

**The speleological expedition**

# **Roraima 2003**

## **Cueva Ojos de Cristal**



**Branislav Šmída, Marek Audy, Lukáš Vlček**



# The speleological expedition Roraima 2003



## Introduction

In January 2003 a small Slovak-Czech speleological expedition acted in the Roraima table mountain (tepuy) in south-eastern Venezuela. In the number of five cavers we were succeeded in a detailed research of today's the fourth longest world cave in quartzites, 2 410 m long Cueva Ojos de Cristal (Crystal Eyes Cave), which had been discovered and just informatively explored by two members of our expedition Marek Audy and Zoltán Ágh in February the 4<sup>th</sup> last year yet. The locality may be considered probably as the most developed classical quartzite cave in the world at present.

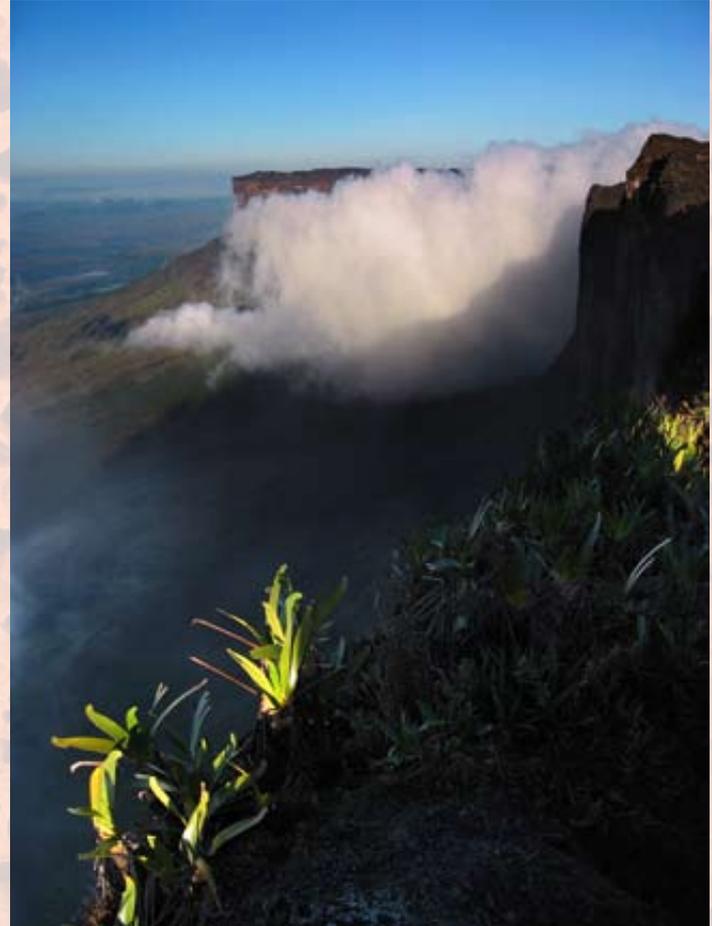


## Arrangements

The entrance into the Cueva Ojos de Cristal was discovered accidentally during an excursion at Roraima. The two above mentioned explorers had no speleological equipment at the moment in order to explore its tract deeply. They entered just 300 m deep into its bowels and they were often surprised by a dimensionality of its underground spaces. The cave continued freely along the waterflow and there were many branchings. So the decision was made: to try to find out its proportions and if perhaps there are also another, until now not known bigger caves under the Roraima surface.



During the year of 2002, within our national federations – Slovak speleological society (SSS) and Czech speleological society (ČSS), we started to motivate people, prepare mate-





a carbide itself. There was an apprehension of having them condemned before flight. There were troubles with a weight of ropes alike (we took approximately 350 m in the end), in particular when before flight to Caracas several competent people deregistered themselves as regards their planned participation in the action. The problem consisted in an unclear situation in the country from where, immediately before departure, we got through media just negative reports on civil disorders, demonstrations and lack of fuel or fundamental provisions.





## **Voyage and the action logistics**

It didn't discourage us and therefore in January the 3<sup>rd</sup> in the number of five persons we took a flight from Vienna to Caracas (with intermediate landing in Madrid). Two participants joined us for a short time during their tourist excursion at Roraima with their friends in about the same time. List of participants of the expedition is as follows: M. Audy, B. Šmída, E. Kapucian, L. Vlček, M. Griflík, Z. Ágh and M. Majerčák.

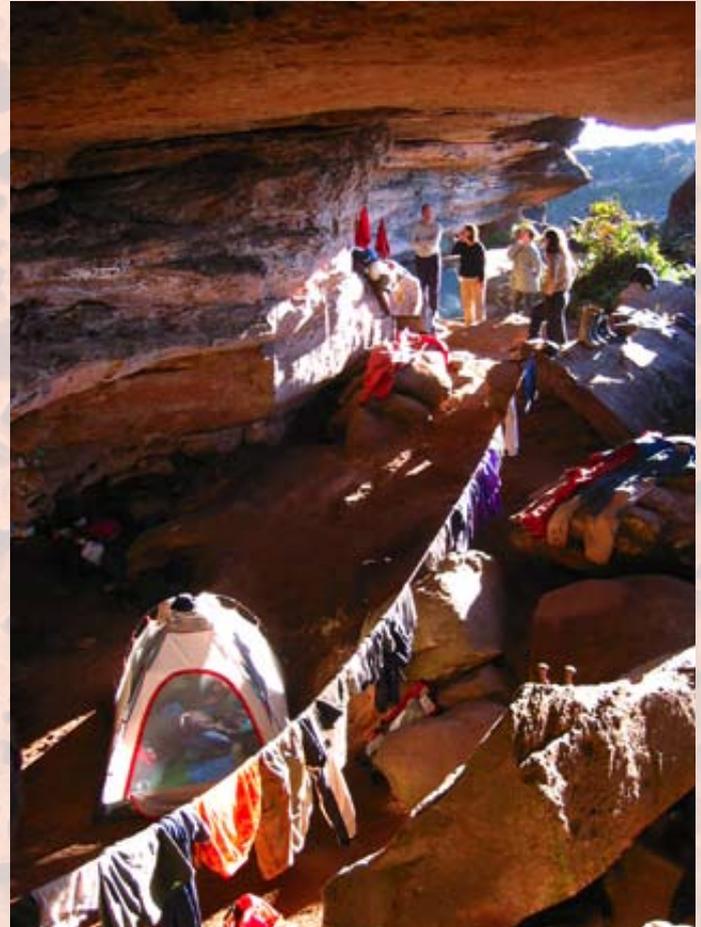
The people as well as their material were then transported by long-distance buses as far as the south of the country, into the settlement of San Francisco de Yuruaní. Here we rented a jeep as well as four Indian porters – Pemons. Together we transported up all needed material (about only 200 kg! for approximately 10 days of stay on tepuy) through savannah and primeval rain forest under the foot of the Roraima mountain up to its apex plateau. The backpacks weighted 20–25 kg in



average. The transport logistics was very effective and we reached the bivouac El Hotel Guácharos, where we set a base camp only in four days from Vienna! Even though we had to solve different tiny problems during the voyage such as the constant negotiation with our porters, a national park admittance in its administration in Parai-tepuy settlement or a terrible downpour during our ascent through forest up to Roraima.

After up in the plateau we started a speleological exploration. We acted here eight days only as a whole and during the time here, as a small but powerful and quality team, we explored totally 16 caves and shaft joints in length of more than 3 km, from among which the Cueva Ojos de Cristal very represents the greatest system. Our research was incidentally aborted with coming one of our Pemón guides who had brought a message from an Inparques (national park) officer

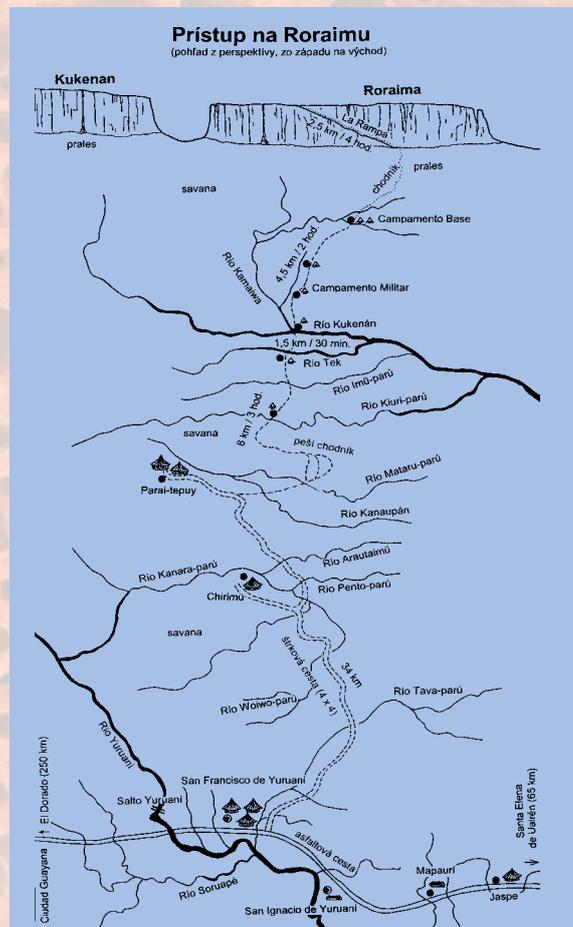
having asked us to descend Roraima down immediately because of our too long stay there without a permission. However, we would not prob-





ably stay on the meseta two or three days more because we have gradually given out a cooker fuel supply.

A transport back ran without any problems then. The part of a group came back home from pueblo of Santa Elena de Uairén. We arrived home on January the 21<sup>st</sup> (the whole expedition lasted less than 3 weeks then). The another two persons continued their voyage after Venezuela nature attractions. The total costs of the expedition concerning its effect were very low, not exceeding 7 500 USD.



## About Roraima

Roraima is exceedingly exemplary developed table mountain (tepuy), one of another 50 massifs of the Canaima National Park, one of the greatest in the world. It is of highly above savannah exposed narrow bench shape. It is long a bit more than 10 km and in south it is wide up to 5 km in maximum. The area is approximately 40 km<sup>2</sup> and the shape is characteristic as for other tepuy: from a wreath of surrounding rain forest under, it is separated by vertical cliffs of height from 300 up to 500 m. At the apex there is a rocky, minimally planted plateau, which is divided just by



local depressions, microcanyons, fissures or rocky labyrinths. The meseta is geologically almost explicitly composed of very pure siliceous sandstones of Matauí formation with volume



of up to 98 % of siliceous grains. These sandstones are subhorizontal or just minimally inclined (generally to the north), massive, layered often with diagonal bedding. The plateau hydrology is partly subterranean, the weaker surface waterflows occur partially here and during rains they fall down through plain edge in waterfalls. The highest point is ground elevation at 2 810 m above sea level. The usual height of the plateau platform oscillates between 2 600 and 2 700 m above sea level. The state borders of three countries – Venezuela, Brazil and Guayana meet here (so-called Zona en Reclamación).



The flora of Roraima is very rich and diverse as to the species. The numerous endemits grow here, for example fly-eating carnivorous plants of genus *Heliamphora*, rose-shaped *Orectanthe* or grassy *Stegolepis* which may be eaten. Many other, less outstanding, mainly marshy-ground species are numerous too. In marshes, respectively mosses, the thick beds of turf with so-called consortia of multiple plant species are created as well as algae vestures. Meanwhile, rocks are covered with organisms of *Cyanobacteria* group.

The fauna is not less interesting. For example, the endemically species of a tiny, black toad *Oreophrynella quelchii* lives here. We ourselves had the beast of prey of genus *Nasua* from family *Procyonidae* in our camp almost each day. Little, sparrow-like birds of genus *Zonotrichia* were flying around. In caves there is a specific fauna then.



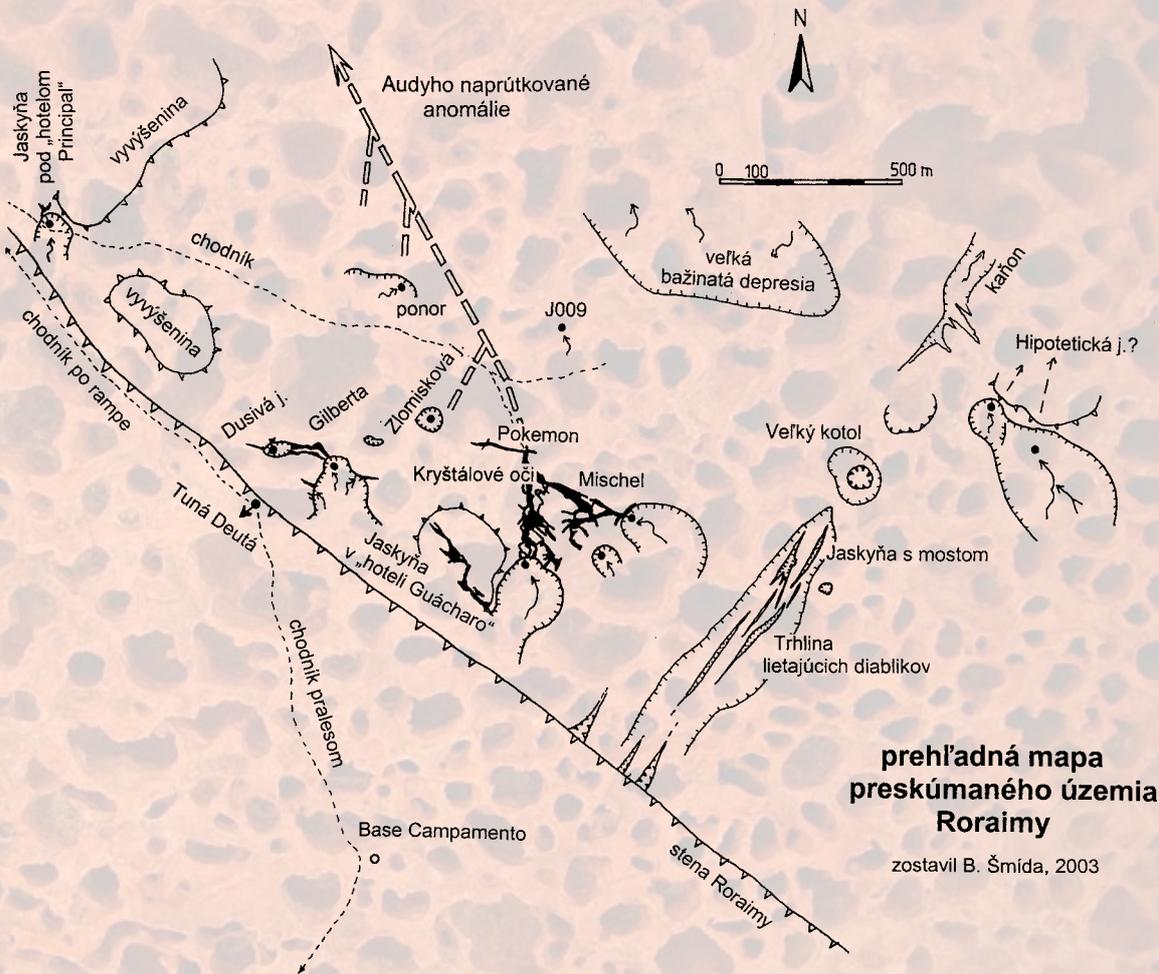
The climate in Roraima can be very rough, with rains, fogs and low temperatures at night decreasing down to zero as it is rumoured. We ourselves enjoyed a perfect, sometimes sunny weather resulting in a trouble-free research, without any incidents with water torrent, especially in caves. We consider the climate to be of alpine type, brisk, but as a whole fresh and enjoyable. No sticky biting insects occur here, whereas which the savannah and rain forest down there are exceedingly abundant with (puri-puri little fly-like biting insects and mosquitoes). It is recommended to enter the area in a season from December to February when it is a relatively more dry seasonal period there.

Roraima is touristically largely visited. It is supposed, that each month approximately 200 people, from that 80 % of foreigners, ascend up there. A trip uphill means minimally five-day action and overcoming heavy rise of around 1 500 m. No special permission is required here, just to be replied at a national park administration officer in Paraitepuy settlement and to pay for porters. A special research permission is given by the administration of Inparques in Caracas. Mountaineering, collection of natural artefacts and superbly developed siliceous crystals is prohibited. Also for that reason we did not collect any natural artefacts samples.



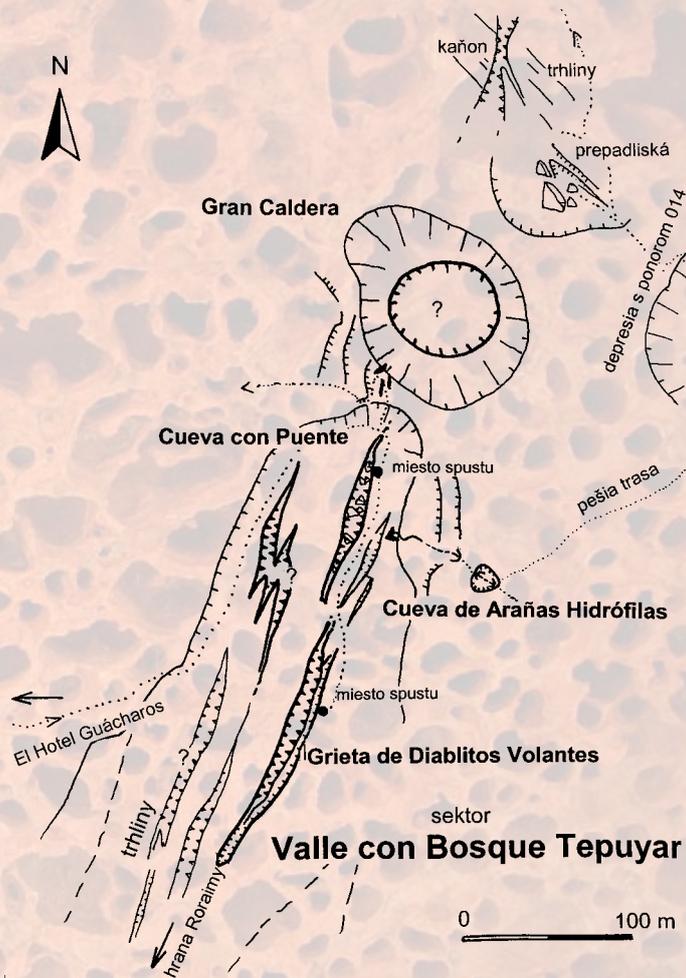
## Exploration

Considering the situation of our bivouac near south-western edge of Roraima we engaged in research on searching for genetical and hydrological connections as regards the longest the Cueva Ojos de Cristal mainly in surroundings of the bivouac. As to the surface, during our stay we better recognised just about 0.5 km<sup>2</sup> of the table mountain area, what is less than 1.5% of its area. For all that we confronted the standard difficulties in a local rough alpine nature, such as frequent fogs, enclosed country, deep



disruptions or total lack of trees (we had to cook on cookers only). We were anxious to stop away from absolute losing ourselves in a strange terrain by walking in two there. Nevertheless, we didn't avoid losing our way sometimes or to be late to our camp. It quickly gets dark here so it may be dangerous then. Whole our stay at Roraima we were fit regarding our health state. We tried to boil a water over or to modify it with special tablets. Provisions were brought here from home almost in a whole content. We have been vaccinated and we also used antimalarial tablets. During the stay nobody suffered any injury in the accident except for tiny scratches or sunburns. Having had the walks we sometimes got to the marshes or mosses here, but they are usually not too deep.

The cave exploration has been done in a basic expeditional pattern. We used a standard equipment, lighten overalls for tropics, gum boots, gloves and a single rope technique. The Cueva Ojos de Cristal was mapped with a help of toposet Vulcain and drawn at great length of enlarged scale 1:500. Though the other caves were mapped just informatively, it is enough for now. Some important surface forms were localised with a help of GPS set. The photo-documentation of high quality from caves was made as well as the short film document about the Roraima nature.



## Cueva Ojos de Cristal

The longest cave explored by us is Cueva Ojos de Cristal cave system, which is long 2 410 m for the time being. As we mentioned above its entrance and entrance parts had been discovered by two of us during the action in February 2002. We continued in a detailed exploration in a presence.

The cave has a character of classical, comparatively great corridors being a very unconventional event for such rocks as quartzites are. Literally we felt as we were in a limestone area somewhere... Until now, just deep, near bottom by water modelated fissures which collapse later and then form huge megadepressions (e.g. Sima Aonda, Sarisariñama) were known in quartzites. The cave discovered and explored by us belongs to the completely different, very unusual and until now not known phenomena, as to quartzites.

The relatively low, obscure entrance is situated near Roraima peripheral edge enough, where there is some semiclosed ponor depression – rocky fold, where water enters into the cave. The cave itself is markedly



# Cueva Ojos de Cristal

Roraima  
Venezuela

Slovenská speleologická spoločnosť  
(SSS)

Česká speleologická společnost (ČSS)

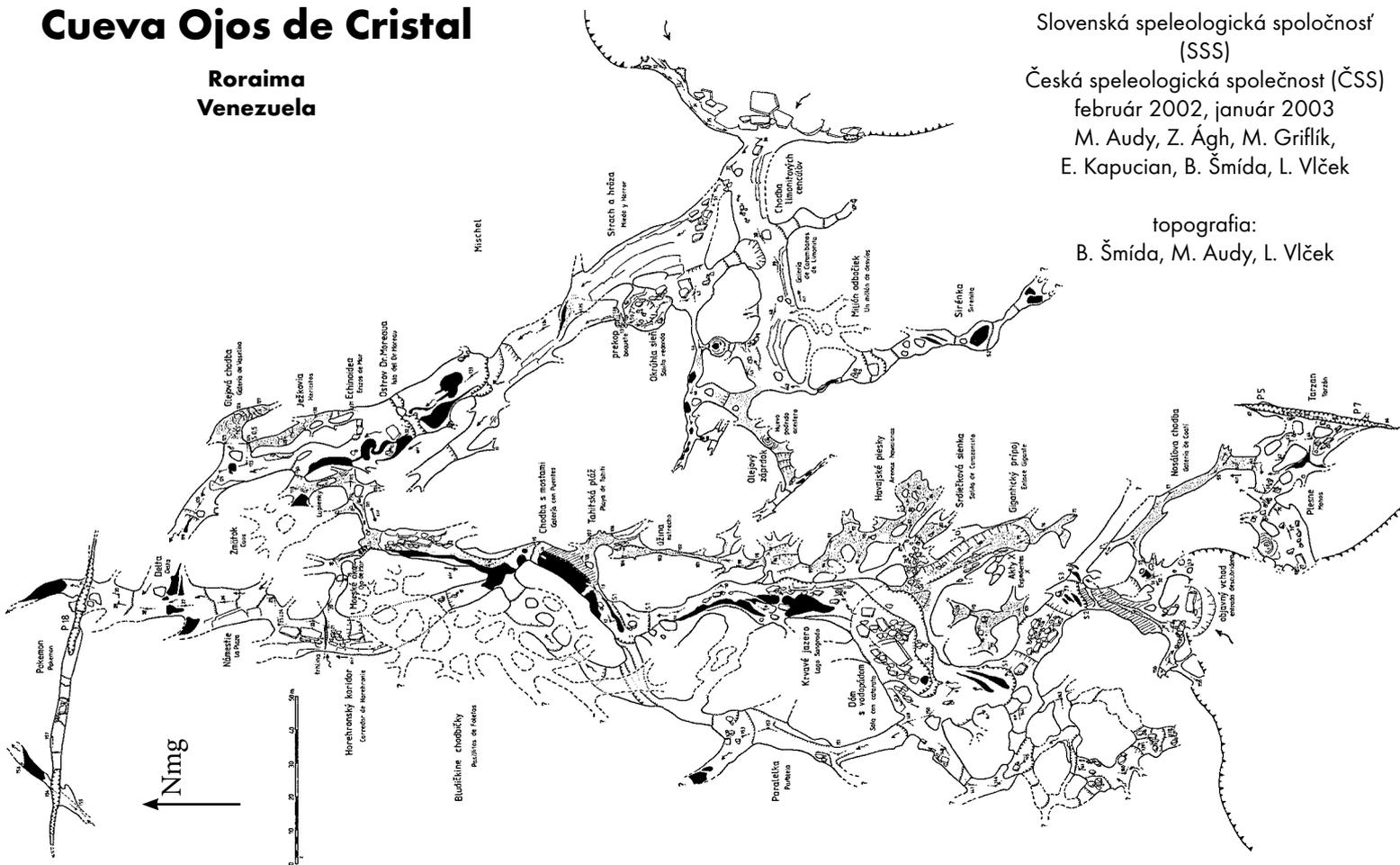
február 2002, január 2003

M. Audy, Z. Ágh, M. Griflík,

E. Kapucian, B. Šmída, L. Vlček

topografia:

B. Šmída, M. Audy, L. Vlček





subhorizontal with a height gradient of 24 m in a 400 m long main traction (whole height difference is 28 m). That is because of subhorizontality of sandstone sediments; cave spaces are developed then exclusively in discontinuities of bedding planes in this case. Also for that reason the corridors are very wide relatively, in some places up to 20–25 m! A height is disproportionally to it lower, 0.8–2 m in average. However, in some places the huge hall-like chambers with a height of 8–10 m are developed. The height gradient in a

cave is got over very steplessly though in entrance parts the steps of several meters height occur there. The bottom of the cave is flat, stony, back and forth the whirlpool holes filled with aesthetic cobbles of 0.3–1 cm fraction develop in there. Some parts with little lakes and pools are filled with sediments of fine sand (originally from walls). In some corridors the rocky dissepiments and bridges occur. Cross sections of corridors mention generally vertical walls as well as a flat, nearly straight roof with a minimal gravitation debris. By the effect of undercutting



the lateral walls, mainly their sides collapse. Thus the big plates with an area of the tenths square meters scale off or the goafs of great blocks with sharp parting originate. However, in the environment of an active water flow they are rapidly disintegrated by the effect of corrosion and then downwashed on in a sand fraction.

The cave has several entrances mostly low and ve-tured by a tropical vegetation. Two of them are the deep fissures indeed. They were given an operative genetic name „Pokemon“. These are not the classical Roraima’s fissures. They outright result in developing the cave passages! Their function as regards the connection with caves or their age are unclear, however, they probably absorb an energy of the cave-forming water, which falls down along the fissure deeply to the underground. They can be considered as the retentive-like, balancing basin, which is able to retain a considerable mass of torrent water of the cave waterflow. The further logical continuance of the caves, just ought to be cut, does not exist (!) or it is imperfectly developed.

We found several such fissures (Pokemons), which could lead to extensive caves.



Through the Cueva Ojos de Cristal a ponor waterflow with capacity of 1–2 litres per second is flowing, but in the dry season it almost dries up. In the case of heavy rains its capacity multiplies (maybe up to several tenths of litres per second; such events were not observed by ourselves). In the lowest corridors there the lakes originate and eventually can disable a movement in the cave. It must be kept in mind during an unstable weather when an explorer can be cut off in underground by the torrent waters for a longer time.

The intensive draughts blow in the cave. According to them we usually knew if the continuance is evident or it is blind. The temperature we measured in the cave was 17 °C. It is almost the identical temperature as in caves around Sima Aonda in Auyan-tepuy, though Roraima's caves are situated nearly 1 000 m higher. Maybe it is connected with their shallow-levelled situation under the surface of the plateau.

The cave corridors are spacious, but also minor, labyrinth as well as creeping. They are usually filled with an orange fine sand, which can be eventually covered on the surface with something like crust, crack-



ing during the movement in the cave. Complexity of corridors connection make the orientation there to be complicated. Some of the connectors are also huge, even without any relation to any well-known tributary. As if they were developed somewhere in a depth of rock in a process of its gradual watering.

However, the greatest corridors of the cave are the active tributaries (Mischel, Sirénka) or their higher inactivated levels. These are gradually concentrated into the one main lead-in. We do not know what is its character like deeper in Roraima's inland, in the area behind Pokemon. However, the dowse proved that the lead-in underruns from the end of the Cueva Ojos de Cristal several hundreds of meters to the north-western direction yet, even with the localised „tributary“ anomalies. It is in a good accord with the



fact, that the cave runs shallow under the surface, parallelly with it in the depth of 20–30 m only. This problem can be solved by the another research.



In the Cueva Ojos de Cristal there occur very interesting speleothems. Their occurrence is just singular, they form aggregations of lance stalactites of dark-brown or black colour and a globular surface. These are up to 0.5 m long (mainly 0.2–0.3 m) and usually inclined to the opposite direction towards dominant draughts, the most frequently in the reduced corridor profiles, eventually above water yet. Their origin can be connected with moist aerosols blowing in the cave then. In this sense we can appreciate also their

composition. They can crystallize from the nitrates (releasing from the bird guano decomposition in entrances or the decaying vegetation) as well as they can be standard iron minerals. The superincumbent beds of the dripstones are usually without discontinuities. Their hem is created almost always by some white-yellow crystalline films, thicker and thin as well. In an immediate surroundings there are also white, twist-like threads or minerals resembling to lichens on the wall.

In one part of the cave we also found speleothems with a biologically conditioned growth. Deep inside corridors, already in the aphotic zone, there are the nests of some tiny birds (of *Zonotrichia* genus?),



which touch the roofs of the low corridors with their wings and backs during their flight. Thus the thick layer of fluff deposits. This also molds and it covers a continuous area of several square meters in some places. Aerosols blowing into the cave moisturise this organic matter on, mortar it together and thus the roof crusts or microdripstones are formed.

We did not meet a similar type of the biologically originated dripstones anywhere for the time being.

In one corridor there probably can be a high  $\text{NH}_4$  concentration because of constantly attacked bird





Though, this will expand cave's volume just a little. A cardinal importance consists in looking for a continuance of the cave deep into massif, behind Pokemon.



dropping by a moisture. This creates the thick layers covered with grey-green crusts. This atmosphere does sensitively affect the human mucous membranes (eyes, nose and breathing problems). Therefore we did not stay there too long.

In the cave we registered a rich cave fauna as to the abundance and the species diversity (mainly giant locusts, spiders and millepedes).

The Cueva Ojos de Cristal is still not explored entirely. Mainly in the labyrinth parallel passages which are not explored very well the possibilities can be found.

## Other caves

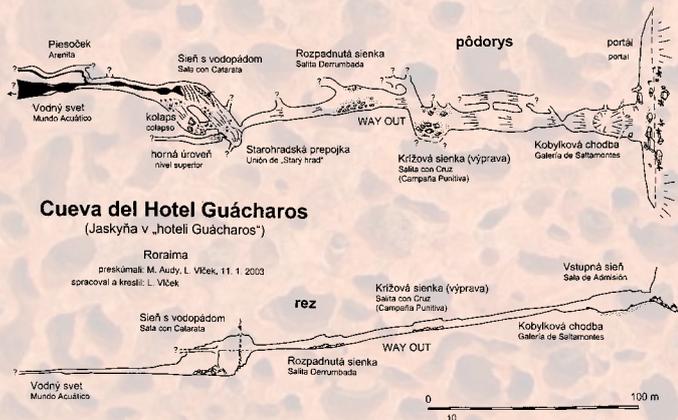
Within the expedition we explored also other caves in surroundings of the Cueva Ojos de Cristal. They tell us more about genesis of these caves in quartzites. The greatest among them is Cueva del Hotel Guácharos which is approximately 300 m long and with an entrance right from our bivouac. The cave had been visited by somebody before us already. The prints of footsteps there

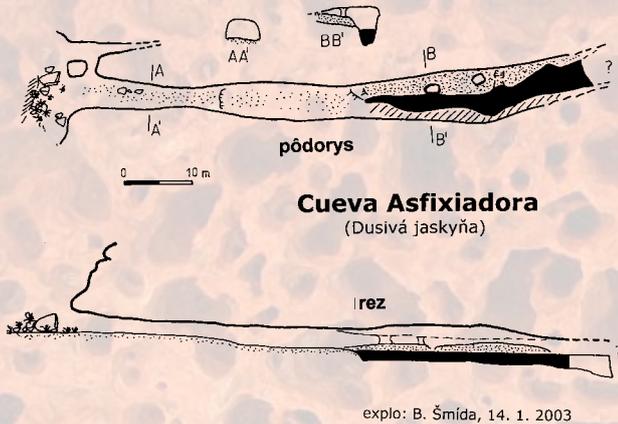


TRÁ, ZKALINOVÉ POKRÁČE

witnessed. However, the visitors got themselves just to the big step with a chamber and a waterfall. The footprints didn't lead further.

Also this cave is of subhorizontal character though its slope is much greater than in the Cueva Ojos de Cristal. It is also situated in a lower level, but the huge underground space (Sala con Catarata) with parameters 15 x 10 x 30 m occurs here as the greatest one in local caves for the time being. Neither this cave was explored by us as a whole. It ends with low corridors overflowed by water or with tiny creeping branches which probably may continue further. We do not exclude also its hatch connection with the Cueva Ojos de Cristal (both they are in the same depression so their development ought to be parallel). If so, the cave system with a length of probably 4 km could develop and it would mean the longest cave in quartzites at all. This is a great challenge for another expeditions.

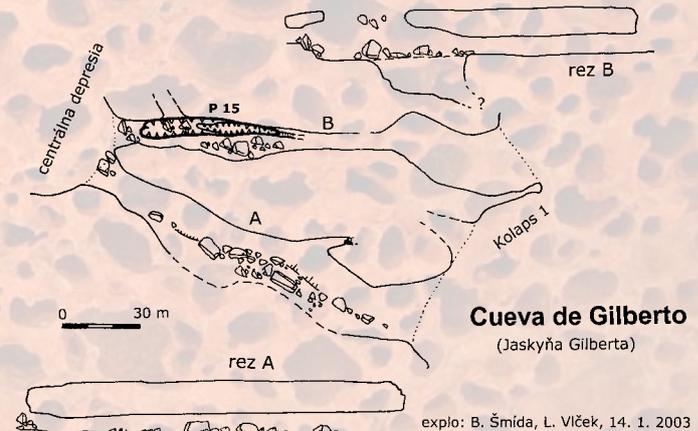




seen by us from beneath a rain forest. Further to the north from the zone there is a monumental doline-like deep gorge or cauldron. We neither could make only a step to its edge because of deep yardangs, an unpenetrable area of great blocks with a primeval forest vegetation. Its diameter is around 100 m. To the east of the area we found a large ponor depression with the creek's flowage up to

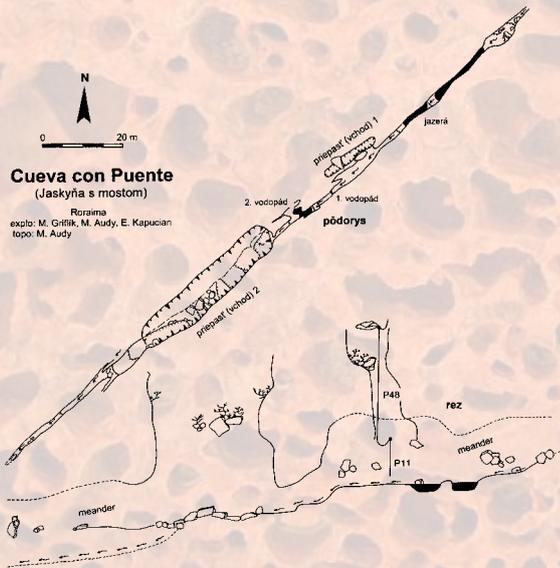
because of deep yardangs, an unpenetrable area of great blocks with a primeval forest vegetation. Its diameter is around 100 m. To the east of the area we found a large ponor depression with the creek's flowage up to

We still found in the camp surroundings Cueva de Gilberto – two big through tunnels approximately 250 m long or Cueva Asfixiadora (Smudgy Cave). However, the both are not explored very well. Another our sphere of interest was the great fissure zone being situated east of our camp. We descended to the two of them and both were overflowed by a waterflow. Cueva con Puente (Cave with bridge) represents a classical quartzite fissure abyss with a length of 250 m (it ended with narrowings at both tips). Grieta de Diablitos Volantes (Fissure of Flying Devilkins) is deep minimally 120 m but we suppose that its further continuance ought to flow into walls as a canyon which was





100–200 l per second still after two sunny days. We were not succeeded in getting into an underground through the huge blocks in the depression periphery. We got just up to 20 m into caverns among these blocks.



# Genesis of the caves

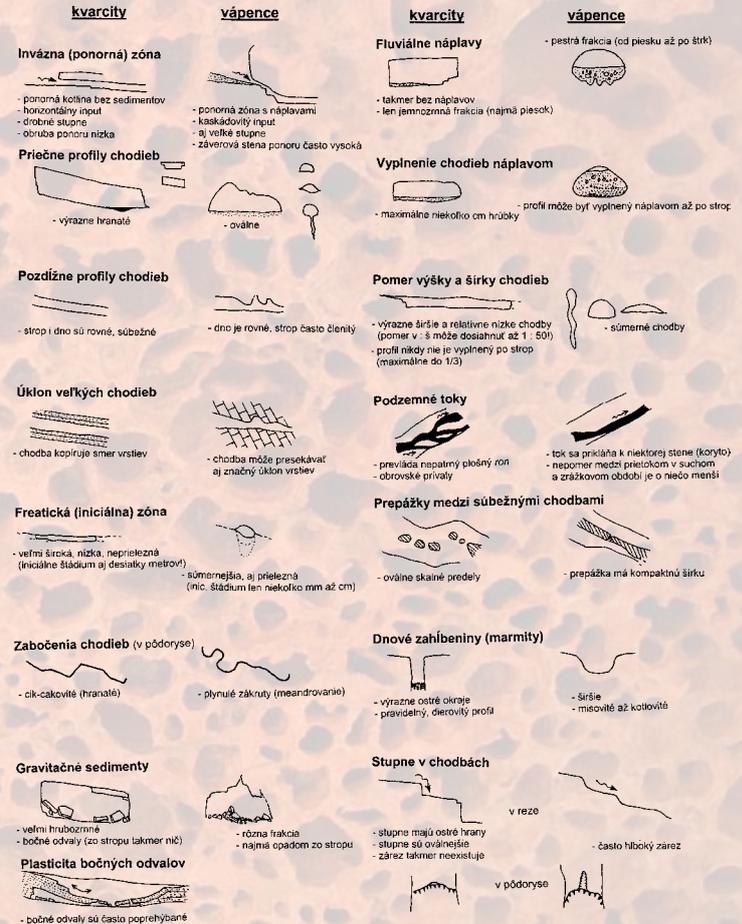
The greatest spaces of the Cueva Ojos de Cristal developed in crossings of several corridors eventually their etages. Probably also here a principle of a mixed corrosion functions although a mechanical erosion of torrent waters against walls of cave tunnels is probably plumbless. Particularly a lateral wall is eroded and it is connected with a sedimentary structure of sandstone.

The fact the caves are situated so shallow under the surface and they are subhorizontal, keeping a slope of corridors accordantly with a deposition of rock beds, may be connected with a selective option of some of its relatively non-rigid, more permeable deposition. As the rocks we observed middle-grained sandstones.

Also in the Roraima's surface we noticed a selective effect of corrosion as to its rocks. The kind of inselbergs occur here and they emerge around 20–30 m above platforms, being intensively laterally undercut. Upon them as well as upon the cave or right in its ground there can be so-called „caps“ – it means less permeable rock depositions (we would tip tiny-grained

(na príklade jaskyne Kryštálové oči)

zostavil B. Šnida, 2003



sandstones). We still do not know, if these depositions within the particular formation repeat themselves and if there could be similar subhorizontal caves developed even with more etages one above another. Also we do not know if some from among the great fissures could within their depth profile incise similar caves. These are but hypotheses. It is evident, that a part of the Roraima's surface has a massive subterraneous drainage.

We are conservative as regards the age of the caves. The objective evidences are missing. Although it is commonly known that rocks of the Roraima's group came under the effect of disintegration from Cretaceous time already, we do not suppose the Cueva Ojos de Cristal could be so old. Neither its protostage. Its exposed position near the massif surface, which mostly come under levelling, witness it all. In any case, supposing that the chemical dissolving of siliceous sandstone lasts for a very long time, the time interval of cave widening can be very long indeed, maybe millions of years.

Within the expedition we mapped familiar ponor depression El Foso too. It is not known where does the water spring out from it. Moreover, it is not clear to us in the case of the caves discovered by us. Although we localised two stronger springs (Tuná Deutá) near the Roraima's entry ramp, we suppose that the drainage of the Cueva Ojos de Cristal surroundings and also the whole zone around south-western meseta's edge progresses to the north or north-western direction, into the valley between Roraima and the neighbouring tepuy Kukenan. In the case, the height gradient of hydrosystems can be from 400 up to 500 m. Nothing but a further exploration can tell what is their character and if they are developed in forms of caves also deeply in the massif.

Having discovered the spacious Cueva Ojos de Cristal, the Slovak-Czech expedition put the very solid foundation-stone up on Roraima.

Translated by Gabriel Lešinský

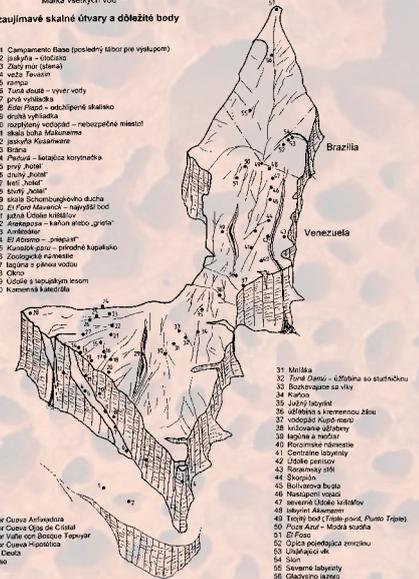
## Roraima

„La Madre de todas las Aguas“  
Matka všechých vod

Gubayana (Zóna en Reclamación)

zaujímavé skalné útvary a dôležité body

- 1 Campamento Base (posledný tábor pre výstupcov)
- 2 Jirákyňa – vodopád
- 3 Zvyš múr (stena)
- 4 veža Tawaiti
- 5 kámpa
- 6 Taniá – štátny výstavný stánok
- 7 prvé vystúpenie
- 8 Erika Páez – odstavčenie skalného štenu vyhláska
- 9 rozptýlený vodopád – nebezpečné miesto!
- 10 skála Jofra Makunama
- 12 jaskyňa Kisanawara
- 13 Erika
- 14 Paurá – štatistická kontrolná
- 15 prvý zjazd
- 16 druhý zjazd
- 17 tretí zjazd
- 18 štvrtý zjazd
- 19 spája Suchobuzko-ho dacha
- 20 El Fort Alvarado – najvyšší bod
- 21 jaskyňa Cofre Velázquez
- 22 Atapexa – kaňon atámo, grúta
- 23 Añelador
- 24 El Atapexa – priepasť
- 25 Kuzakó-ovca – prirodzené hupavisko
- 26 Zoológická rezervácia
- 27 jazirina s plávajúcou vodou
- 28 Okno
- 29 Ústie a korčadym insum
- 30 Kamená katedrála



- 31 Miriaka
- 32 Taniá Dama – súťažná so stadiónu
- 33 Rozhranenie so vlny
- 34 Karfi
- 35 Jaskyňa špeciálna
- 36 Miriaka a Inzensova žbica
- 37 vodopád Suchobuzko
- 38 kaňonová úžlina
- 39 kaňonová úžlina
- 40 Porozumiteľské miesto
- 41 Centrálna jaskyňa
- 42 Ústie parížov
- 43 Rozhranenie sily
- 44 Škorpion
- 45 Rozhranenie hruha
- 46 Následný výstup
- 47 severná ústie katedrály
- 48 jaskyňa Alvarado
- 49 Fyziologický štádium, Punto Triunfo
- 50 Pico Anzi – Maska súčasná
- 51 El Foz
- 52 Ústie podzemnej zmluky
- 53 Jaskyňa AK
- 54 Sun
- 55 Severné tabuľky
- 56 Chladný jazero
- 57 Nava

spoločaná podľa Roberta A. Marrasa, upravil

|     |                                     |                |                |              |
|-----|-------------------------------------|----------------|----------------|--------------|
| 1.  | Sima Auyan-tepuy Noroeste           | Auyan-tepuy    | 2 950 m        | SSI-SVE      |
| 2.  | <b>Cueva Ojos de Cristal</b>        | <b>Roraima</b> | <b>2 410 m</b> | SSS-ČSS      |
| 3.  | Sima Aonda Superior                 | Auyan-tepuy    | 2 128 m        | SSI-SVE      |
| 4.  | Sima Aonda                          | Auyan-tepuy    | 1 690 m        | SVE, SSI-SVE |
| 5.  | Sima Acopan 1                       | Chimanta       | 1 376 m        | SVE-UEV      |
| 6.  | Sima de la Lluvia                   | Sarisariñama   | 1 352 m        | SVE-FPE      |
| 7.  | Sima Menor de Sarisariñama o Martel | Sarisariñama   | 1 179 m        | SVE-FPE      |
| 8.  | Sima Aonda 2                        | Auyan-tepuy    | 1 050 m        | SSI-SVE      |
| 9.  | Sima Aonda Este 2                   | Auyan-tepuy    | 820 m          | SVE          |
| 10. | Cueva Aguapira 6                    | Aguapira       | 680 m          | SVE          |

