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LA VENTA
ESPLORAZIONI GEOGRAFICHE

KUR

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TULLIO BERNABEI

KUR number 20 that you hold in your hands signs an important milestone in the history of this journal, exactly on its 10th birthday. Let's see what has changed and the reasons that brought to this decision.

First of all, KUR transforms from a six-monthly into an annual journal, meaning it collects material over a longer time period, thus becoming a bit thicker. The main reason is related to the general economic situation that is also felt by our association – useless to remind we are financing ourselves – but also to the increasing editorial effort tied to the semestrality, forcing us to respect deadlines, timeliness and expectations that not always can be fulfilled. Even more in a situation in which personal and working commitments of the members, that are all volunteers, are becoming increasingly complicated, year after year: to be more clear, the time we can dedicate to our hobbies and passions is diminishing, and this certainly is not only true for the “laventines”...

The second major change is the fact that texts of the printed edition are now only in Italian, eliminating the English translation of the pages and leaving more room to contents. Of course we do not want to lose the international character of KUR, being a journal that is very much appreciated by our foreign caver friends, as demonstrated during the recent International Congress in Brno. This is why we also publish the entire version of KUR in English on our website, ready to be downloaded and printed by whoever desires a paper copy. This will hopefully allow KUR to be read by a much wider audience, without having to spend large amounts of money for the postal services.

For what concerns our dear subscribers, not much will change, except the fact they will have to wait longer for the next KUR, since it will be annual, but they will be rewarded with larger contents: just look at the contents of this 20th issue.

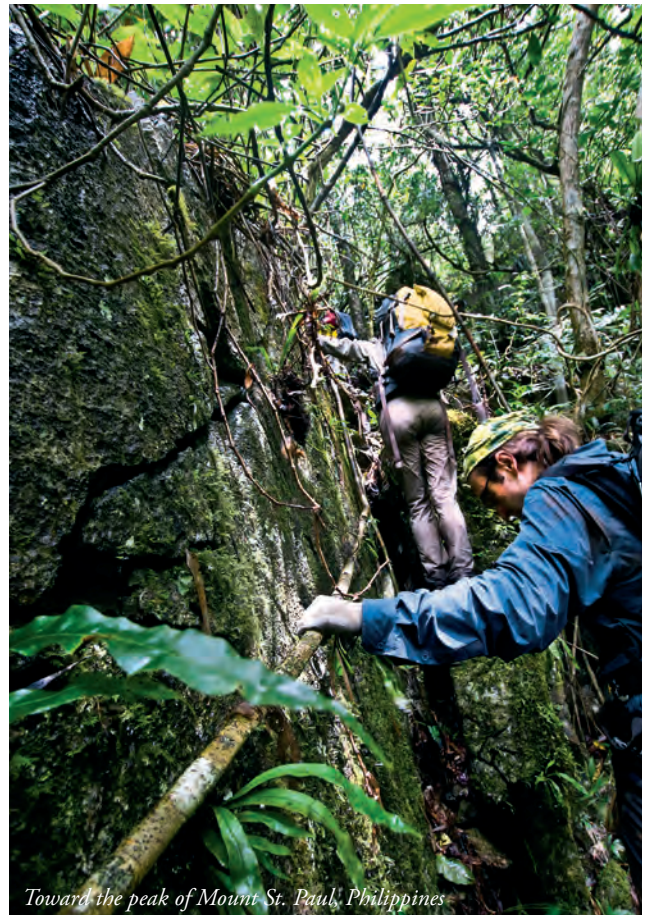


Cueva del Rio La Venta, Chiapas, Mexico

As usual we have some stories regarding Mexico, or to be more precise Chiapas, where several exploring teams have worked during 2013: Carla Corongiu gives a general overview of the expeditions, especially focusing on the very good relationship built up with the local people, while Francesco Lo Mastro tells us about the intimate contact that is created between explorers and the tropical bush. Gaetano Boldrini, instead, describes the unforgettable descent in the Sumidero Canyon of the 700 metres high cliff to reach a big resurgence, occurred exactly 20 years ago. This probably is still the longest rope descent carried out on a vertical wall to reach a cave entrance. Still in Chiapas the Centro de Estudios Kársticos La Venta has been founded, a local association promoted by La Venta dedicated to the study and the protection of the Mexican caves that, we hope, will carry out its activities for a long time.

The origin of the mysterious Venezuelan tepuis, true “sand castles”, where recent important discoveries have taken place, is very difficult to explain: Leonardo Piccini however manages in this difficult task using a clear and exciting language, an educational piece of writing that really was still missing.

Tono De Vivo, on his side, takes us up to the unexplored summit of Mt. St. Paul on Palawan Island, in the Philippines: 1028 metres of limestones hosting incredible voids, a physical and symbolic place that we dreamt on since over 20 years. One of the most important caves in the world develops in this mountain, the Puerto Princesa Underground River that has become one of the Seven Natural Wonders of Earth very recently. This is a very complex and extraordinary underground cave system from a geological, climatic and biological point of view, where the impact of visitors has to be controlled and studied to allow its sustainable management: this topic is illustrated by Paolo Forti.



Toward the peak of Mount St. Paul, Philippines

Finally, Luis Torelli and Pino Guidi, cavers of the “Commissione Grotte Eugenio Boegan” of Trieste, give a historical and technical overview on the explorations that we are carrying out together in the infernal depths of the Stufe di San Calogero, at Sciacca in Sicily. This shows that the world waiting to be explored can be everywhere, also very close to us. We only need the ability to find these secret places.



Salone Paolino Cometti, Imawari Yeuta, Auyan Tepui, Venezuela

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Events, presentations, exhibitions, Two eventful years to share information about our activities

It's been a very eventful past two years for La Venta. 2012 premiered with the celebrations of the association's 20th anniversary which saw in March the grand opening of the exhibition "The Colours of Darkness: exploring the underground planet" hosted in prestigious Sala Zanardelli of the Vittoriano Monument Ensemble in Rome.

The event was organised in collaboration with the Universities of Bologna, Florence and Siena, with contributions by the regional geological association, and under the aegis of the Senate of Italian Republic, the Parliament, 'Roma Capitale', the Mexican Embassy in Italy, the Italian Speleological Society, the Italian Speleological Society and the Italian Alpine Club. The Company 'Comunicare Organizzando' realised the exhibits.

The Italian President Giorgio Napolitano awarded to the event a representative medal.

The 'Vittoriano' Monumental Complex made available free of charge the exhibition area. Intermatica, New Foods, Shunda provided the remaining sponsorship, with technical collaboration from Ferrino and Cantine Cattaneo, whose wines were offered for the opening ceremony. 60,000 people visited the free admittance exhibition.

The exhibition also hosted the launch of the latest book edited by the association: "Cueva del Rio La Venta: an underground dream", as well as four conferences on exploration, scientific research, archeology, speleological rescue.

The event in Rome, which celebrated 20 years of existence of the association, has also been an opportunity for a great party with our members and the participants to our latest expeditions.

The exhibition was proposed again in different locations, and customised to each of the new locations.

At the end of April the exhibition made an opening in Monteponi (Iglesias), during the Second Symposium on Mine Cave. Twenty panels and a giant picture of Naica 'Cueva de Los Cristales' have been in display for almost a month, thanks to a financial support from the Sardinian Speleological Federation.

An earlier edition of the exhibit was hosted in Lanaiatho (Oliena) by the Province of Nuoro, in April 2010.

In the period between end of August and end of September the exhibition was hosted in "Franco Anelli" Speleological Museum in Grotte di Castellana, in Bari, thanks to the interest of Grotte di Castellana srl. The downsized version including thirty backlit panels, videos and some scenic arrangement earned a lot of success with the public.

Between June and July, 2013, thanks to financial contribution by Banca della Marca, Ferrino, Dolomite, Gra-



Inauguration of the exhibition "The Colours of Darkness", the Vittoriano Palace, Rome

fiche Tintoretto, Chelab, Amphibious and New Foods, the exhibition was hosted in the entrance hall of the Treviso Province building.

The exhibition has recently undergone a face lifting and will be in display at other locations in Italy and abroad. The two years have also seen a very dense calendar of talks and presentations.

We'll recall only the most relevant. In February 2012 two conferences and projections took place: Giovanni Badino presented "Geographical Explorations: the secrets of glaciers" in Polcenigo Theatre in Pordenone; Tullio Bernabei and Giovanni Badino presented "La Cueva de los Cristales" at Sport Specialist shop in Balzago, Lecco. In July, invited by CAI Bosco Chiesanuova (VR), Francesco Sauro presented his explorations of the Venezuelan Tepui, in Chiapas forests, in Uzbekistan caves and in Palawan island in the Philippines. CAI Padova hosted evenings devoted to Uzbekistan and Giauli adventures on Mount Pelmo.

The movie "La Grotta dei Giauli", realised by our associates Enzo Procopio and Tono De Vivo was realised around that mountain, on the northern flank of Mount Pelmo, telling the story of fantastic creatures: "The Giauli", created and carved in Swiss pine wood by Cortina d'Ampezzo artist Mauro Olivotto Lampo.

The film, produced by Alchimia Treviso in collaboration with La Venta, was hosted by prestigious events,

Dark Star 2013

In the month of August 2013, some members of La Venta Association took part to the 2013 Dark Star expedition, in the Baisun Tau range, Uzbekistan, organized by Russian speleologists from Yekaterinburg and Moscow. The explorations were concentrated in the cave called Dark Star: a vast and complex labyrinthine system, with large galleries covered with ice in the higher parts (internal temperature close to -5 °C) and, further down, several narrow and wet leads, often crumbly, that at the moment do exceed the depth of 850 meters. At present it does not appear easy to continue the exploration toward those that are considered the springs of the system, that are 2500 m below the entrances, located between 3500 and 3700 meters above sea level. However, there are ample opportunities to discover new continuations in what looks like an ancient and vast system of large sub-horizontal galleries that open at several points over the immense wall of Hodja Gur Gur Atà, 40 km long, the main limestone ridge of Baisun Tau. The Italian group that took part this year (Tullio Bernabei, Tono De Vivo, Umberto Del Vecchio, Ferdinando Valentino) has given an important contribution to logistics and explorations, while taking care of the photo and video documentation.

like the Trento film festival in May 2013 and the Lessinia Film Festival in August. Its projection is still ongoing at various locations and events in Europe.

The La Venta association is also involved in social activities and organises presentations at various associations such as rehabilitation centres for drug addicts.

On the night of July 13 La Venta participated to the event "Speleonotte 2013", organised by the association Culture Sotteranee of Terni, on the Sant' Erasmo plateau at Cesi: around two hundred fifty people saw the presentations of photos and videos from the Venezuelan Tepuis, on Giauli's adventures and on recent explorations of the El Ocote forest in Mexico.

At the end of July 2013 the 16th International Congress of Speleology took place in Brno, Czech Republic. Our association contributed with a large stand set-up in collaboration with the Italian Speleological Societ, and presenting on primary research topics, like ongoing explorations in Naica, Mexico, on the Venezuelan Tepui, at Mount Kronio in Sicily, on the caves of Uzbekistan.

As usual, our association participated with stand, presentations and projections at the yearly speleological meeting, which took place in Italy at the beginning of November.



Ice Maiden, Dark Star, Uzbekistan

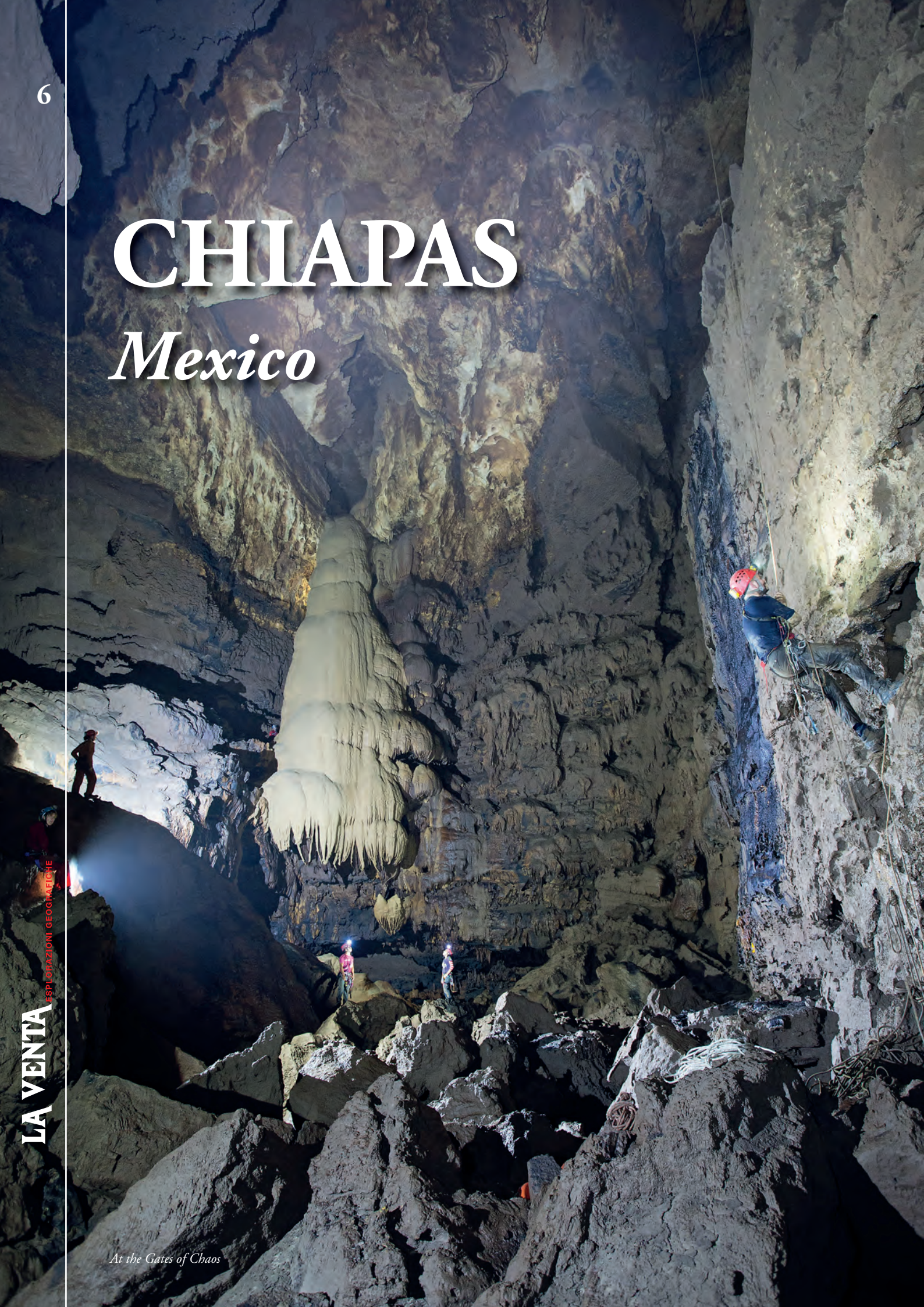
CHIAPAS

Mexico

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At the Gates of Chaos



CHIAPAS 2013: IN THE RIVERS OF THE NIGHT

Carla Corongiu

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My first expedition to Mexico dates back to November 2009, when a series of bureaucratic problems made impossible the scheduled expedition to the Juquila Canyon (Oaxaca) and we had to fall back on an emergency solution: Chiapas! After that tour, I went back six times in the space of a few years. The Rio La Venta Project has been revived from that ill-fated expedition: who would have thought?!

The speed at which we adopted the “fallback” brought us other problems and, after a week in the wilderness on the plateau on the left side of Rio La Venta, we had to exchange for a new route. Guided by the local Grupo Espeleológico Jaguar, we moved to the plateau of San Fernando, near Tuxla Gutierrez, to explore a sinkhole that looked interesting. Every cloud has a silver lining, so after an on-off start and a beautiful exploration, began also for me a real adventure in that wild part of Mexico, that at the time I did not know existed.

A good season began, I like to define it a revival, that led us to establish further partnerships with the villagers and the institutions, gradually increasing our knowledge of the territory and forming great friendships. We started the survey works, exploring dozens of kilometers of new caves and forging, as the time went by, an ambitious and multidisciplinary project, so fascinating that it drove us to come back again so many times.

Now fully integrated into the project, I find myself back here in April 2013 with old and new friends: fifteen Italian and four Mexicans. These expeditions are always big, so difficult to organize and coordinate, but truly successful for our activities. They allow us to work on several

fronts, including speleo-diving, which in recent years has taken strategic importance, being of particular interest to the local communities, always interested in the underground water reserves.

This time our intentions are very ambitious: we have, in fact, to complete different suspended tasks of survey, exploration and photographic documentation. Furthermore, we have to verify some reports of new entrances and to conduct water testing. As always, that all is made possible thanks to the support of the Reserva de la Biosfera Selva El Ocote (with which we have just signed a new agreement for the next six years), and the Protection Civil of the state, the municipalities of Cintalapa and Jiquipilas and, of course, the local communities.

This time I am in the group that has to go along the Cueva del Rio La Venta again to complete the photographic documentation and try to ascend a flowstone under an overlooking, unexplored gallery. We have five days; we are six Italians and three Mexicans. None of us has ever completed the full cross trip, but fortunately we can count on the experience of our friend Manuel Perez, tireless guide of the colony Adolfo Lopez Mateos.

With him there are also Fabiola and Hugo, two young speleologists of the village, my former students in the speleology courses we have held here in recent years. I'm really curious to see how they get through.

We are all loaded like mules, but the three of them, with a physique half of mine, seem to load twice: are they going to manage it? We have caving overalls and boots, they wear trainers, denims and short-sleeved t-shirts.

Just the first hundred meters of the cave are enough to



Entrance of Cueva Los Bordos



Archaeological findings in Cueva Los Bordos

make me change my mind. Yes, the students have surpassed the master: they move around with ease and with an incredible lightness, despite the overloaded bags and the inadequate clothing.

This is getting interesting, we go among the huge and varied environments of the Cueva. At the first internal camp, Manuel feels ill: he has temperature and wants to go out. We look at each other, worried: he is the only one who knows the way out, and the exit is too far for a person in those conditions. On top of that, we can't go back, because we are making a rappel traverse, and the pits behind us are not equipped anymore.

After a quick consultation, and after excluding any allergies to drugs, we decide to give him a good dose of paracetamol; in the following days it would prove to be the perfect panacea to cure all the participants. Our hypochondriac kits (mine and Salvatore's) would be the salvation of the "crossing group".

Along the way, when Sandro sees an inspiring view, we stop and help him and Simona to position the spotlights. One, two, three, go! Fast, shot after shot, Sandro announces that the photo is successful. He is so quick and direct that we look at each other incredulous and happy, not to have to stand for hours like mummies waiting for his "ok" sign.

On the second day we reach the Porte del Chaos Hall (*Gates of Chaos*). Here the ascent of the big flowstone is awaiting us: Vittorio starts climbing, supported by Salvatore. At the same time, Andrea sacrifices himself, as usual, and goes up carefully on the dangerous rope damaged by the floods, to replace it with a new one and get to the Forra dei Sogni (*Gorge of Dreams*) and, from

there, to the second internal camp.

It's late when Vittorio reaches the gallery overlooking the salon. After a quick glance, he decides to stop and rest, and to continue the exploration the following day. During the long day we explore, survey and photograph the new gallery, named by the Mexicans "Gato con Botas". For a lack of time we can not ascend a flowstone in the terminal part of the gallery and we have to leave the rest of the exploration to those who would continue the crossing.

However, we can find the link to the Forra dei Sogni: from now on we can avoid the dreadful ascent of the Porte del Chaos Hall, which in recent years has inspired horror stories in anyone taking part to the route.

On the evening of the fourth day we reach the exit. Miraculously unharmed, without fever, running out of paracetamol, satisfied with the exploration and the beautiful photographic reportage. It's time to swim in the beautiful canyon of Rio La Venta, to eat the fish caught and cooked by our friends of the village and then, finally, to rest our poor muscles.

I fall asleep, happy under the stars, lulled by the song of the river and the forest, unaware that the following day the climb back (without mules) would make me regret to have plunged into the canyon.

During the strenuous climb on the steep hills scorched by the sun, I look with pride at our students. They are a little tired, with their shoes almost destroyed, but they do not turn a hair, despite the temperature reaching 40 degrees in the shade. They are happy to take part to an exciting adventure, so I think that yes, it was worth the effort. The courses, the slide shows, the meetings with the people and all the efforts to involve the locals are bearing fruits.

After the Cueva, the groups come together and then split again with other goals. This year, just my luck: Francesco, our expedition leader, decides that I would go to the cave of Los Bordos, located on the right side of the canyon and already explored by the French in 1987. The area is described by everyone as beautiful and wild. At the beginning we are eight people and our task is to retrace the survey and explore the side branches, not mapped in the previous topography. It all seems perfectly organized, but the first problems arise when searching for a new path. That would lead us to wander for hours under the scorching sun, with our overloaded backpacks. I get my very first sunstroke and start to think that, after all, I am not so lucky...

We are forced to go back and retrace a different more beaten way. Only the following day, exhausted and burnt, we come under the wonderful waterfall of Conchuda, a series of heavenly ponds fed by the river that pulls out of the cave a hundred meters over.

Unfortunately, we can not fully appreciate the beauty of this place. A curse affects not only me, but all the rest of the gang, that begin to suffer from joint pain, diarrhea, nausea, a series of ailments that would hurt us in turns until the end of the expedition.

After ascending the waterfall, we settle the base camp

near the cave. It is a fantastic place: a huge resurgence that now, in low flow condition, gives off about five liters per second. Too bad that all along the cavity, in the pools, there are strange oily liquids stagnating and rotting, and that the water stinks of guano: we would drink it for seven consecutive days. Our spirit of adaptation, our optimal team connection and liters of Mycrodin -the disinfectant we are already dependent on- allow us to gloss over any intestinal disorders and roll up our sleeves, focusing on our goals.

We begin the survey and exploration of the cave and in one of the unexplored branches, after an ascent of twenty meters, we run into a wall built to separate a fossil gallery from the rest of the environment. Intact vessels, human bones and a few arrows indicate the presence of burials. Typically we get excited knowing to be the first to step on an unexplored land. But in this case it is the opposite: we get excited to discover that someone, long before us, knew to perfection this environment, so much to elect it a place of worship. So, very cautiously and aware to have found something special, we carry on the survey and the photographic documentation of this gallery frequented in ancient times.

In the following days we are six. The exploration gradually becomes more complicated due to the heavy, stale air: the more we enter into the cave, the harder we find to breathe, we are slowed down and a headache torments us until we abandon the idea of reaching the terminal siphon. Only Giorgio, named "the Superintendent" for his archaeological knowledge, seems not to accuse any problems: no dysentery, no illness or weakness. Is there a trick in the two or three daily baths he takes in the pure and pristine waters coming out of Los Bordos? For us it remains a mystery.

In any case, to avoid further problems possibly caused by the presence of carbon dioxide, we prefer to devote

ourselves to the survey, new ascents, and documentation of the initial parts. In the hope of finding new hidden entrances, we have fun walking on the ledges outside the cave. At a short distance from the camp, at a higher level, we find a huge entrance, fossil and very nice, already reported 25 years ago by the French expedition. And here, too, there are traces of an ancient frequentation.

Our week in Los Bordos goes fast, to the taste of spaghetti with tuna, and in an eye blink the last day arrives. Dismantled the camp, we wait for the mules and guides that should help us to carry our heavy backpacks. But nothing happens, nobody arrives. We have to cope with it, so we are slower and have more time to exchange ideas and points of view. We are determined to come back! Next year we need a larger team, several more days, a CO₂ meter and, if we want to organize a speleo-diving exploration, almost all the expedition must be dedicated to it.

The rest of the group, that has not taken part to the crossing of the Cueva and to the mission to Los Bordos, during the expedition has worked on other areas, ranging from the right to the left side of the canyon. Surveys of known caves have been completed and new cavities have been explored. At the same time, a strong team of Italian-Mexican speleo-divers, supported by different members of the expedition, has devoted themselves to the inspection of the siphons in the resurgences of Aguacero and Vertiente.

The most interesting results have been collected in the Cueva del Naranjo, where the submerged part explored reaches a development of 310 meters and a depth of 45 and seems to continue magnificently. In the area of Hierba Santa our mates have tackled the terminal siphon of the homonymous resurgence, exploring it for about 80



Rapids in Cueva Los Bordos



Diving in the sump of Cueva del Naranjo

meters of development and 4 of depth; and it seems to continue on a larger space.

The works in this area are now so vast and complex that an expedition is fragmented into many small independent groups, each ending with a story to tell. That is how, with a good coordination, we can say with satisfaction that the 2013 Chiapas expedition has been perfectly successful. Let's see the next!

The expedition team members: Giorgio Annichini, Silvia Arrica, Tullio Bernabei, Salvatore Cabras, Leonardo Colavita, Carla Corongiu, Marta Cristiani, Vittorio Crobu, Kaleb Zárate Gálvez, Alicia Dávila García, Federico Faggion, Massimo Liverani, Francesco Pandolfo, Andrea Pasqualini, Pepe Pez, Monica Ponce, Pierpaolo Porcu, Francesco Sauro, Sandro Sedran, Simona Tuzzato and Elena Volpini.



Exploring on the wall, Los Bordos

THE SELVA IS SOMETHING ELSE - SELVA 2013 EXPEDITION

Francesco Lo Mastro

The cool wind blowing on your face, the wide horizons, the perspectives, the long shadows at dusk and dawn, the noises of human activity brought by the wind, but also the reassuring awareness that one can always be quickly rescued should trouble arise... none of this exists in the *selva*, all of this makes the difference.

Parallel to our many Mexican speleological expeditions, which twisted and turned essentially through inhabited territories, flows another lode of adventure and knowledge: the green universe of the forests of Chiapas.

Year after year, meter after meter, as if hacking a path open with machete blows, we have increased the knowledge of these complex territories, advancing inside them with passion, effort and tenacity. We have been captured, swallowed, one might say, by this fascinating environment and by its extraordinary history.

2013 has been the year in which emotions and discoveries have been shared by a group of people that, for the first time, included also non-La Venta members.

The experience was more than positive, a reminder that this environment is generous and hospitable with those who love and respect it.

Due to the peculiarity of the terrain and of the logistics, this expedition was divided into two parts, each with its precise objectives.

The first part of the program included reaching a large

sòtano in the *selva* Veinte Casas, which we had spotted the previous year from aerial photographs and had nicknamed "Chiccivà" (Whogosthere). It is located near the Bochil colony, in the Cintalapa municipality, and getting there was not easy; for one, there are no known water springs in the area and therefore the whole supply for the trip had to be shouldered along the path. A light squad reached the objective in three days, their objective being not only to determine its exact position but also to find possible water sources, which would have been indispensable for the following explorations.

The discovery of a promising cave in the *selva* Veinte Casas, in the Monte Bonito area, was another success of the expedition. At present we have reached an internal sink, from which one can hear the roar of a waterfall that feeds a large underground river. One of its likely resurgences is thought to be located a few thousand meters downhill.

The second part of the expedition saw us being literally swallowed by the *selva* El Ocote for more than ten days. The area of interest was that around Rabasa, a colony surrounded by the deep green of a lush forest. From there, we proceeded on foot towards Tierra Colorada, a small, farmed area that represents the last human outpost at the borders of the green ocean. The forest is constantly trying to win back that patch of land, every day, meter by meter.



Camp in Tierra Colorada, Rabasa, Selva El Ocote



Big doline near Tierra Colorada

The base camp at Tierra Colorada was the starting point for explorations in the heart of the forest, a really inhospitable place to be.

Our progression was utterly difficult; often accompanied by monkeys and noisy parrots, we faced humidity, steep slopes, tangled vegetation and a terrain characterized by corrosion features: wide karren fields and hundreds of cockpits. In the end we succeeded and were able to reach and explore a depression, a large hole amidst the green, which we had previously spotted in the aerial pictures and called Sótano de las Huellas. During the remaining days our efforts were focused on reaching other distant points of access to remote valleys, inside which the aerial photos had shown other chasms. Definitely these will be

the objectives of future expeditions.

This is what the *selva* allowed us to accomplish this year. We will be back to explore, deep in the green world, with new goals, hopes and dreams. We do not know what the *selva* will have in store for us, but we are certain that it will always be a source of many emotions for us who love and respect it.

Expedition members: Pietro Cortellessa, Umberto Del Vecchio, Paolo Forconi, Kaleb Zárate Gálvez, Francesco Lo Mastro, Daniel Paharnicu, Laura Pala, Chiara Pulvirenti, Abraham Ruiz, Alberto Ruiz, Lucas Ruiz, Laura Russo, Cecilio López Tercero, Gianni Todini.



Sotano de las Huellas

On November 21st, 2012, a visibly excited group of people posed for a photograph in a Mexico City notary office. They had just founded the CEKLAV, which stands for Centro de Estudios Kársticos La Venta (La Venta Centre for Karst Research).

The founding members were Alicia Dávila, Kaleb Zárate, Argelia Tiburcio, Tullio Bernabei and Natalino Russo, but immediately after the founding Luis Dávila (brother



Rancho El Arco

of Alicia, better known as Beba), Israel Huerta, Monica Ponce, Delmar Cancino, Gianni Todini, Francesco Sauro and Leonardo Colavita also joined the Centre. Almost all are also La Venta members, which explains not only the name but also the goals and the philosophy that this new Mexican association intends to pursue.

Twenty years after the start of systematic explorations in Mexico (and specifically in Chiapas), the amount of collected data and the results, not only speleological but also “social”, of so much work needed an extension and a systematic approach that La Venta alone, with its two expeditions per year, couldn't fulfil.

It was necessary to transform what was achieved into an organised and organic process which could be present in the field on a nearly daily basis, could continuously maintain contacts with the institutions and could make use of the great deal of accumulated knowledge not only for research but also for training, environmental education and conservation of karst environments. Briefly, a Mexican structure was needed, able to deal with all that and progress better and faster: that is why CEKLAV was born.

Naturally, for such an ambitious project, it's not enough to simply create a new association, nor is it enough to bring together the existing data: what's needed are people who work at it, political contacts, new projects, financial resources and a lot of enthusiasm. This is clear to everyone and is the way being taken.

At the end of January, the Centre was officially present-

ed at the National Speleology Congress at Mérida (Yucatán) and in February the first two general agreements were signed with the Universidad de Ciencias y Artes de Chiapas and the Universidad Politecnica. Also an agreement was signed with the town of Cintalapa, where much of the activity takes place.

CEKLAV will also take over the administration of our Reserve at the rancho “El Arco”, where we hope to build a documentation and learning centre on site. There are several projects, but our current priorities are the creation of a cave register and studies on the underground waters and their quality: these are clearly important themes for the area, the community and the institutions. Then it's obvious that also the challenge of adventure and sustainable tourism has to be met, a tricky field which by its very nature is dangerous because of the appetites it generates and the manipulations it's subject to. This is where CEKLAV can play a decisive role, by making proposals as well as guiding institutions towards a sound and low impact development.

The Centre isn't an alternative to or a competitor for local speleology, on the other hand, it wants to stimulate its growth by working at a higher level, with the clear goal of influencing future public policies in the field of karst and cave management.

In the medium term we'd like CEKLAV to become an attractor and a driving force for speleological and scientific research in the Rio la Venta area, by providing whoever is interested, from anywhere in the world, with hospitality, documentation and logistical support for



At the notary public in Mexico City. From left: Kaleb Zárate, Argelia Tiburcio, Natalino Russo, Alicia Dávila, Tullio Bernabei

their studies at “El Arco”.

Chiapas and its immense karst areas, which are still mostly unexplored despite over thirty years of research, are a true speleological paradise that will attract growing numbers of enthusiasts from all over the world. We hope then that CEKLAV, after our initial baptism, will grow and live its own life, gradually becoming one of the main driving forces of future speleological research in Chiapas as well as of the conservation of the underground world that characterises this unique region.

ANTONIO DE VIVO

Dread from the underground

With the slogan "L'avventura del futuro, il futuro dell'avventura" (*The adventure of future, the future of adventure*), Nathan Never is the first Bonelli comic strip of the science fiction genre. Ideated by Michele Medda, Antonio Serra and Bepi Vigna, it debuted on newsstands in 1991 with an album titled *Agente Speciale Alfa* (*Special Agent Alpha*), the main theme being the three laws of robotics by Asimov. The three authors, nicknamed *La banda dei sardi* or *Il trio dei sardi* (*The Gang or Sardinians' Trio*), have worked with this publishing house since 1985, producing stories for *Martin Mystère* and *Dylan Dog*. The top artists are Dante Bastianoni and Claudio Castellini, that later would become cover artist up to the 59 issue.

The character of Nathan Never is inspired by Rick Deckard, the protagonist of the film *Blade Runner*, that shares with the comic strip the vision of a cynical and pessimistic future and the gloomy urban landscape. Recurring characters of the series are the Polish genius of computers Sigmund Baginov and the first Alpha agent, Legs Weaver, the latter inspired by the actress Sigourney Weaver, star of the *Alien* saga.

Nathan Never shares the same fictional universe with other Bonelli characters: *Zagor*, *Mister No*, *Martin Mystère*, *Dylan Dog* and, of course, *Legs Weaver*. But here there is the characteristic of a strong continuity, a constant consistency of the series, a feature not very present in the other Bonelli alba, but typical of some foreign comics. The series *Nathan Never* is set as a coherent set of issues, where the events told tend to permanently change the lives of the characters. So their consequences are outlined in the subsequent issue. The adventures of *Nathan Never* take place in a future that is set, accord-

ing to our calendar, in 2188. A twenty-third century that sees our planet ravaged by human follies, natural disasters and threats that come from other worlds.

The series *Nathan Never* can be seen as structured in macro-areas or "chapters". They are groups of alba that refer to one or more "enemies", although sometimes these chapters overlap, increasing the suspense and giving way to new adventures. Between the chapters we find some short stories, that act as a buffer between one adventure and another, and that are often linked to the main threads.

The caves have always represented an alien world, somehow science-fictional. But usually, in the comics, the underworld stands on the background or is temporary, passing environment. The adventure we are going to talk about, on the contrary, is developed fully inside a cave, during two alba, the 87 and 88 issues, published in August and September 1998.

They are "Terrore dal sottosuolo" (*Dread from the Underground*) and "I signori di Marte" (*The Lords of Mars*), both scripted by Alberto Lisiero and Gabriella Cordone and drawn by Ernestino Michelazzo.

The story, very detailed and complex, is played between the present (of *Nathan Never*, of course) and a series of flashbacks to external events of 15 years earlier.

Olga Ustinov, Sigmund Baginov's sister, asks his brother for help to find Francine, Grace and Mike, three friends with whom they have shared an adventure into a cave in the touristic village "La Giungla" (*The Jungle*) fifteen years earlier, and now suddenly and inexplicably disappeared.

During the first visit to the cave they leave the tour group (led by a robot guide) and decide to explore some non-touristic galleries, bumping into strange phosphorescent spores, losing their way back and escaping to



fatal falls into deep chasms by the skin of their teeth. Back to “La Giungla”, Sigmund and Olga, with the help of Nathan and Legs, begin the search for their missing friends, guided by the speleologist Karen. When they find Francine, the woman shows signs of a terrible mutation. Mutation that, in a short time, starts to affect also Olga and Sigmund. It is the activation of the mutation that inevitably pushes the contaminated back into the cave. A call without conditions, “like a salmon migrating upstream”, says Nathan Never. A beautiful metaphor for the passion for speleology...

Besides daring descents, escaping and chasing along labyrinthine tunnels, and the extraction of the mutant organism by the physician of the tourist center, the story reveals gradually the truth about what is really happening. The five friends, who have shared the cave explorations fifteen years before, have been all contaminated by strange phosphorescent organisms discovered in the depth. A long incubation period, finished almost simultaneously for all of them.

The contaminating beings come from Mars. They have escaped from a planet that has undergone deep upheavals, with an environment, once suitable for life, now transformed into an inhospitable and extreme desert.

The presence of the mutants is also known by some deviant services of the army, that try in every way to destroy the “nests”, the places where the spores, at great depth, develop and grow. But their real purpose is to prevent everyone, besides them, from stealing the spores, with the intent to sell their secret to major pharmaceutical companies. Nathan and his friends must then contend at the same time with the army, the mutants and the many pitfalls of the cave. The organisms, originated on Mars, have the ability to mutate and to take on different appearances depending on the environmental conditions and the guests they can develop on, resembling closely some troglobite animals: a fictional transposition of reality, of the extraordinary ability of the living beings to adapt to different environmental conditions, and in particular to the underworld.

The cave extends for dozens of kilometers (one of the longest and deepest on Earth...) and presents almost all the possible aspects of the underworld. These aspects are described in a rigorous and scientifically correct way since the beginning of the story, when we can relive the visit to the cave following a robot guide that explains with a metallic voice the karstic phenomenon, the speleothems, the groundwater and the water table surface. But in a proper science fiction comic strip obviously we can not restrict to pure reality. So the speleo-robot shows fossils of giant extinct insects now incorporated into the resin and lush plant life “that still survives in what is its natural environment”...

But the most amazing part of the story comes when Nathan, Legs, the speleologist Karen and May, a colleague

of the Alfa agency, take part to their last exploration in search for their missing friends, including Olga and Sigmund. To by-pass the military block, Karen takes her friends to a high entrance of the cavity, obviously known only by her. From there, after a short descent, they get to a 600-meters (660 yd) pit, a single vertical stretch without any rebelay. They drop simultaneously, anchored to a jag of rock overhung just right at the center of the pit. Everyone descends on his own rope, carried in a small backpack that must have the same characteristic of Eega Beeva's trousers. Karen explains to her mates what to expect from the edge of the jag, without any belay rope. But perhaps this in the least sci-fi aspect, considering what many speleologists of our times usually do...

Our friends wend their way through slithering and labyrinthine tunnels to derail the soldiers that now press them closely, nervous from having been by-passed in such a striking way. Other descents, other galleries, then the bitter truth: the cave is flooded by recent rains, and they must continue in the water. Falls, risk of drowning, vortices where our heroes are like to be sucked in. The belay rope positioned by Karen eventually disengages from the rock, and Nathan ends up in one of the vortices. While his friends are captured by the troops, he begins an incredible journey between the subaqueous and the aerial, among siphons, waterfalls and other endless vortices. Eventually he is saved by the mutants, including Mike, one of the first to have disappeared. In the depth of Earth, Nathan is accompanied by the “Mother”, the Martian being who guards the gene pool of her species. To Nathan, who is a man devoid of prejudice, pure from the soul, the Mother telepathically tells the story of their odyssey and their next departure to other worlds, because the Earth will soon be destroyed by other wars, other cataclysms... And, above all, they are looking for a place where the Other is not discriminated. Nathan asks for clarifications; he wants to understand, without judging, with a heart full of worry for the future that awaits his planet. A eulogy for the acceptance of diversity, a dialogue between beings totally alien to each other, taking place right in the “other” environment par excellence, the cave.

Nathan, following the directions of the mutants, finds his way to the exit and joins his mates who have already given him up for lost.

The soldiers have blasted the cavity and have operated a powerful bacteriological weapon to destroy spores and mutants, but they do not know that the cave is much broader and deeper than the dimensions indicated on the maps: it is an infinite and deep maze where the Martian beings will complete their mutation, and then will begin their long journey through space to other worlds...

TEPUI

Venezuela

LA VENTA

ESPECIFICAZIONI GEOGRAFICHE

CASTLES OF SAND

Leonardo Piccini

17

LA VENTA

ESPLORAZIONI GEOGRAFICHE

In collective imagery, sand is a metaphor for something intangible (“like sand running through one’s fingers”), of transition (“it’s written in sand”), of precariousness (“like castles made of sand”) and of the passage of time (“sand flowing through an hourglass”). It’s a docile and mouldable material. A base element, from which all is made and to which all returns. Also in ancient mythologies sand plays an important role. For example, the Golem in Jewish mythology is made of sand; anthropomorphic, weak, yet strong at the same time. Sand often accompanies desertification processes, whether for natural or anthropic reasons, and human history has been conditioned by its unstoppable advance. Entire civilisations have, in fact, disappeared into the sand and entire populations have been forced to migrate. Perhaps this is the reason why sand appears so frequently in mythology and in imagery, basically as a metaphor of our destiny.

But what is sand, really?

The technical definition describes an incoherent sediment made up of rock grains ranging in size between 40 microns and 2 millimetres. Sand is formed by the mechanical wear of bared rocks, especially through meteoric weathering and degradation. For geologists it’s an important material and is the subject of in-depth studies. A large part of the Earth surface is covered by sand, either loose or lithified, that is re-compacted and “glued” together to form new rock, which will then become sand

again, in a cycle that can be repeated several times (a metaphor of reincarnation in Asian philosophical thought, notably Buddhism).

Sand can be described according to its lithological composition, that is the rocks which the single grains are made of, their average size and their shape.

Lithology, size and shape can tell us a long story, beginning with the nature of the “mother” rock and passing through the various events which the sand has gone through before being deposited on the shore of a lake, on a beach or on the bottom of an ocean.

Meteoric alteration affects the less stable minerals, leaving the more resistant ones practically unchanged. Among these, quartz (silicon dioxide) is certainly the most common. Sands are therefore made up mainly of quartz granules and, if a sand goes through several lithification-alteration-lithification cycles, it inevitably ends up being a *silica sand*, made up entirely, or nearly so, of quartz granules. Such sand is fairly rare (and highly sought after by the glass and electronic component industries) and if it becomes cemented again, it turns into the strongest rock we know of: quartzite (or quartz arenite).

In order to become lithified, silica sand has to be subjected to great pressure, which happens when thousands of metres of other sediments get deposited over it. The pressure melts the quartz at its contact points with other



Forms of erosion on the Pared de las Mil Caras, Sima del Viento, Auyan Tepui

grains, filling the gap between them until they're fused together. They're also compacted and any water trapped in the spaces gets expelled. The result is an extremely hard rock which is apparently unassailable by atmospheric action. But even if transformed into quartzite, sand can't escape its metaphoric destiny: "Sand you once were and sand you will be again". Effectively, it's what's happening in certain areas of our planet, like the Gran Sabana in South America, where there are strange flat-topped



Isolated pinnacles are typical morphologies of the Tepui

mountains, locally called *tepuí*, which are composed of very ancient quartzite rocks. For this process, the term *arenization* has been coined, that is, the "transformation into sand". It's such an efficient process that even underground cavities are formed in these rocks, sometimes having colossal size. It's an apparent paradox: the hardest and most resistant rocks on the planet have holes like a Swiss cheese created by the small amount of water which infiltrates them. But why doesn't the same thing occur in far more alterable rocks, such as granites or simple sandstones (mixed sands cemented together)? The answer isn't evident and several researchers, including some belonging to the Association La Venta, are working to understand this process.

An essential role is played by the purity of the quartzites in the Tepuis. Many minerals, including common silicates, once altered are transformed into clayey minerals, which tend to block fractures thus preventing water infiltration. Quartz, instead, doesn't go through a true alteration process: silicon molecules simply get detached from the crystalline structure and travel freely, unable to react with other substances dissolved in the water. It's a slow process, very slow. But if there's one thing which the Tepuis don't lack, it's time.

In fact, the Gran Sabana quartzites were formed almost two billion years ago, on an Earth which was very different from today's, without life on the emerged areas and therefore lacking a protective vegetative cover which would shield them from the elements. The planet had one large continental mass which initially included all the emerged areas (the supercontinent called *Pangea*) and later what is now Africa, South America and Antarctica (the ancient continent called *Gondwana*). The central parts of these land masses were probably covered by extensive sandy deserts which were periodically flooded by gigantic rivers. The rivers transported immense

quantities of sand. It was in such an environment that the tepui quartz sandstones were formed, accumulating thousands of metres of sands for at least a billion years. Then something happened, fairly recently from a geological point of view: only a few hundred million years ago. The continent split, giving rise to an ocean which lapped those arid and desolate sandy plains. Mountains formed and new rivers etched them. For the quartzite, the time of reckoning had come. Again exposed to the elements, furthermore in a humid tropical environment, they succumbed to the "terrible" arenization. Their slow crumbling began.

On the outside, these rocks build a hard shell of silicated iron oxides which allows them to resist, but beneath they don't have any defence against the slow dissolution of the silica cement.

In the places where this process is more efficient, generally along fractures or particular layers, the grains, freed from the cement which bound them, are carried away by the infiltrated water. At the beginning imperceptibly, grain by grain, then always faster as the microscopic conduits thus formed widen and allow the water to move more energetically. This is exactly how caves in quartzite are formed: from the hard "battle" of the silica rocks against their inevitable destiny.

At the end of the day, even tepuis are only "castles made of sand" and the caves which develop within them look like chambers and labyrinthic corridors connected by secret passageways.

They are transitory forms, like an immense *mandala* made of coloured sand which is just waiting to be swept away by a spring rain.



Extreme forms of superficial erosion

Madrid, February 27, 2013

We are on board the plane that will take us to Caracas, awaiting the takeoff. Once again directed towards the Tepui, that fantasy world that perhaps more than any other on this planet is difficult to describe. More than twenty years have passed since the first time...

Organizing an expedition to Venezuela is never easy, but this time it has been really tough: permits, problems at work, relationship with the Venezuelan speleology, funding in doubt until the last moment. But now here we are, finally, eager to see "The Lost World", and every effort made, every hour of sleep lost, is dissolved quickly in the space, the light, the air of the Gran Sabana. The plane is moving, heading the runway. We are facing a long trip: Caracas, Puerto Ordaz, Santa Elena de Uairen, Kavak...

San Jacinto, March 1

At Raul's home, who since 1992 has driven us around the Gran Sabana on board Cessnas and helicopters. Raul is an exceptional pilot, with over 40000 hours of flying experience, and considering the hours he has given us in recent years, he is definitively the main sponsor of the Tepui Project... For years he has been building his new house in this small town 12 km south of Puerto Ordaz. It's just me and Vitto, tomorrow we are going to fly with him by helicopter directly to Kavak. The others have already left, with three off-road vehicles, to Santa Elena de Uairen, where an old Antonov (1942, serviced in 1992) will bring people and materials to the small village under the Auyan Tepui, our final destination. At Raul's home welcomes us Mollin, known as El Indio, whom we met in 2009 during the expedition on the Akopan Tepui. He



Beginning the abseiling to the cave on the wall

is Raul's do-all man, and in 2009 he was his logistic assistant for the helicopter. Among the many guests who crowd the barbecue organized by Raul, we met Falco, a helicopter mechanic with thirty years of experience. It seems to be one of the best in Venezuela; at present he would like to retire, but his work is too precious and different companies operating in this area do not want to let him go. Raul turns to him, lucky us...

Kavak, March 2

We arrive by helicopter from Puerto Ordaz almost at the same time of the others by Cessna and Antonov from Santa Elena. Kavak is a small village of Pemon natives in the Canaima National Park, offering an excellent touristic hospitality, with bungalows and a small restaurant. From here we will depart to settle the camps on the Auyan Tepui, whose profile stands out a few miles from us... Our group has been joined also by Felipe, a pilot and friend of Raul's, who, with his Robinson, a small touring helicopter, offers himself to fly over the area of interest



Settling the base camp at Sima del Viento



Sima de la Cascada

to determine where to settle the advanced camps. The Robinson is really small, therefore only Francesco joins the pilot. The flight is very useful, and Cesco comes back thrilled with the confirmation of what Raul has seen during his overflights. A large cave in the wall, a deep *sima* (fracture) less than a km far and a vast depression farther north. This area in the Auyan is totally unexplored by the speleological point of view, we only have two weeks and no known cave left to focus our efforts on in the case our expectations should not be met. Therefore we have to play our best cards, because any delay, any error of assessment, means additional costs in terms of flight hours. We decide to settle two mini-camps: Cesco and I will go to the cave on the wall, while Carla, Vitto, Jo and Jesus to the Sima. Basing ourselves on what we find, we will decide what to do...

Wall Camp, March 3

I'm in my tent, Cesco is already asleep. It has been a long, busy day. Dense moments of enthusiasm and deadly disappointment. It's a little past 7 when Raul and Julio, the other pilot of the expedition, unload us a few hundred yards from the edge of the wall. We start immediately to look for the access, among leaps of rock hidden by the vegetation. The plants are laden with water, and at each step they unload their content on our boots. Our idea is to descent freeride as far as possible, but it is too dangerous, we do not understand what we are moving on, we do not know if under our feet there is ground or pure emptiness. So we decide to equip the descent till the edge, hoping that the 200 mt rope will be enough. The descent is more complex than expected, fighting between tangles of vegetation charged of water and rotten and flakey rock. The bolts just fixed come out after a simple pull of the fingers, and the space that separates us from the ledge, where the cave opens up, seems endless. After a series of pulse-pounding splitups, one last stretch of 70 meters, totally in the void, makes us land in the lush vegetation: we climb up a short slope of slippery blocks and enter into what looks like a large freatic gallery. We expect exciting continuations but after about 30 meters everything closes. Incredulous and disappointed, we begin the long ascent: the laying up seems to be even more challenging than the descent, because the rope passes inexorably into the vegetation and we climb under a continuous shower, hoping that the bolts resist.

At the camp (our little tent) we call our mates at the Sima: unfortunately they have only bad news. There seems to be no leads, but Jo and Vitto are still underground, to seek access through the debris boulders of the bottom.

We begin to think about possible alternatives, but after a while we talk again to Carla: Vitto and Jo have entered and walked a couple of kilometers into big and beautiful galleries. Cesco and I hug each other, happy as children. We try to tell the good news to our mates in Kavak, but the satellite is off.

In order to be light we have loaded just the bare minimum, the dinner we prepare is really frugal. Anyway,

tonight we are happier, on an empty stomach and without a drop of rum, than our friends in Kavak, on a full stomach...

Sima del Viento, March 4

After several flights, transporting our material with a net hanging under the helicopter, we are finally all together in what will be our camp for the next ten days. The wind that is wedged inside the fracture has helped our mates to name it and therefore the camp after. We set up the tents, kitchen, bathroom and deposit of the material, following the instructions of Jesus and Virgil, the two park guards whom were asked to collaborate to our expedition by Inparques (The National Institute of Parks). We are within a national park, and the regulations on environmental protection are, rightly, very strict. They are strict regarding the detergents to use for washing the dishes, the paths to follow when moving within the camp, the possible damage to the vegetation, the collection of waste. They are so in particular regarding the feces, that we have to collect and take to Kavak.

In small groups, we descend into the cave to survey what we have already explored and to look for the best and easiest way of access to the galleries. Our attempts will prove to be vain, but we begin to know this cave and its underground rivers, just beautiful. As often happens in this corner of the world, it starts to rain heavily, and the walls of the Sima transform into real waterfalls. We have some experience of this kind of situation, so we decide to wait for the flood to subside. We go up the long, steep, and now wet slope of boulders that represents the access to the bottom of the Sima, and it is already night. Our mates at the camp welcome us with a great mixed salad of cabbage, beans, corn and tuna. Cesco and Jo have surveyed over a kilometer and a half of galleries and the Cave Sniper, a new tool developed by Polish speleologists, allows us to download and view the data and the polygonal in real time. Midnight is long past and we are

exhausted, but the sleeping bag can wait a little longer. We have an important meeting to attend: the oldest caves in the earth and the most innovative tool invented by man to make them visible. We look at the survey and topographic map of that part of the mountain that we are exploring, and we understand that our ten days stay will not be enough...

Agorafobia, March 5

Today is chore day for me and Freddy: reorganization of the camp, collection and purification of the water, arrangement of the technical materials, preparation of the dinner. While our mates go down to continue the exploration and survey and to take pictures, we disequip the rope used to initially descend to the bottom of the Sima. The day is beautiful, the edges of the Sima, kissed by the sun, stand out against a clear sky. Everything seems to be suspended, in perfect balance...

It is half past eight in the evening when our first mates reach the camp. Jo and Cesco tell us of galleries and labyrinthine areas beyond imagination. At one point, they say, the gallery is so large that you get lost in it. You lose the perception of distance and space, you get to suffer from agoraphobia. The gallery goes up to 150 meters wide, too many to deal with the normal parameters of speleology...

Ultima Esperanza, March 6

Divided into different teams, we continue the survey and documentation. The web we are gradually drawing is enriched with known spaces and names to be referred to. Rio de los Italianos and Rio de los Venezolanos are the two rivers that can be accessed from the bottom of the Sima; together they form Ultima Esperanza (*Last Hope*), non-casual name due to the circumstances of its discovery a few days ago. The main branch continues with the Galeria de las Mil Columnas (*Gallery of a Thousand Columns*), and the name is certainly not accidental. The wall



Galería de las Mil Columnas

of the Sima is La Pared de las Mil Caras, “the Wall of a Thousand Faces”, for the anthropomorphic morphologies that are evident along its surface. The Gallery de Los Guacharos hosts several nests of this characteristic bird that usually nests inside caves. The vast galleries discovered by Jo and Cesco form now Agorafobia. In these gigantic environments the ceiling extends absolutely flat, without any intermediate support. There is no denying that in these environments you feel concerned: according to what physical principle they do not collapse? But the gigantic debris areas you meet tell a story of gigantic geological energies that sooner or later will be free again. On the other hand, the Simas are nothing but ancient galleries that were unable to sustain their own grandiosity...



Universe of Silence, March 7

During this expedition, it seems there is not an end to the surprises in store. After a short flight on Raul's helicopter in a very clear sky, we enter the cave. In addition to the technical material we have left in Kavak, Raul also brings us some fish, freshly caught.

We descend along the main branch, Ultima Esperanza: Cesco, with Alfredo and David, continue the survey, while four of us enter a large branch that starts from the Volcano, a massive conical stalagmite on the right side of the river. With Freddy, his brother Jesus and Jesus Lira, our friend and park guard, I immerse myself in an environment hard to define: the dimension suggests a salon, but it is a gallery. We advance wordless, trying to figure out where we are going. Only darkness around us, also the Scurion head lamps at maximum power seem unfit to illuminate such vastness. In short, the notes of the river behind us are muffled, then disappear altogether. We name the gallery Universo del Silencio: we overcome debris areas, lakes, opaline concretions never seen before. It is hard to choose the path to avoid damaging the mineral

jewels that stud the floor. We reach a debris area, we can overcome it, we also find another exit in a deep fracture, the Sima de Amistad: the large boulders of the bottom are green and slimy for the widespread dripping, in the distance we can hear the roar of a waterfall.

Coming back on our steps we get lost a couple of times, despite the cairns of stones set along the route. We reach the river, where we meet our friends coming back from the survey. They have also reached another exit, Mundo Perdido, adding another 1300 meters to the known cave. Together we go up the river, toward the exit, then the steep slope to the base camp. There we will have a wonderful pasta with fish sauce.

Paolino Cometti Hall, March 8

We are back to Universo del Silencio, to put on paper the dark spaces explored yesterday. Cesco and I move forward on flat floors, sometimes covered by debris. The ceilings, endless, flat and without intermediate supports, do not cease to inspire us with awe and feeling of inadequacy. We are on virgin ground, the gallery is so vast that, in comparison to yesterday, we have followed a different route. We survey for hours, then the desire to see beyond takes over...

We leave our tools and bags on a stone which, we believe, would be easy to find on our way back. Only the sound of our steps, the creak of the soles on the breach, disturbs the almost religious silence surrounding us. It is strange: silence, dark and boundless void seem to be allies to create an atmosphere of anticipation. It is during a short break that we feel it: it is still far away, almost imperceptible, but clear and precise. The sound of running water, living on the rocks that contain it, mixes to our steps. It is the legendary, coveted sound of a river. The gallery gradually widens (yes, it widens...), the floor goes down, the vault goes up. We are in a salon of gigantic dimensions. We go fast down the slope that gets lost in the lake formed by the loop of the river, and our cries of delight bounce on invisible, far walls. We follow the river for a few hundred meters, then we come back on our steps. We dedicate the salon to our big friend Paolino, who left us some years ago. Naming the underground voids after our departed friends may seem like a silly thing, but it is not: what better than our Earth can conserve their memory?

We retrace as closely as possible the outward journey, often we would like to fly above the brittle concretions that surround us. Here, time has stopped, and we, a few privileged, are given the opportunity to observe a moment of it.

On the exit ramp from the Sima we chat about caves on Mars: who, one day not too far away, will have the chance to explore them? At the camp we come back with our feet on the ground and drink to Imawari, the Gods protectors of the mountains. In the Pemon tradition they live in the caves, so we dedicate to them the whole system we are exploring.

Ropes on the void, March 10

The helicopter arrives at 11 in the morning, to take to

Kavak those of us who have to go back first. Considering the variability of the weather conditions on the Tepui, programming the helicopter flights is always a gamble, but this time we go without fail: Giovanni, thanks to the collaboration of Luca Mercalli and the Italian Meteorological Society, has provided us with almost hourly weather forecast. In fact, the day is clear and sunny, ideal for the helicopter. Jo, Alfredo, Fulvio and Jesus leave us among hugs and kisses; we were a small team since the beginning, now the cave really becomes too much for the remaining forces.

We have promised Raul to take him inside the cave, before our way back, in a few days. Raul has some back problems and for him walking down the long slope would be a little complicated. So we decide to set up a 100 m tyrolean on double rope from the edge of the Sima to the solid debris rock of the bottom, a few meters far from the entrance of the cave. Beautiful, aerial, fully functional. the only thing we do not think about is the difference between our weight and Raul's... We will think about that when we bring him in the cave with us. Tomorrow will begin the last chapter of this fantastic adventure. To optimize time, we will set an internal camp.

The Silence Camp, March 11

We organize ourselves in order to have three of us in the cave, Cesco, David and I, while the others will go back and forth to supply us with charged batteries. Given the size of the galleries, we are working with our head lights always at full power and the batteries must be replaced frequently.

We set up the camp along the Universo del Silenzio, and we survey throughout the day. With Vitto, Carla, Freddy and Jesus we dedicate more than two hours to photograph the Paolino Cometti salon. The spaces are so vast that the available light seems to be absolutely inadequate.

At the camp we will have a dinner of freeze-dried food and a deserved rest...

Řato, March 12

We are on the river, upstream the salon. A debris area has blocked our way, so we move in a side gallery. A few hundred meters, then the gallery opens on the bottom of an external pit with a breathtaking beauty waterfall. The afternoon light illuminates the long toboggan and the water spray that comes down to the boulders of the bottom. We dedicate the salon and the pit to Řato, the god of water.

"Only gods and ourselves know this place. Gods are immortal, we are the privileged". David has put into words what is passing in the minds of all of us.

Yes, we are really privileged...

The river, March 13

Last day of internal camp, we survey the river downstream. The creek is majestic, swollen by the rains that, we are told by our mates, have hit the plateau in recent days. We survey among wide bends and smooth rock bridges. We continue in the hope of reaching the resur-

gence, on the same wall of Mundo Perdido. But the vault lowers more and more, forcing us to move on our fours. There is a lot of water, and we do not know the weather conditions. Reluctantly we retrace our steps, because the situation is too dangerous. We survey by-passes and fossil galleries, meeting the disturbing prints of possible giant centipedes. Now we look around carefully before sitting down on the ground...

Leaving the Sima, our head lights illuminate Raul's helicopter that, as agreed, has joined us at the camp with Julio, Ricardo and Maritza. The camp is nestled in the clouds, the dim light of the base camp tent reaches us when we are at a few meters.

Cesco downloads the data of the Cave Sniper: over 15 km of development, the Universo del Silenzio reaches 225 m of width... fortunately we can celebrate with the red wine brought by Raul...

Tyrolean, March 14

It's half past 7 in the morning when I put my nose out of the tent, bumping into a grey and wet wall. I do not see anything, it is drizzling. The coffee (after three days without a drop of it at the internal camp) immediately improves our mood and even the weather seems to be improving. The clouds gradually thin out and the sun begins to pierce through. Today is our last day, and we have to take Raul into the cave. We go to the tyrolean, to check it and try it again. The descent is very nice, suspended among the many waterfalls that pour down from the walls. Due to a lack of ropes, however, we are forced to use a single bearing rope, and when we hang Raul to the tyrolean the system proves to be less efficient. Our friend ends up against the right wall, bathing for dozens of meters. Eventually, however, we can finally lower him, soaked and sure to climb back on foot. Raul's dream of visiting the cave with us finally comes true: we take him only in the galleries of Ultima Esperanza, but it is enough to make him understand the uniqueness of this place.

Raul's return along the debris area is slow and arduous, but nothing on Earth, he says to me, would make him hang on the tyrolean again.

At about four in the afternoon the helicopter takes off, heading Kavak: tomorrow it will return to take us and all the material.

Before leaving, the flying machine passes over the camp, a few meters above our tents. Raul greets us in this way.



The Auyan 2013 team members

IMAWARI YEUTA, THE CAVE WHERE DWELL THE GODS

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Vittorio Crobu

At the base of the west wall named Sima del Viento a vast area with debris accumulations provides access to a series of passages hidden under the line of the wall of the Sima, towards choke environments that open downward. Here a series of galleries interconnected and gradually heading north-west meet active zones like the Rio de los Venezelanos and the Rio de los Italianos, where originates this central part of the cavity. These active galleries are crossed by several fossil branches forming large lateral branches interconnected to the confluence of the two rivers. Upstream the Rio de Los Italianos we can go up gradually following the river, among gorge-shaped areas and large sandy bends, with a fairly smooth and flat roof, to large areas with accumulations of blocks on the floor. The Rio originates from the base of debris deposits adjacent to the southwest side of the said Sima entrance. A fossil gallery of decent size, traversed by a considerable air flow, detaches from here to the south, leading to another active portion of the system, viable for only a short way upstream. Downstream this river, heading south-west, we walk among large bends and ponds, up to a tributary coming from the south and the next link with Agorafobia, an immense fossil environment with a flat and wide roof, that north ward is connected to the Rio de los Italianos. Proceeding now downstream, among beautiful morphologies, we reach the Rio Saul Gutierrez, always slightly downhill. The creek runs through a wide gallery with large accumulations of guano on the side, that continues with stretches of flat floor and soft

forms of erosion on the rock. The water flows beside spectacular nests of Guacharo (*Steatornis caripensis*), drum-shaped and often placed directly on the floor or, more often, on the side. Here we are just a few steps from the way out that allows us to go outside through two entrances into the deep Grieta de los Guacaros, while we lose the Rio, concealed by the blocks. Returning to the central part, continuing toward west over the Confluencia, we walk along the collector of the Rio de las Mil Columnas, with its bridge-shaped formations and columns, arranged along various parts of the active gallery to form strange figures and picturesque landscapes. The river proceeds, after a mild descent, with a floor of smooth rock with multicolored veins. Along the way we meet various fossil branches coming from the right, that open up on the north on a vast fossil area called Tierra de los Volcanos. Aside from the intersection and continuing northwest downstream, the river intersects a wide debris area above it, leading us on large blocks lying on a nearly flat floor and formed by a collapse of the ceiling. Huge salons with flat ceilings, divided by bumps of collapsed material, lead us outside again through a debris area and a short re-ascent among the blocks, below the line of walls called Mundo Perdido. Returning backwards and entering the Tierra de Los Volcanos, among large stalagmite formations of iron hydroxides, many stunning views open up, with ceilings that extend flat on huge and interconnected environments that in some places reach widths of hundreds of meters. The floor is



The huge Paolino Cometti Hall, 180 x 250 meters



Mammillary formations on the ceiling of Universo del Silenzio

occupied by large angular blocks covered with gypsum crystals and opal formations, while lakes of crystal water occupy the lowest-lying areas. We have reached the Universo del Silenzio, a huge tangle of fossil galleries where we proceed with the use of our compass, up and down collapse hills due to the subsidence of the ceiling, entering progressively into the northern portion that occupies the plan of the cave. Environments that are not well definable stretch in every direction, making it difficult to get oriented. The floors present, now and then, delicate speleo-themes. Heading northeast for about a km we reach an entrance area opening at the base of a deep crack. While to the north we enter progressively into a huge environment (Salone Paolino, 270x170 meters of surface), with a ceiling about 30 meters high crossing the central axis of the Collector de Noroeste, the most important river met in the system. Going upstream, we proceed on a vast active gallery with huge debris deposits placed in the area adjacent the Gran Derrumbe. A lateral gallery with a strong air flow departs northwards from the main branch leading to the Sala de Rato, large and almost circular, with a huge purple lake including a waterfall about 70 meters high that comes from the outside. The Collector de Noroeste descends downstream toward west through large halls and parallel galleries. The area is extremely labyrinthine and all the sections of the galleries reach at least in one point a width of almost 300 meters. The river flows in the eastern sector, forming rapids and large lakes. While to the west the fossil conducts develop gradually to higher levels, like the Galeria Flores de Monica, literally covered with spikes of chalk. Continuing in the active zone we come to a vast debris area that lowers the ceiling significantly. This stretch can be overcome on the left going up in a

large lateral gallery that soon descends on the river. The exploration has been interrupted in a very large crawlway, always less than 1,5 meters high and over 40 meters wide, where the river flows dangerously.

The 2013 Auyan expedition

February 27 – March 19, 2013

Northern-eastern area of the Auyan Tepui, Canaima National Park, Estado Bolivar, Venezuela.

Participants: Virgilio Abreu, Alfredo Brunetti, Carla Corongiu, Vittorio Crobu, Antonio De Vivo, Jo De Waele, Fulvio Iorio, David Izquierdo, Jesus Lira, Francesco Sauro, Freddy Vergara, Jesus Vergara, and the pilots Raul Arias and Julio Testaferro.

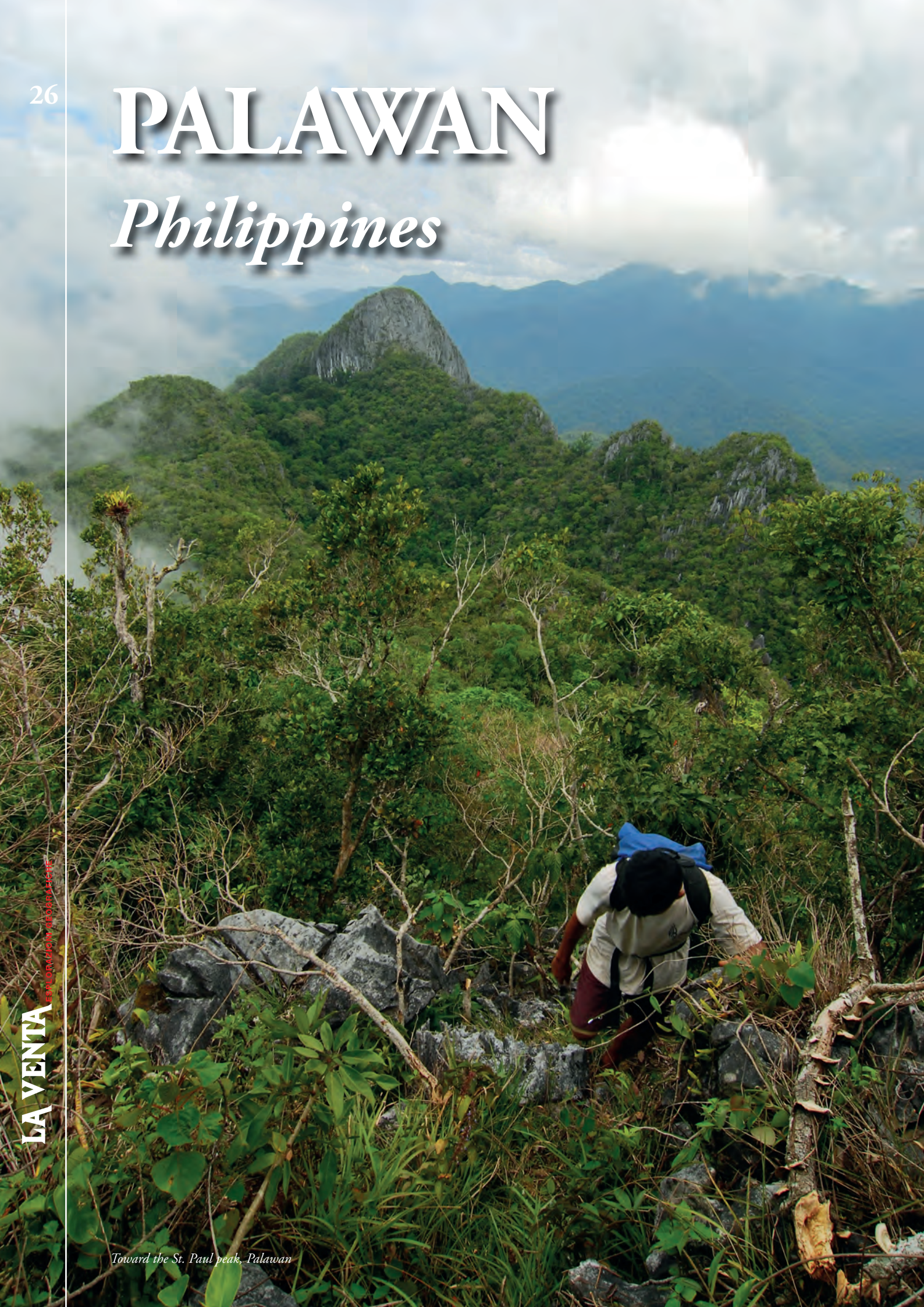
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PALAWAN

Philippines



LA VENTA

ESPECIALIZADA EN REPORTAJES

Toward the St. Paul peak, Palawan

ON THE SUMMIT OF THE EMPTY MOUNTAIN

Antonio De Vivo

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LA VENTA

ESPLORAZIONI GEOGRAFICHE

Almost thirty years have passed since the first time we visited the Mount St. Paul karst area, on the island of Palawan. A 1028 metres mountain which contains one of the most extraordinary caves on Earth: a seven kilometres long underground river which empties into the ocean and a maze of large fossil galleries which are inhabited by hordes of bats and cave swallows (*balingsasayao*). It's a wild place, of stunning beauty, which has been a Philippine National Geological Monument since 1971 and in 1998 was added to the UNESCO World Heritage List.

Back then, the fishing village of Sabang consisted of only a few houses, no tourist structures: A paradise... After that first visit, we returned many more times, mesmerised by the idea of being able to discover, piece by piece, the secrets hidden inside the St. Paul Dome: a limestone mountain which had never been climbed, which could contain higher entrances and thus allow great vertical explorations, down to the underground river and then to the sea.

For years we tried to find the massif's weak point, but we were always turned away by the character of the terrain, full of cracks and holes. It was like trying to cross a crevasse field near the front of a glacier...

Now we're here again, at the end of yet another wonderful expedition, with a few days to spare and the old dream which continues to haunt us unceasingly. This is a special year, the 150th anniversary of Italian unification,

and we just dedicated the kilometres of new galleries we discovered inside the Underground River to that event. It would really be exciting to crown the expedition with St. Paul's summit.

It is early morning on March 19th when we reach Kwago, the entrance station to the park located to the south of Sabang, along the only road which connects this area to the capital, Puerto Princesa. The road is nearly all concrete now, but until a few years ago travel was strictly limited by meteorological conditions: during the rainy season, the long dirt road through the forest became a river of mud and Sabang was accessible only by sea.

There are six of us: Daniela, Silvia, Giampaolo, Marco, Leo and myself. The other expedition members are heading for the eastern part of the massif where in past years we discovered some vertical cavities, among them Nagbituka, which is currently the deepest in the Philippine archipelago.

Our Philippine friends are there waiting for us: Manny (Manduran), nicknamed Jungle Bear, Ernie, Rinaldo, Joel, Felipe, Bienvenido and Bonbon. The route which awaits us is partly the same one we followed during the first days of the expedition, when we climbed the steep slopes of the southern flank to reach Binang Bangan, a gigantic entrance which is clearly visible from the sky as well as from below and which had tickled our imagination for years. The effort spent forcing a way through the tangled and thorny vegetation and the scrambles over



Looking for the way to the peak



Baraba camp

tall collapse blocks wasn't rewarded: Binang Bangan was only a huge cavern without any hope of a continuation. I still carry a strong reminder of that place. After exploring the big entrance, we found a small opening a couple of metres up, close to the camp. A nice cave, with unexpected concretions and some bats. It was reachable fairly easily by using a large hanging root: coming down, I jumped and landed with a foot in a hidden hole. My knee creaked and the following hours confirmed that I had at the very least a serious sprain. I passed the next day at the camp, frustrated by not being able to continue the expedition and then descended into the valley with a lot of care and pain. The loving care of my female expedition companions and a massive dose of the first aid kit pain relievers then slowly reduced the damage. Now I'm here, repeating to myself and to my knee that the climb up St. Paul is doable...

We start the long walk carrying heavy backpacks, slightly helped by walking sticks, meeting *carabao* slowly dragging their long sleds through the path, which is deepened by their repeated passage. We pass the village of Bayatao and continue on towards Kayasan. On our left, on the cliffs of the Layag massif, we notice a large entrance, which has never been reached and would certainly be difficult to attempt. From Kayasan we head north, slowly approaching the St. Paul massif. After eight hours we reach what will be our base camp for the summit attempt. A flat area, very beautiful, between widely spaced large trees to which we attach our hammocks, for protection against the many insects but which will still allow

us to enjoy the wonderful noise of the tropical forest. Our Philippine friends tell us that the place is called Baraba (the place of rattan) and its proximity to a small spring really makes it an ideal camp. The fire which our companions lit creates a play of light and shadow which completes the magic of the place...

Among the many sounds making up the tropical symphony, which accompanies our frugal dinner, the chirping of crickets dominates all else. Before giving in to tiredness and fainting into our hammocks, we try communicating with our distant companions with the satellite phone. But we're in a very closed area and the few visible satellites aren't able to make a good connection. We try to fix that by extending the antenna with a stick and, incredibly, it seems to work. We exchange just a few words, but enough to say that all is well.

March 20.

The first light is filtering through the tree canopy when some noise starts making its way into the hammocks, becoming progressively louder: it is the call of the green crickets, which is more like the horn section of a big band than the classic chirping we're used to. It's Manny who tells me that they're crickets: it seems impossible that such small creatures can produce such a powerful sound.

We divide into two groups: Leo, Silvia and Daniela head towards what we call "il morso" (the bite). It's a large entrance which is clearly visible on the cliff of the second peak, right above our camp. St. Paul in fact has two distinct summits, one at 962 m and one at 1028 m.

Giampaolo, Marco and I try to find our way up to the main summit. From this point on, everything has to be improvised, since not even our Philippine friends have come this far and, as often occurs, in these cases it's easy to make a mistake and end up on impassable tracts. My use of "impassable" isn't coincidental: we read it for the first time on a topographical map of an area not far from here, the Maros Karst on the island of Sulawesi, in Indonesia. Many parts of the map were marked as "impassable". Tropical and equatorial karst areas are considered to be among the most difficult to travel and the St. Paul is an excellent example of that.

The first try brings us directly to a vertical cliff. We trace our steps back and try to climb the ridge with the intention of then going from one peak to the other. We climb nearly vertically on sharp and movable rock blades and vegetation that hides everything. Everything is unstable, dangerous, we can't lose our concentration. With great difficulty we reach the crest and continue. Below us we see "il morso" and then the view opens. An extraordinary spectacle, between the two peaks: the 1028 before us, to the north and the 962 behind us, to the south. We're very happy to be the first to have climbed up here. We continue between sections of naked karst and thick vegetation. At 3 p.m. we stop, above the deep saddle that separates us from the two peaks. The St. Paul is there, in front of us, but unreachable from here... In a couple of hours we're back at camp (going back along the opened way is much faster than opening it...), where we meet our companions. They also don't have any great news for us, "il morso" is just a large collapse, similar to Binang Bangan. But once they returned to camp, they tried another way towards St. Paul, attacking it from the east. It's a way hypothesised by Leo by studying aerial photographs and topographic maps: they tell us that the part they covered was fairly easy. Tomorrow we'll make a last attempt, the last by necessity since in two days we're flying home...

March 21.

First day of spring, cheered by the cricket orchestra and by the hope of achieving our old dream. We hope, but don't believe in it too much. It seems impossible to be able to solve the riddle of the climb in a single lucky day. We advance in a long line, six Italians and six Filipinos: as long as we're walking outside the limestones, progress is easy, but sooner or later we'll have to enter the karst chaos. Leo's great idea is just that: try to climb up the metamorphic areas as long and as high as possible... We climb up a gully on the left, which brings us to a suspended valley much higher up. The entrance of the valley is flanked by a majestic tree, probably a *dao*, which we call "The Guardian" because it seems to guard the silence of this magic place. The valley rises gently, the atmosphere is suspenseful: we advance, a bit incredulous that we haven't yet been rejected by the mountain... We're above 700 m and the valley unveils a surprise: a sinkhole, an upper entrance to who knows what system, whether the PPUR or another totally unknown cave. It's been since 1989, from the first helicopter flyover, that

we've kept on considering the possibility of finding high entrances of the underground system. Enter from above, descend along pits down to the river, then reach the sea paddling the *bancas*... This could be the way, but we'll have to come back, now we don't have the time or the necessary equipment.

After a few hundred metres we leave the suspended valley and go left, towards the ridge. The climb is slow and exhausting, by now we're on the limestones. Ernie performs miracles to open a way through the thick vegetation and finally we're on the ridge.

The last 200 metres of elevation are marked by a constant reading of our position on the GPS, nearly every ten metres. Incredulous and happy, we climb onto the fore-peak, then we move on to the higher peak on exposed rock blades on which it's difficult to keep one's balance. Leo and I are ahead, the others have let us go on: an honour due to how much we've dreamt of this moment. We embrace each other, then take group pictures with the Italian flag belonging to my mate's grandfather. It's the 150th anniversary of Italian unity and I have brought it along with the hope of using it just for this occasion. We place the geodetic nail, 1028 m elevation.

We return to camp, as it's almost evening.

We're so happy, that we "save" the large scorpion that had decided to keep us company while cooking dinner. As it is a rather disquieting companion, we capture it and put it in a jar. Tomorrow we'll set it free, before heading back down.

Today is a day for celebration, also for him...



On the peak



Along the touristic section of the underground river

PUERTO PRINCESA UNDERGROUND RIVER: A SHOW CAVE LIKE NO OTHER

Paolo Forti

Almost all nations in the world possess caves that are open to mass-tourism and, although no one has ever come up with an actual list, it is reasonable to assume that they number in the thousands, possibly more than 10,000. Of these, more than a thousand receive tens if not, hundreds of thousands of visitors per year, bringing the total visits to over a hundred million worldwide.

The vast majority of show caves have undergone varying levels of 'modifications' to accommodate their use as tourist attractions, such as the creation of walkways, the widening of narrow passages, possibly associated to the partial destruction of concretions, and the installation of artificial lighting systems characterized by various degrees of intrusiveness. At any rate, the natural environment of these caves has been altered beyond recovery, even in the event that the flow of visitors should cease in the future.

We should also mention, however, that there are a number of caves open to the public in which none of this has taken place; these are usually small caves, in which it is the visitors who have to gear up for their (speleological...) tour. Still, the cave suffers the impact of being a tourist destination: the creation of beaten paths by the repeated walking along the same areas, the impossibili-

ty of preventing the visitors from stretching a hand to touch the walls—or worse still, the concretions—and the constant bringing of dust inside it...

From this point of view, the Philippines' Palawan Cave, known as Puerto Princesa Underground River (PPUR), is an absolutely peculiar case. Here tourism began more than twenty years ago, and now brings in more than 200,000 visitors per year along a path of about 2.5 kilometers. And yet, inside it there are no natural or artificial walkways, no artificial lighting, not a single footprint has been left by a tourist. Zip, zero... the dust problem is non-existent, as well; not a spore nor a pollen grain has accumulated inside. How is this possible?

Surely, part of the merit goes to the managers of the cave, and of the surrounding Natural Park, and their decision to preserve it in its natural state when the decision to open it to the public was originally made. However, to tell the whole truth one has to acknowledge that most of the merit goes to the cave itself: a huge underground estuary, navigable for more than five kilometers, ending in a lagoon which is in direct contact with the open sea... No widening of the passages, then, no walkways or handrails; tourists are brought in by purposely-designed canoes with outriggers (called *bancas* by the locals) pro-

pelled by ores. The boats always remain at a distance from the walls, so no direct contact is possible, and the cloud of particles that surrounds the tourists is taken down by condensation. This latter phenomenon happens in most touristic caves, but in this particular instance dust ends up outside in the sea, due to the combined action of the tide (that can be felt even five kilometers from the entrance) and the constant flow of fresh water from the river.

There is another aspect of PPUR that likely makes it the least vulnerable cave in the world. One of the main risk factors that threaten touristic caves is the warming (temporary or progressive) deriving from the artificial input of thermal energy; part of which obviously originates from the light fixtures, while the rest comes from the tourists themselves. In other large touristic caves, the former aspect of the problem has been partially solved, or at least eased, by the use of 'cold' light sources (and, more recently, by switching to LEDs) or by splitting the system in sub-sections in the different parts of the cave. Of course, this is a non-issue inside the PPUR: no light, no energy input. The heat carried by the tourists themselves is also irrelevant, not only because this is one of the hottest meteoric caves in the world –and therefore the transfer of heat from the bodies of the visitors to the cave is minimal– but also because PPUR is characterized by a “very high energy”. As a matter of fact, it is likely one of the world's highest energy caves.

Where does such a large quantity of energy come from? Mostly from the tides, that four times a day cause the movement of tens of thousands of cubic meters of water; besides, inside the cave strong winds push large masses of air (in excess of 150 cubic meters per second) and this, due to the presence of temperature gradients, leads to the formation of actual clouds. To all means and purposes, one could say that the weather inside PPUR is constantly “stormy”.

The combined effect of tides and internal winds leads to energy levels in the order of 20-25 megawatts, comparable to the output of a medium-size power plant.

But there is more; the presence inside the cave of millions of bats and birds (salangane), with the consequent production of large amounts of guano, supports a complex food chain that also comprises numerous aquatic species. Such ecosystem provides a relevant, albeit hard to quantify, contribution to the energy balance of the caves, mostly due to the degradation of biomasses through decay (oxidation) reactions.

Should one consider solely the energy balance of the cave, PPUR could receive a very large number of visitors; in other terms, it would be the cave that every tourist board wished to have... or would it?

Not quite, as there is another factor to be taken into consideration and that is the interference caused by tourist flows to the colonies of mossy-nest swiftlets and bats that live in the cave.

For the former, tourists and birds do not really meet, and the swiftlets leave the cave to go hunting early at dawn and return at dusk (at any rate their nests are locat-

ed deep inside the cave, well beyond the visitors' area). Therefore, in the event of a future increase in the number of visitors the only strict rule that will have to be enforced is to begin the tours not too early in the morning and stop them not too late in the afternoon.

For bats, however, the situation is reversed, as their lifestyle follows a completely opposite schedule: they leave the cave at dusk and come back at the crack of dawn. In this case, the overlap with the visitors' presence is complete, also because bats remain within the first 500-1000 meters from the entrance, i.e., in the dead middle of the tourist area. There is a real danger that an excessive number of visitors could disrupt the daily rest of these animals.

The Park guides have reported that in the rare instances in which the number of visitors reaches or exceeds one thousand, a certain number of bats wake up and fly away from their resting spots on the ceiling. Hence, it appears that the presence of bat colonies is the actual 'critical factor' dictating the maximum number of daily visitors and it is unlikely that this value will change much in the future. Marginal increases could be obtained by implementing stricter regulations for the initial part of the cave, such as a ban on talking, photography with the flash, or otherwise illuminating the ceiling. Still, the principle remains the same.

This fact does not represent a loss in economic terms, though, quite the opposite. In fact, Sabang's Natural Reserve is included in UNESCO's World Heritage List and, thanks to wise long-term planning of Palawan inhabitants and authorities, the whole area surrounding the St. Paul karstic massif has remained pristine. Despite the dramatic increase in the number of tourists, the environment is the same as thirty years ago, when only explorers arrived to visit PPUR. No road has been opened, no landing has been built near the cave, no power line has been laid; even now, the entrance of the cave is ruled by monkeys and monitor lizards.

It is in everyone's best interest, chiefly and foremost for those who are responsible for managing the tourism in Palawan and PPUR, that this situation remains unchanged. Creating a road leading to the entrance of the cave (something that is now being asked for by the tour operators of the Capital) would destroy what is now an intact stretch of tropical forest, with unavoidable consequences at the UNESCO level. Besides, far from bringing an increase in tourism revenues, it would instead deal a mortal blow to Sabang and to the businesses that, in the most environmentally conscious way, live around PPUR, the only tourist cave in the world that is still in its natural state and has not been adapted in any way for receiving visitors. For this reason, La Venta Association, which has been exploring Puerto Princesa Underground River for more than twenty years, as well speleologists must support the personnel of St. Paul Park to make sure that not only PPUR remains the natural heaven it is now, but it becomes a worldwide example of eco-compatible management of a tourist cave and of a pristine territory with an exceptional, if fragile, ecosystem.

GAETANO BOLDRINI

The descent from the Árbol de Navidad

I'm sweating, but it not because of the heat. Sitting on two large bags, containing the ropes I'll have to take with me, I wait for Tono and Topo to give me the green light to begin my descent. It has been two hours since they disappeared beyond the edge.

*the resurgence of Arbol de Navidad*

I'm sweating, while I look at the small tree to which the rope has been tied, and I wonder if I'm doing this for real. The other wall of Sumidero Canyon is far from here, and the slow-flowing river at its bottom is farther still.

A hummingbird hovers in front of me, like a helicopter; then it noses up, before diving down. Down, it is a seven-hundred-meter vertical drop; down, it is that strange mix of fear and joy. It is the demarcation line between visions and reality, the border between excitement and humility; it is the rope that, like a spider thread, unravels for five hundred meters along the wall to the entrance of the cave. Down, it is the waterfall that from the cave crashes for two hundred meters more into the river. Down, it is what I have had not had the courage to look at, because I am scared.

In *Dune*, Frank Herbert wrote: "Fear is the little death that brings along total obliteration". I am sweating because I am scared: scared of climbing over the edge and talking to my ghosts; scared of finding myself clinging to

a karabiner, without being able to go up or down; fear of flying off, forever, and stopping doing what I like. Yet... *this* is what I like!

Stall.

This magical place is called Árbol de Navidad: the Christmas Tree. How many times have I seen this gigantic concretion, its roots in the river's waters and its top in a cave, two-hundred meters higher up. How many times have I taken photos of it, how many...

"Crr, crr". The radio crackles with static, then Topo's voice: "Clear. You can come". "Ok, I'm coming", I reply. Now I can only descend. I have two bags of ropes, and I'll need them all, together with the little self-pride I have left.

One step, two steps, and I am on the edge. I rig the descender, not looking down; I feel nauseous, stare at the wall. I begin my descent; rock, twig, rock, small tree, rope, rock. They all follow one another for twenty meters, sliding upwards. First rebelay. The rope shoots straight to the right and ends on a spit-bolt hammered in the middle of nowhere. I stretch horizontally, reaching as far as possible; I reach it. Damn Topo, how the hell did he manage to hammer it so far?

Ok, I managed to hang my longe to the anchor. I pass the rebelay and continue my descent, a vertical drop of seventy meters until the next spit. The twisted rope makes me rotate: rock, little tree, rock. The void. Another stall, this time it's terminal. My back is to the wall, I have a full vision of the canyon: pure void. The unavoidable curse of law of physics forces me to stare at the void, inside me, outside me.

I scream; it bounces around in the canyon and comes back to me. Fear has melted away, only joy is left. I am sweating, but now it is because I'm hot.

*Canyon del Sumidero*

GIOVANNI BADINO

The Urals

The Urals are a mountain range that separates Asia from Europe: there are endless woods of birch, pine and fir trees, but especially rich mines of all kinds of metals, and caves.

The Urals, September 2012

Northern Urals, 600 kilometers north of Yekaterinburg, on the eastern side of the chain, at a latitude of 61°. In the sixteenth century Russia conquered this area, once inhabited by the population of Mansi, that is now almost completely lost.

It was -and still partially is- a concentration camp where the prisoners used to work in the mines or, right here in the Ivdel area, cutting trees.

This has made the area relatively accessible with off-roads vehicles, and has made it part of the world of speleology. In this area there is a strip of less thick limestone, 3-5 km wide and extending from north to south for more than 100 km. The speleologists from Yekaterinburg have worked here since 2007, and so far they have retrieved a few dozen cavities, the largest, the "Severnaja" being about 3 km long.

It is the object of a sparing touristic interest for hunting, for skidoo rides and now for speleology.

Two years ago, the base area for the excursions (Vishai, a valley occupied by a prison camp until 1990) was rav-

aged by a fire that destroyed the infrastructures, that are now slowly being rebuilt.

We arrive in the evening of January 3, after a 12 hours journey from Yekaterinburg . We are four speleologists, to make some sampling and survey in this season. The night is deep, and on the other hand the day (usually a twilight) lasts less than six hours, and this will limit much our actions.

The temperature is "rather cool", -35 °C

We set our camp in one of the structures, while in a side caravan there is a Polish former deportee who has adapted to these places and works as a guide, and just below there is the house of the general manager. The next day we hasten to complete the logistics and take a ride in the area, it is deadly cold. The region seems to be an ancient plateau cut by rivers that have carved out a world. The caves, both here and where we are going, are generated by leaks of the rivers and are generally accessible from their own banks.

Here and there, there are the remains of reticulates and writings, at one point there was a cave where the prison guards used to get drunk and then was blown up.

The next morning (the sun rises at 11...) it is luckily "warm", -25 °C, so the trip on skydoo will be bearable. Casimir, the guide, unloads us an hour and a half later at about 15 km to the south-west, in the mountains, and soon we rush into the woods and then down from the plateau to the river before nightfall.



Speleo journey at 61° N in the winter



Ice near the second entrance of Severnaja

Half an hour walk in the snow and then Genja begins to rummage in the middle of the fallen logs at the base of a small wall, until he opens the entrance of the cave that will host us for two nights. The Severnaya, in fact. The entrance is very narrow and it swallows violently the now nightly air. We take the material in and then we come into a wide gallery covered with ice deposits. A little further there are plain zones and, most importantly, liquid water.

We set the camp and go for a walk in the cave, truly remarkable.

First of all it is warm, about +5 °C and this is interesting in itself, because the average outdoor annual temperature is about -1°C The fact is that the precipitations here take place especially in the summer (the winter is so cold that there is little water vapor in the air, so it snows very

little), and then the seeping waters are “hot”...

This, incidentally, makes walking on the frozen river dangerous, because here and there are “hot spots” that can play tricks.

In addition, the cave is occupied by beautiful snow-white concretions, that are very, very recent. I have the impression that there has been some recent change (acid rain or the like), which has renewed the look of this cave, otherwise muddy.

In a couple of points we get closer to other entrances and it seems to come into another world: the temperature plummets dramatically, everything is covered with ice, it seems we are getting close to the lair of a monster.

A long night goes past and we go out in the ice to make a tour of the surrounding caves. We visit a lot of them, occupied by water in the summer, now by ice. In one of them, in a side branch in the middle of the ice, bitterly cold, there is a deep pond of liquid water: evidently it is a window on the waters flowing into the mountain.

In another one there is a structure of wood; Casimir will tell us that the deportees made to secure a goat they had captured.

Another is full of cut logs. I am reminded of the beaches in the Svalbards, where you find many of these same Siberian logs, cut decades ago, stranded after descending huge rivers and crossing the Arctic Ocean. It was from places like this that they have begun their journey.

We conclude the short day with a visit to a spectacular natural double arch, then we return in the heat of the



The frozen river that formed the karst system

Severnaja cave.

The next day a couple of survey trips in the cave and then some photos from the plateau finally in a bright sunny noon, 6° from the horizon. In the distance we see forests and snow, limestone and endless karst in an immense space.

Then the sound of an engine approaching announces that our free time is over.

The Urals, June 2013

This time, thanks to an invitation received from the Academy of Sciences and the University of Perm, we should have visited, in the Northern Urals, a huge bauxite mine, where there are strange very deep karst phenomena, about 1000 meters (3300 ft) below sea level!

Unfortunately, due to an unexpected surge of bureaucracy, we are denied the permits at the last minute... Fortunately our Russian friends immediately show us an alternative program that will be very interesting anyway. They take us to visit the famous Kungur Cave, a large gypsum cavity, already famous in the mid-eighteenth century for the internal crystallization of ice. Then we descend into Ordinskaya, maybe the most beautiful submerged gypsum cave in the world, where operates a very important speleo diving school, because it prepares to dive at prohibitive temperatures (2 degrees in the water and -15 in the air!!!).

Finally, a quite long transfer by car takes us to Bashkiria to visit the world's larger underground glacier.

Finally we spend an evening on the far side of the underworld, at the local caving club.

“Caves have much more than three dimensions, and therefore they have many depths, even though we are usually accustomed to consider only the vertical one, the maximum distance between the extreme points accessible to us. But if we look more deeply, as at the cultural depth, the Askinskaja cave, at one hour's drive from here, is much deeper than Krubera”.

Surprised silence, Askinskaja for them is a semi-show cave where no speleological enterprise may be carried out. In fact they ask us why we have come here for this cave.

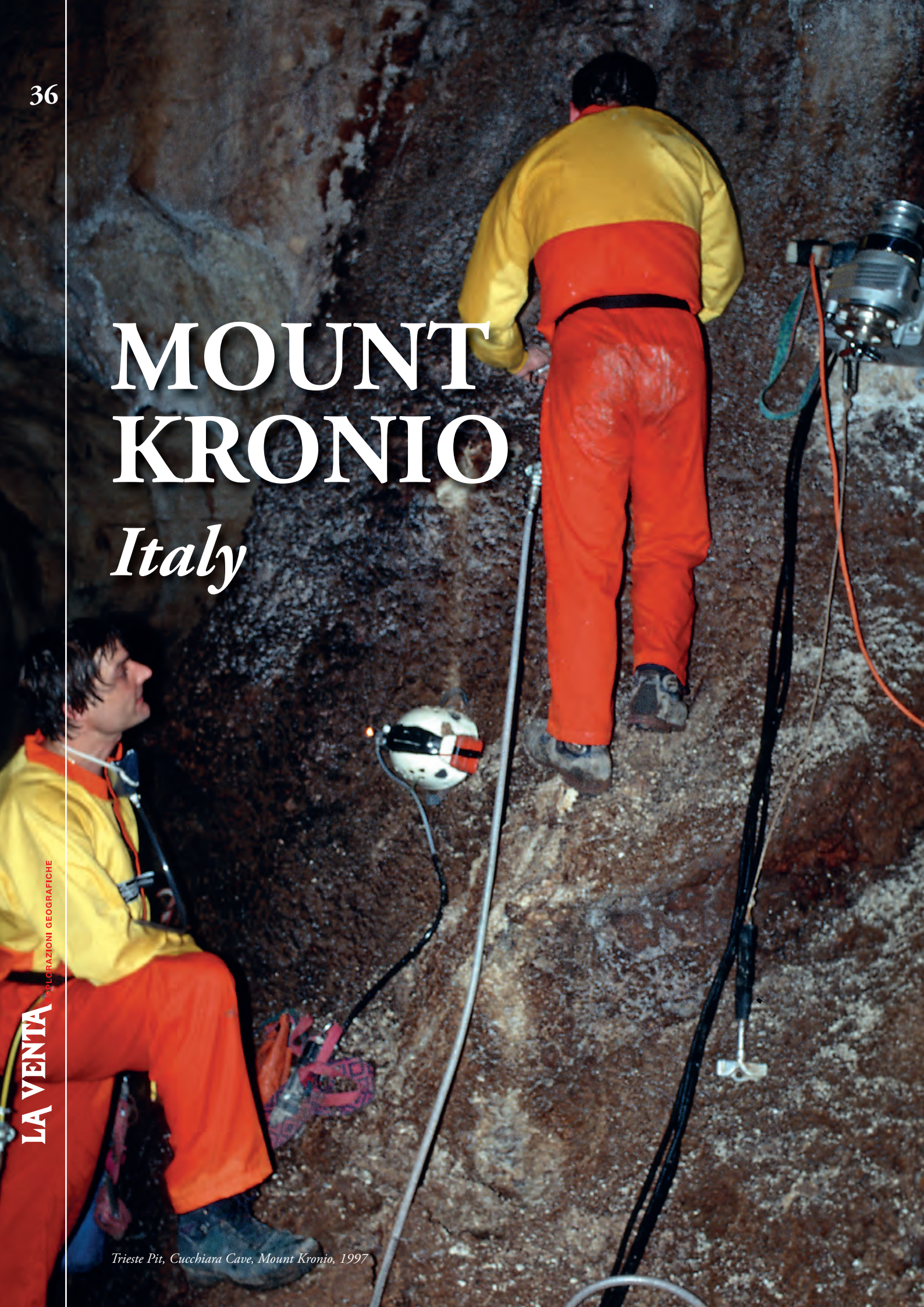
“Askinskaja contains what, reasonably, is the largest underground glacier in the world. The fact that it is made of very large crystals indicates that it is very old. Everything that came in there has been tapped and preserved in a perfect way. And it is still there, just beneath the surface studded with odd shapes that perhaps echo the underlying archives. That is not only a glacier, it is an immense library of the past of this area, a multitude of accumulated books that no one has opened. And you wonder why we have travelled so far to see it? We have come so far to let people know of the existence of this library and of its untouched books.”



General view of the underground glacier of Askinskaja cave

MOUNT KRONIO

Italy



ESPLORAZIONI GEOGRAFICHE

LA VENTA

Trieste Pit, Cucchiara Cave, Mount Kronio, 1997

STUFE DI SAN CALOGERO: THE EVOLUTION OF THE EXPLORATION TECHNIQUE

Pino Guidi – Louis Torelli

Introduction

Le Stufe (*Stoves*) di San Calogero are a complex of caverns, formed by slides, pits and galleries traversed by hot steam, located on Mount Kronio, situated in southern Sicily. Known since the most remote antiquity, they appear to have been used at first for cultural and then for healing purposes since immemorial time: from the setting up of the Greeks, according to Diodorus of Sicily, and later by the Romans.

On the top of Mount Kronio stand a monastery and a temple dedicated to the cult of San Calogero who, according to the tradition, restored the thermal baths driving away the demons.

The mountain consists of dolomitic rocks of the Triassic. The southern slope is affected by several faults that have resulted in steep walls where several cavities open; at the foot of the mountain the talus debris covers the fault contact between the dolomite and the impervious cover formed of marl and clay. The northern side gradually slopes down to the Portolana valley, then up again to Rocca Ficuzza, 901 m high.

From the group of caves next to the top come out currents of warm, moist air condensing into columns of steam up to 20 meters high; hot air comes out also from other chimneys, for the most part not viable. The whole plain below is affected by a layer of mineral water with a temperature ranging from 32 °C to 56 °Celsius; part of this water is used for therapeutic purposes at the Baths of Sciacca.

While in the prehistory the Stufe appear to have been traversed by man up to the lower galleries - documented by the presence of vessels and depositions in Di Milia and Bellitti Galleries - from the Middle Ages onwards, only the upper caves, those with a direct communication with the outside, have been frequented.

The presence of hot steam (37-38 °C on average) and moisture to a condensation level is a very convincing deterrent. Medical studies conducted later have shown that an excessive sweating - loss of two to three litres of sweat with stays longer than half an hour - deprives the body of salts essential for metabolism resulting in tachycardia, tachypnea, heat stroke and, finally, collapse.

The first explorations

At the Stufe, the first attempt to go down the slide that overlooks the initial pit, where, at its end, branch off the lower galleries, dates back to 1903, when Raffaele Di Milia tried to accomplish it with the help of a rope. In 1942 there was the first speleological expedition: L. S. Medeot descended, using a steel cable ladder, part of the pit, but he was rejected by the hot steam that prevented any perspiration, so he risked to faint.

In January 1957, Medeot came back to the Stufe with

the speleologists of the "E. Boegan" Cave Commission. Using steel wire ladders with wooden steps they reached the bottom of the pit and discovered the *pitthoi* (antique Aeneolithic vases). In the wake of the discovery, also the archaeologist S. Tiné wanted to descend but he fainted during the ascent for a heat stroke due to the prolonged stay in the cave. He was saved by the timely intervention of G. Coloni, who almost dragged him outside.

The air suits

The discovery of the vessels and of the archaeological deposits gave to the exploration of the internal part of the Stufe not only a speleological but also an archaeological value. The descent with traditional techniques, however, had proven to be too dangerous for the scarce perspiration that caused an heat stroke followed by collapse. After a series of medical experiments in a Turkish bath, it was decided to solve the problem adapting the divers' technique to speleology. So were made suits of a thick canvas used for sails and trucks covers, provided with a hood with a glass visor. The cooling of the speleologist was done by blowing dry external air (10/15 litres per second), brought to the cave by using $\frac{3}{4}$ inch hoses of rubberized material (those commonly used in the industry). Every ten meters, they had a hub connected to a rubber tube of smaller diameter, ten meters long, joined at its end to the suits with a separate valve mouthpiece, part of the air entering into the suit at the waist and part in the hood. In this way the speleologist had a range of



Stufe di San Calogero, 1957



Stufe di San Calogero, 1958

ten meters from the axis of the main pipe and the ability to connect with the next junction.

This solution, tested under medical supervision in a Turkish bath, proved up to the task, despite the weight of the suit and its rigidity would lay more of a problem. But a decade later two of these suits, recovered in the warehouse of the Commission, were adapted and used for the exploration of the Gortani Abyss by Mario Gherbaz and Adelchis Casale, who got down, exploring, to nearly -700 meters (2300 ft). The 1958 expedition managed to fully explore the Di Milia Gallery, to perform an initial quick survey and to document the archaeological deposit. Among the flaws that emerged in that expedition, as well as the weight and the size of the suits, very rigid, there was also the irrationality of the glass visor, which steamed up soon, and the unsuccessful clutches of the pressure joints, too delicate and prone to clogging with mud.

The suits become lighter

Four years later was organized an expedition with newly designed suits. They kept the 1-inch mother-tube conveying below the air produced by a compressor placed outside, and the small connecting tubes. But the suits were now of normal cloth, one-piece; the hood with the visor had been eliminated and replaced by a mask covering mouth and nose where, through a corrugated tube, went part of the air blown into the suits. It was a huge step forward, the new materials not only allowed a stay at the bottom far more protracted than the previous ones, but they were also a lot less tiring for the operators, particularly in the ascent on the *cave ladders*, small pits (of 7, 5 and 13 meters) leading to the lower galleries.

In 1974 the pits leading down were equipped with a fixed wire ladder, built to measure. For that work - that engaged the speleologists for several days - were adopted suits made on the patterns of those used in 1962, again with the mouthpiece but with the clutch on the connecting pipes simpler than those used previously. Thanks to the fixed ladder and the new suits, the Di Milia Gallery was examined in depth allowing the discovery of a large lateral branch, the Bellitti Gallery, also interested by the presence of prehistoric artifacts. In the remaining time the search was extended to the rest of the mountain, identifying the Cucchiara and Gallo caves. The latter is strongly blowing while the first, besides being blowing (30 km/h) (19 mph) is interested, in its interior, by a mixture of hot and cold air currents. In 1978 an explorative trip to Cucchiara led to the discovery of a large internal pit, over a hundred meters (350 ft) deep, the Trieste Pit, from which rises hot air (39.5°).

Space Intermezzo

To find out what was on the bottom of the Trieste Pit, in 1979 we organized a new expedition. To descend the pit, equipped with a metallic crowbar to lower the speleologists directly on the bottom, Mario Gherbaz designed a new suit with an aluminized material on the external surface. The clutches for the air (ventral, pectoral and snorkel) were connected to a speleo-diving cylinder. His idea was to take advantage of the reflective surface of the suit to disperse part of the heat while the air of the cylinder would have to compensate for the amount blown outside. It was not like so, because the



Stufe di San Calogero, 1958

cylinder got discharged before reaching the bottom of the pit; the suit seemed not to have fulfilled its function.

End of the century expeditions and equipment

The speleological and archaeological interest for the Kronio underground complex brought back several times the speleologists from Trieste: in 1984, 1986 and 1991, again using light suits ventilated with air blown inside. The heavy mouthpiece, fed by a large corrugated tube, was now replaced by a plastic one, much lighter and easy to handle, connected with the cooling system via a small tube, again made of plastic.

The last expedition of the short century, in 1998 - the eleventh for the "E. Boegan" Cave Commission - managed to reach the bottom of the Trieste Pit. The light suits had been improved again by creating in them a network of small tubes for a more rational distribution of air. Outside it was conveyed from the compressor - placed on the forecourt of the Stufe, a hundred yards above the entrance to the Cucchiara. - with the usual industrial $\frac{3}{4}$ pipes of rubberized canvas. The tubes inside the caves were still of $\frac{3}{4}$ inch, but made of plastic, lighter and more maneuverable. This time the speleologists were lowered on the bottom of the Trieste Pit using a "windlass" winch, without air to cool the body but with a cylinder to breathe from, as a Dräger detector had reported the presence of harmful gas on the bottom.

New century, new equipment

In the early years of the twenty-first century, La Venta Association, engaged in the study of the Crystal Cave in Naica (Mexico) offered its collaboration to "E. Boegan" Cave Commission. The purpose was exploring the Kronio Caves, trying to join the experiences accumulated in Naica to those of the triestine speleologists, lasted for several decades. From this joint venture was born the "Kronio Project", a program that - besides continuing the explorations - carries out research about the steam flow and its chemical composition, as well as investigations in the field of biology, geology, mineralogy, entomology and physiology (reactions of the human body operating in such difficult conditions).

It would be a winning partnership, both for the creation of a video documentary (one of La Venta's specialties), and for the continuation of the exploration. The first joint expedition, in November 2008, allowed us to test the use of the refrigerating bodices, that have proved effective but, unfortunately, too quick to warm up (up to half an hour).

In the last century (in 1962, 1963, 1969, 1986) the archaeological research was restricted to the initial caves, documenting the human presence from the Sicilian Neolithic (VI millennium BC) to the late Aeneolithic (II millennium BC). Until 2012, the environment prevented the archaeologists to carry out thorough investigations in the innermost galleries, while in the initial caverns the excavations of the previous years have given a fairly complete picture.

The December 2012 expedition gave us the opportunity, thanks to the technology of suits inflated by fresh air



Stufe di San Calogero, 1986

from compressors located outside, to bring an archaeologist to the findings, allowing an initial study and the collection of various sediment samples. The novelty of this last expedition on Kronio was the direct intervention on the Stoves - announced by time - by an archaeologist of the Superintendence of Agrigento, Dr. Nuccia Gulli.

To allow a quiet and sufficiently long stay inside the cave, it was decided to turn to the old, tried and tested cooling systems, the suits connected to pipes joined to



Trieste Pit, Grotta Cucchiara, 1997



Stufe di San Calogero, 2008

external compressors, insufflating outside air, cooler and drier.

To allow a greater drop in temperature were also tested small portable coolers, always connected to the compressed air, but they have been rarely used because they created a too wide thermal gap. Their use, however, has proven important when installed within a small tent arranged inside the Stufe, where the temperature was thus lowered to about 27°. They may certainly serve in emergency situations or just to allow us to perform, in the most favorable environmental conditions, limited research.

Outside were used two compressors by 10,500 l/min, connected in pairs, not for the amount of air required, but for a safe continuity of air supply in the event of failure of one of them.

Inside it was laid a $\frac{3}{4}$ inch rubber tube along the whole length of the cave, while every 20 meters were applied several shunts, with $\frac{2}{8}$ tubes that, connected to the suits, allowed the explorers to move up to the next connection. In this way it was possible to carry out the full path of the Di Milia Gallery remaining always stocked with fresh air and allowing a longer stay.

The archaeological part was limited to a study of the vessels present at the beginning of the Belletti Gallery, including the collection of samples to be analyzed, taken inside and in the vicinity. The archaeologist was also accompanied to the end of the Di Milia Gallery, where she

could personally verify the extraordinary amount of vases deposited and also the different types of them. In the future they will be catalogued and placed on a 3D map. Furthermore, the laying of the tubes was essential to explore the continuation detected in previous expeditions, situated at the end of the Di Milia Gallery. To this end it was decided to use speleo-ladders, easier to use, instead of ropes. So it was ascended a slippery and muddy slope of about ten meters, beyond which opens a 20-meter pit, also extremely muddy (semi-liquid guano). Its descent, rather complicated considering that the explorers had to drag also the air hose, unfortunately did not give the desired results, a viable continuation. Even a "window" placed on the chimney above the pit turned out to be a low and impractical tunnel, if not artificially expanded. As often occurred in the past, the most promising things were found at the time of closing the expedition, and this happened also this time. In the recovery phase of the tubes, made then without external air, we noticed in fact a side opening, so far omitted because judged as one of the many unviable cracks. But, moving a few stones clogging the passage, (we were on the side of the debris slope at the entrance of the Di Milia Gallery) it was opened a meander quite easy to transit, where have been immediately found a stone statuette and an engraved stone, certainly very ancient. Close to them, placed on the ground, there were also two small terracotta objects. To continue the exploration without causing any dam-

age, they were moved from the path, but after a few meters was found a skeleton almost completely submerged in the mud. Here the exploration stopped, both for the lack of fresh air and to avoid contaminating the site, still virgin ground and certainly subject to future studies. This new discovery opens up new horizons, archaeological and explorative, because the meander continues and further expands, always affected by a flow of hot air. Dr. Gulli was immediately informed of the discovery. With the approval of the Superintendent, Arch. Meli, she insistently asked us, even though we were now departing, the recovery outside of the new findings, by placing markers in the same places where they were originally. This was done, with their presence at the entrance of the Stufe, and all the material was delivered to Arch. Meli for the next study, which promises to be very interesting.

Conclusions

On Mount Kronio the speleologists have found themselves faced with fascinating problems of archaeological, hydrological and biomedical nature. The large *pitthoi* and the funerary depositions in the inner galleries of the Stufe are prior or contemporary to the establishment of the hot steam flow?

The archaeological excavations conducted between 1962 and 1986 have not only allowed to date the human presence in the caves, they have also confirmed that the caves were much larger. The excavations have deepened over four meters, allowing more light to come in from the entrance and a greater dispersion of hot air. It may be that the flow was already present, but less invasive. What is the origin of the hot air? What are its connections with the layer of thermal water? What is the genesis of the



the Naica breathing system

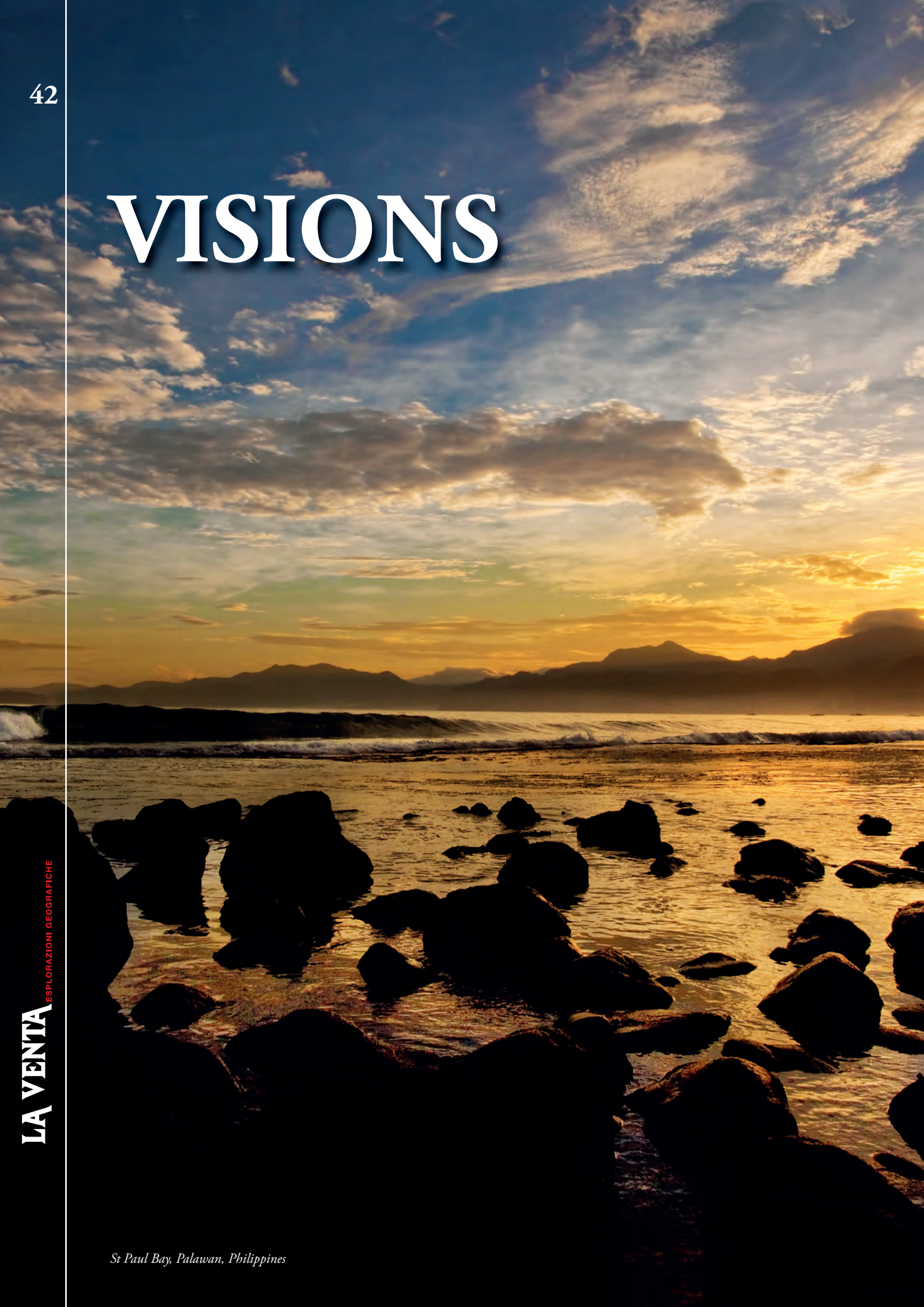
cave system and, if the galleries are of vadose origin (i.e. produced by running water), what was the sub-aerial hydrography when they were formed? And finally, what is the behaviour of the human body in these extreme conditions?

These are all questions that can be answered only by further explorations.



The compressed air system

VISIONS



WHERE ARE THE HOTTEST CAVES IN THE WORLD?

Giovanni Badino

43

LA VENTA

ESPLORAZIONI GEOGRAFICHE

The sea is very calm, the day is beautiful, the Raven tinkers with the controls of the ship, I lean out of the porthole to explain to the small group of spectators standing on the raft next to us the meaning of the journey we are about to make.

«At the foundation of the concept of “cave” there is the absence of something, the cave is there because the rock is lacking. So the cave is something that is not there, and in fact, in hindsight, if you have to drive in a peg -that is there- to descend a pit -that is not there- you are forced to drive it in the rock -that is there- around the cave. Yes, I know it sounds silly, but when you get to deepen your vision of caves you realize that it is not at all».

«To me it seems strange having to explain it», says the Raven continuing to control the instruments. I ignore him. «Then, defining the temperature -and even more the heat capacity- of a cave is very difficult, because every single element surrounding it -air, water, rock- has its own temperature, subtly different from the others, so everything is in constant interaction».

I glance at the Raven, he seems not to hear me.

«But we can say that the temperature of a cave is the average among its components, and that this parameter has also a physical sense, since in general these differences are very small, less than a degree, although there are caves of a special type where this does not happen. The average temperature of the cave is that of the fluids that have traversed it in the last millennia and, therefore, that

of the water seeping through it.».

«The temperature of a cave, that is not there, is determined by the water that is no more there. Ou sont les neiges d’antan? Dans la température de la grotte », adds the Raven that has leant out of the porthole of the bridge, too, to steal my audience. I keep on.

«The water running through them may come from the outside, or from above, or from the depths of the Earth, then the caves are divided into two major groups: the “above” and the “below” caves. “Supernal” and “infernal”, would say Ottavio Rinuccini».

«Sottane and soprane, we would say in the Monregalese», intrudes upon one of the audience, a Wild Boar. I continue.

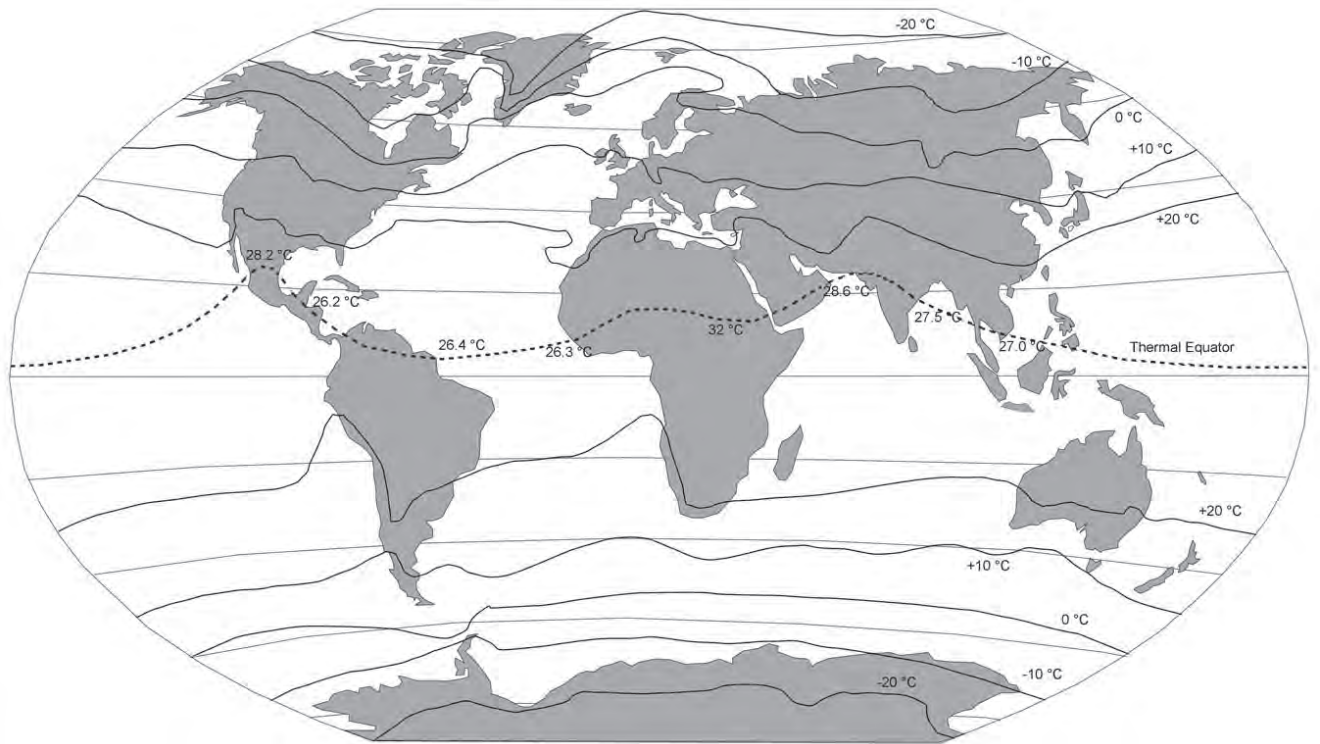
«But even more precisely we can call them “Epiepaffic” and “Hypoepaffic” , from the Greek επαφή, meaning “contact”. Almost all the caves we know are of the first type, while we know only a few of the latter, because they typically do not have viable entrances. The former are in thermal equilibrium with the external climate, the others are in thermal equilibrium with the deep fluids, so they make jokes of the rains».

«Such as?» asks a Fox; clearly the public is losing the awe I deserve.

«We know only a few hypoepaffic caves: there is Cristales in Naica, the most important of all, the one in Monsummano, Italy, that of Acquasanta and relatively few in other thermal areas. A few...».



Chihuahuan desert, heading toward Naica



Isothermal lines and thermal equator on Earth surface.

«Is that all?» croaks the Raven interrupting me, «Even there is a cave that is not there, then if you expect that, to be classified as existing, it needs to be visited by you, Heaven forbid!». And he croaks a laugh.

I go on focusing on the public, thought I have heard giggles at the joke of the Raven.

«Now, let's ask where are the hottest caves, among the epiepaffic ones» I glance at the Raven to see what effect has my neologism on him, but he has returned to the commands «that is, among those in thermal equilibrium with the external climate».

I look at the audience: «The answer is obvious, where the outside climate is warmer».

All of them are nodding.

«All right, so these caves were formed in warm areas, near the Equator. In addition, at low altitude, since the average temperature decreases everywhere with altitude. In the mountains it is colder than in the valleys, so the water seeping into the ground is icy. And in the caves over there it is striking cold. So the Hottest Epiepaffic Caves must be at a low altitude and low latitude».

It is evident that I have been convincing, so I go on.

«Everyone knows that the average temperature at sea level goes down gradually as we move toward the poles, but not on a regular trend. In Europe, for example, the average annual temperature drops by 0.7 °C for every degree



San Marcos y Pinos Range, Cuatro Ciénegas, Coahuila, Mexico



Akopan Tepui, Gran Sabana, Venezuela

of latitude to the North Pole, but this decrease varies from one area to another, depending on the morphology of the territory and on its position. In fact, the southern hemisphere of the planet is colder than the northern one, mainly because of the presence at its center of an immense continent covered with ice, Antarctica.

The Raven's croaking voice, from the inside of one of the photonic heads he is controlling, interrupts me: «Over there, there are The Coldest Ones and those with the More Brilliant Entrances», he says.

That's true, but it has nothing to do with us, he just wants to poke his beak into...

«Furthermore» I keep on undeterred, «In the northern hemisphere concentrate almost all the emerged lands, so there is a lot more climatic variety. The result is that the line of the highest average annual temperatures does not coincide with the Geographic Equator, but it winds just north of it, making larger loops within the emerged lands. Is that clear? We will call "Thermal Equator" this line of maximum average annual temp...

«Sailing test!» has screamed the Raven over my last words, and I am interrupted by the whistle of the swelling sails, accompanied by the blinding glare of the photon thruster.

After a moment there is silence again. I continue louder. «What are the average temperatures along the Thermal Equator? Let's say that it is quite regularly between 25 and 30 °C, but in maritime areas the gap is reduced to 26-27 °C. Small differences. In conclusion we have understood that we will find the hottest epiepaffic caves looking along the Thermal Equator, and at a low altitude. In addition, we will have to take account of an important detail that I discov...»

«Ready for sailing!» has croaked the Raven filling the air with light and whistles, just when I am about to tell how the climate types affect the temperature of the subsoil. Evidently the Raven tends to boycott my findings. Back

to silence.

«I was talking about the air-rain anomaly. We must keep in mind that there may be some difference between the average annual temperature of the air and that of the precipitation, because in some places the rains are concentrated in the warm season, in others in the cold ones. Of course, this variability along the Thermal Equator is very small, but we will take it into account. But here we have to leave you, dear spectators, to make our journey as warmer as possible, at least on the annual average, and to demonstrate that the cave we are exploring in Palawan is not only the Most Powerful Cave in the World but also the Hottest Epiepaffic Cave...».

It is all a fluttering, howling, meowing and clicking of the paws on the raft. I went well, despite the Raven.

I sit next to the rudder.

«Are you ready, helmsman? », I say to the Raven.

«Yes, for four hours I have been waiting for you to finish chatting».

«Come on, then».

We raise the sails for this circumnavigation. Exactly here the Thermal Equator intersects the International Date Line, in the middle of the Pacific, the raft with our friends shrinks and then disappears into the blue sea.

This is also the starting point where, in this journey, we will be more southern, because the point where the Thermal Equator comes close to the Geographic one is located in these areas. Here the temperature –average annual- is a little less than 27 °C. There are neither lands nor caves, even the Hawaii are much more northern and considerably colder, 24 °C.

The bow of the ship is East-oriented but, as we approach the American coast to follow the line of the Thermal Equator, we have to aim it slightly North.

The photonic sails whistle while at the horizon appear

the first emerged lands, we have arrived in southern Baja California, Mexico, the weather dries up suddenly and finally we can see a little karst. But soon, alas, appears also a very high plateau and therefore, right where we could find the hottest caves, the altitude cools them.

We continue our internal flight. Arrived almost at the center of Mexico, I point out to the Raven, on the right. «It is certainly strange that Cristales, the Most Important Infernal Cave, is right on the line of the Thermal Equator».

«Huge and with thousands of giant crystals», says the Raven.

«Thousands? I counted 162», I answer.

«I know, I know, you have missed almost everything, as well as under there», he points to a large boulder on the left, surrounded by lakes in the desert, «almost everything».

The precipitation here is concentrated in summer and the temperature of the rains, and then of the caves, is a couple of degrees higher than the average of the air; but the altitude is high, it is relatively cold. This is the area where the Thermal Equator moves further North, it is time to go decidedly towards South-East, the ship sails along the ridge of Central America.

The climate is rainy, the vegetation bursts forth with its humic acids, the caves are many and at a low altitude.

On our left we see a vast network of submerged galleries, under a peninsula dotted with pyramids. I look at the thermometer that we are dragging underground, marking 26 °C, down towards the coast the effect of the concentrated rainfall is decreasing down to zero.

We leave Panama and, on the right, now arrived at a latitude of 10° N, we enter South America, gradually orienting the bow to the left...

We plough through the central areas of Venezuela, where

immense plateaus rise and very slow waterfalls come down. But here again the caves raise their altitude and in the Orinoco plains there are not any.

«Even here you have lost time, jackasses», croaks the Raven, «and also it seems to me that you do not remember that cave over there to be so hot», he croaks again, pointing to a huge chasm on the edge of the main plateau. Yes, actually I remember one very cool night, in Sima Aonda.

«And, again, it is at a high altitude. Have you ever wondered why at high altitude it is colder than below?»

«Yes, and have you ever wondered why at the same temperature moist air is colder than dry hair?»

«Yes. And have you ever wondered why the clouds, that are made of water, do not fall to the ground?»

We come out through the sea around the Guyanas, we are again very close to the Geographic Equator.

It is time to cross the Atlantic and we do it with a route that takes us slowly northward until we approach Africa around Sierra Leone.

«Here, for sure, there will be very hot caves, but I do not think they have been explored well, yet», I say to the Raven.

«Yeah, because in other countries, on the other hand, you have explored them deeply», he answers, «and in any case here the hottest period is in late spring, while the precipitation is in late summer, so the rains tend to slightly cool the caves».

Below us the climate, from rainy and maritime in the Guinean forests, becomes dry and continental in the Sahel. We begin the longest stretch within emerged lands, we aim the bow to North-East.

The most northerly point of this section is Tomboctou, we go beyond and put again the bow right East to finish the crossing of Sahara through Niger, Chad and Sudan.



The Mount St. Paul Range, Palawan, Philippines

The underground thermometer marks terribly higher average temperatures, about 34 °C, the altitude is relatively low. I become thoughtful. Little precipitation but in the warmest periods, the caves are still warmer than the outside air.

«Yes, the Hottest Supernal Cave in the World is here», says the Raven «and in fact you do not have any projects in these areas», he adds, just to irritate me.

The flight continues.

We give a sideway look at the Nile while crossing it and then off again to East, up to Northern Eritrea, now rudder to the left, the bow heading ENE, we overstep the Red Sea. We plough through Yemen and Oman in particular, full of very hot caves but also of mountains that cool them.

A short stretch of Ocean brings us to the coasts of Pakistan (28.6 °C, the thermometer says), and to the second northernmost point of our trip, then the Thermal Equator controls the rudder to starboard, course ESE, crossing obliquely India, the temperature decreases a bit, the humidity increases, the monsoon precipitation rises again the temperatures below ground, we are again close to 30 °C. Then the temperature drops and we go out, from Orissa into the sea, we go beyond the Andaman («Are there any caves?» I wonder scanning them), we cut through Northern Malay Peninsula and Southern Vietnam, the effect of the concentrated precipitation has been cancelled. We plough again through the sea, always with the rudder heading ESE, the temperature is now 27 °C, then appears a strip of land just oblique to the Thermal Equator.

«And do you know what holds together the clouds, that are also made of droplets completely unrelated to each other? », asks the Raven.

«Here we are, finally, in Palawan, can we fly into the

Most Powerful Cave?»

«Sure», says the Raven, then he screams «rudder down and left, turn on the bow lights!».

When they are turned on, the ship has a tremor for the opposite push of the photons, it comes down to the surface of water, always really fast.

«All to starboard », says the Raven, the ship bends and slips through the foot of the highest mountain.

Here there are large galleries on dark and calm waters, swarming life, swallows and bats rush past us, a skeleton greets us.

The flash of darkness is over, rudder up and left, again the sea, route to East, towards the Date Line on the Pacific expanses, the journey is about to end.

«That cave was hot, wasn't it?.. » I say to the navigator.

«Hot?..»

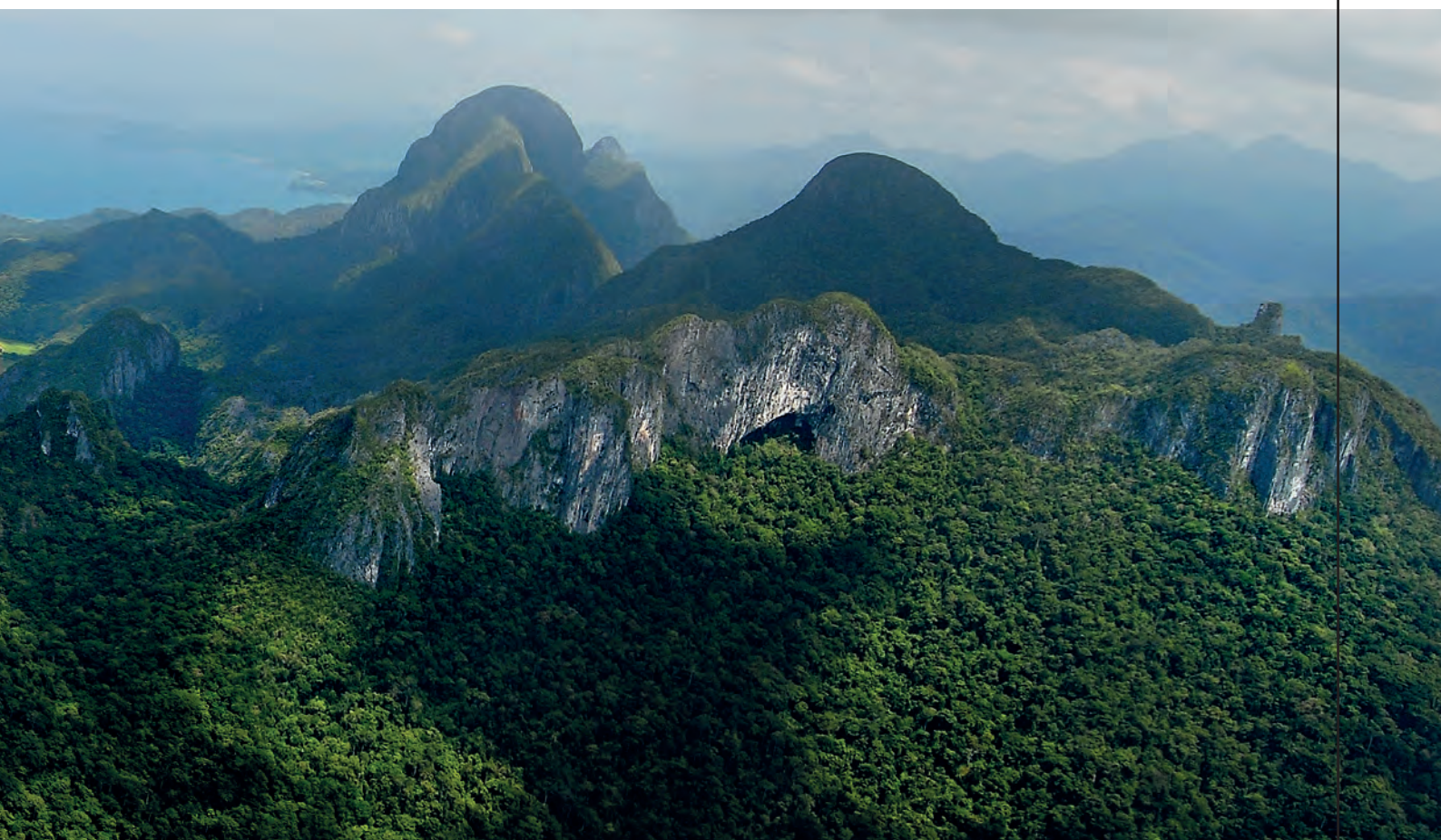
He gives me a dirty look, «It is since we have started this journey that we are more or less at the same temperature, a little above the ground or just underground. And the cave is not particularly hot, indeed».

«Ah, so that's not really the Hottest Epiepaffic Cave?»

«Nah, there is a whole equatorial bunch of caves at that temperature, fool. Anyway, as we passed, the cave told me to make you know that you can call "Epiepaffic" your dog».

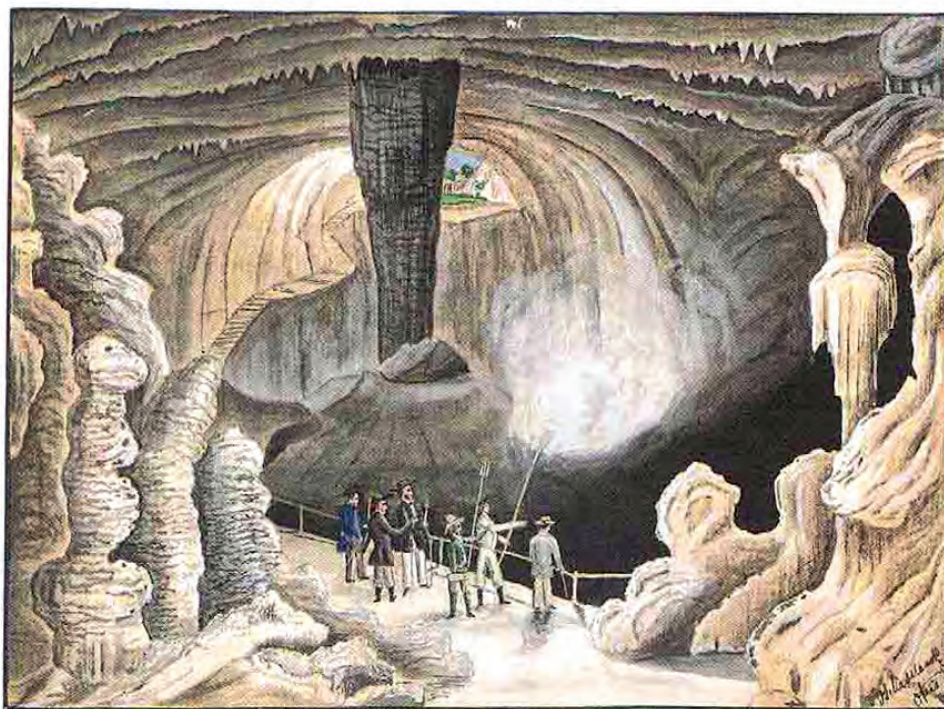
«Ah!..», and I fall silent, disappointed, looking at the Thermal and Geographic Equators approaching and marking the end of our trip. We come back to the raft of our friends on the blue sea, the ship slows down losing altitude.

The cave of the Subterranean River in Puerto Princesa is not the hottest of all, ugh. And how obnoxious is, this Raven...



PAOLO FORTI

DIE GROTTE VON CORNIALE



besucht von C. S. V. zum ersten Male den 30 Mai 1852 - 5 Mai 1852

Corniale's Cave (Vilenica)

An interesting handwritten diary has recently resurfaced from oblivion, appearing on the shelves of an antique bookshop. Written in the mid 19th century by an unknown tourist with a passion for caves, it is now part of the assets of the Italian Speleological Society. This document is of incredible historical relevance, as it describes the most famous karst area in the world at a time when speleology was still in its infancy. Obviously, many caves are described, e.g., Postumia, San Canziano, Opicina, Eggenhofer, but the one that gets the most attention is the cave of Corniale. Besides occupying several pages of the manuscript, this cave is also depicted in a beautiful watercolor drawing. Such emphasis should not come as a surprise, as the cave had been a renowned tourist attraction from the early 17th century and up to the begin-

ning of the 19th century it was much more famous than Postumia and San Canziano. Its popularity was linked to its 'strategic' position: just 11 kilometers from Trieste's harbor and only a few hundred meters from the old route that linked it to the Empire's capital. It was a must-see stop for anyone traveling between Trieste and Wien. Corniale's fall in popularity began at the end of the 18th century, when a new, more direct road was built further away from it; the opening of Postumia Cave to tourism in 1819 then greatly contributed to its decline. Between the 18th and 19th century, Corniale's cave was the subject of many artistic depictions sold to wealthy tourists, but none of them is as beautiful as the newly discovered artwork.

A low-angle photograph looking up at a massive, ancient tree trunk. A person wearing a light-colored t-shirt with 'LA VENTA' on the back, grey pants, and a blue backpack is climbing the trunk. The person's arms and legs are spread out, gripping the bark. The tree trunk is thick and textured, with a large hollowed-out section. The background is a dense canopy of green leaves and branches, with sunlight filtering through. The overall scene is one of a person interacting with a natural wonder.

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