not including T66 [10;11;12;16;19;21;23;24]. However, in the last field-work trip of the project TN17/T06', several prehistoric pottery fragments were collected in the fissures of basaltic rock in the southeast of the T66 cave entrance. Some fragments have a wave pattern, others are non-pattern pottery (Fig.19;20). They all seem to be broken from a rounded pot (?), but we could neither find any piece of the rim (upper) part nor the sole (bottom) part of the pot.



**Fig.19. (left); Fig.20. (right). Several fragments of prehistoric pottery were collected in the fissures of basaltic rock near by the T66 lava cave entrance. Photo: Luong Thi Tuat.**

#### **6. Some concluding remarks:**

- The results of the survey and study on T66 lava cave once again demonstrated the endogenous origin of the Krongno lava cave system, which is closely related to the multi-phase eruption activity of Chu B'Luk volcano, distributing in the basalt-covered area of the Xuan Loc formation, in the Middle Pleistocene ( $\beta Q_1^{2x}$ ), with uncomformable contact with the terrigenous sedimentary rocks of La Nga formation ( $J_2$  In).
- Located south-southeast of Chu B'Luk volcano, T66 lava cave presents a relatively complicated structure, contains a number of typical lava cave features, but which are relatively rare in the local area, such as: gas-escaping lava stalactite, blow-out lava hole, evidence of different lava flow directions and drainback flow, etc. Also, it contains biodiversity and archaeological values, as well.
- As T66 lava cave was discovered, surveyed, and measured in June 2020, it is the latest lava cave discovered in Krongno lava cave system. We hope that further investigations will lead to the discovery of more lava caves in the area in the future.

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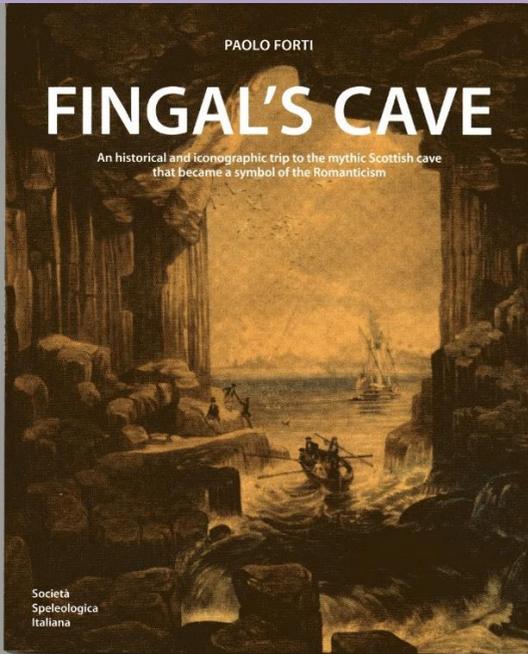
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## FINGAL'S CAVE

### A Book Review by Martin Mills.



Fingal's Cave by Paolo Forti. Pub. Bologna 2021. Società Speleologica Italiana, Bologna. viii + 79 pp. English text. ISBN 978-88-89897-20-1.

I hope this is not becoming a habit? I have at once to admit an interest. In the early months of 2021 Kirsty and I proof-read a draft. The author, of course, needs no introduction – he is known to most of us. Subtitled “A historical and iconographic trip to the mythic Scottish cave that became a symbol of the Romanticism” outlines its intention. In full colour, soft-bound on gloss paper, 130

objects from the Franco Anelli collection housed at the Speleological Documentation Centre, Bologna (which I have been privileged to visit) are illustrated and detailed. The contents are divided into 21 themed categories ranging from the obvious books, paintings and drawings, engravings, postcards, stamps to piano rolls, paperweights and even domestic paint. The first chapter of just seven pages succinctly summarises the island's history, geology, and famous visitors to what is undoubtedly the most famous Scottish cave.

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If you, like me, thought you knew most things about Staffa and Fingal's Cave there is actually more than something here for everyone. As one who has been fortunate to visit the 'wondrous isle' four times, camp on the island, have numerous books, around 250 prints/engravings, and quite a lot of ephemera, even I am staggered by how much commercial merchandise has and continues to be produced as I sit here wearing a Fingal's Cave T-shirt! I wonder what Sir Joseph Banks would make of it all 250 years later after his "discovery". Finally, I will go as far as to suggest that this is the most significant book on the subject to be published in the last quarter century. Unhesitatingly recommended.

March 2022