EXPLORATION ABROAD

Slovak cavers on table mountains, Venezuela: a decade of speleological work

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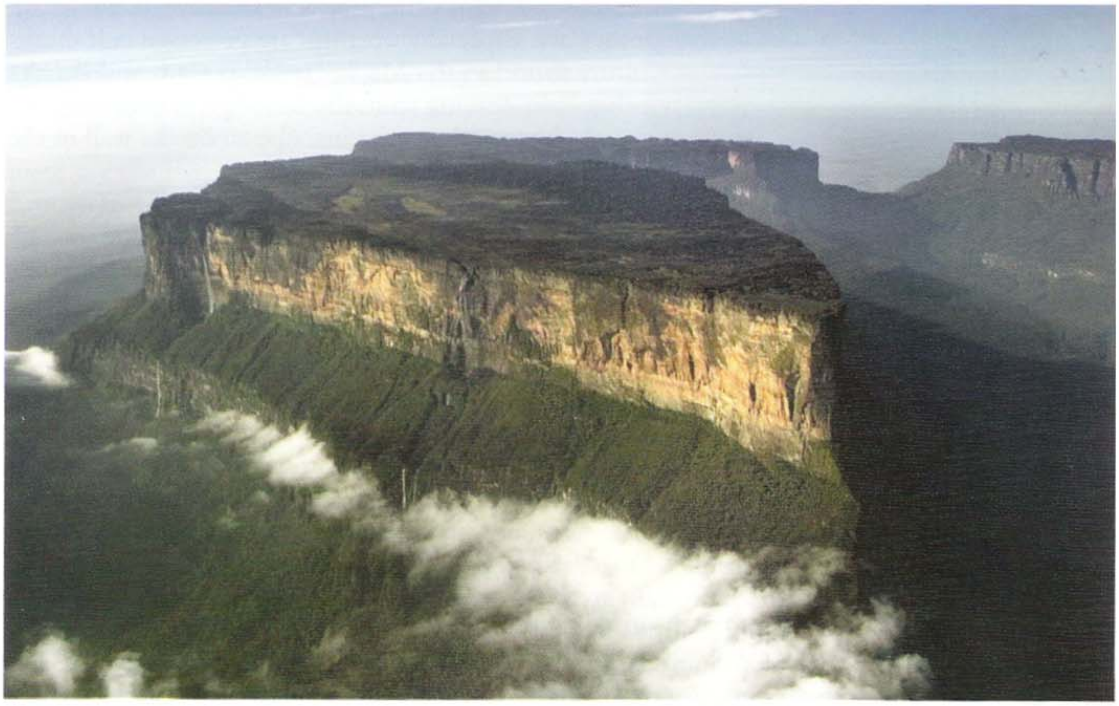
The table-mountains of the Guyana Highlands currently remain an ever-lasting treasure-trove for different types of scientific discoveries. They were first described by the royal surveyor Robert Schomburgk in 1838, and the first expedition to the Roraima Tepui meseta was led by Sir Everard im Thurn and Harry Perkins in 1884. Since then, several hundred general scientific expeditions, including tens of speleological expeditions, have explored these mountains, and fascinating discoveries including numerous novel species and unique caves have been made on virtually every trip.



Roraima and Kukenán tepuis from above, Venezuela. Photo: Ch. Brewer-Carías

Early speleological explorations of the quartzite massifs of the Guyana Highlands began on the Autana Tepui – a gigantic rock pillar towering 1,300 m above the Venezuelan Amazonia (Brewer-Carías, 1972, 1973a, 1976a; Colveé, 1972, 1973; Urbani & Szczerban, 1974; Szczerban & Gamba, 1973; Szczerban & Urbani, 1974; Galán, 1982; Pérez La Riva, 1976; Pérez La Riva & Reyes, 1976; Urbani, 1976a; Owen, 1978). Speleological explorations then continued on the Jaua-Sarisariñama – an extensive meseta hidden in the deep jungle of the Río Caura River Basin (Urbani & Szczerban, 1974; Szczerban & Urbani, 1974; Szczerban & Gamba, 1973; Brewer-Carías 1973b, 1976b; Nott, 1975; Urbani, 1976b, c).

The cave on the Autana Tepui was first described in 1757 as a portal resembling a large stone eye set in the 800 m southern wall (Gilij, 1780). Although this was visible from a long distance, no further detailed explorations were performed in those days. The first actual speleological expeditions were led by the naturalist Charles Brewer-Carías in the early 1970s. To the amazement of the entire party, they discovered that this cave consisted of several fascinating horizontal passages up to 395 m in length. These entered the walls from several different locations, suggesting inter-connections throughout the entire mountain range (Brewer-Carías, 1970, 1972).

Helicopter above the Kukenán Tepui. Photo: P. Masarovič

The surface of the extensive meseta of the Sarisariñama Tepui is covered by dense jungle vegetation at 2,300 m a.s.l. Although it looks flat, the meseta is in fact characterized by huge vertical depressions with diameters up to 350 m and by steep walls of the same depth. The huge passages running off these depressions form entrances into the rock massif, thus making it obvious that discovery of these unique caves would have been impossible without such manoeuvrable helicopters. The depressions of Sima Mayor with depth of 314 m and Sima Menor with depth of 248 m on the Sarisariñama Tepui are drained by springs several kilometres distant (e.g. Brewer-Carías, 1973b, 1976 b, c; Urbani & Szczerban, 1974; Szczerban & Urbani, 1974; Szczerban & Gamba, 1973). Detailed mapping of these depressions showed that based on the total measured volume of 18 million m^3, the Sima Mayor Abyss can be classified as one of the largest known karst cavities in the world. Two cave segment branches enter in opposite directions from the lowest part of the smaller depression known as Sima Menor (or Sima Martel sensu De Bellard, 1974a,b, 1975; or Sima Gibson sensu Brewer-Carías, 1974, respectively). These are called Cueva de la Cascada and Cueva de los Guácharos. Another huge karstic collapse called Sima de la Lluvia Cave is situated close to these sites. This one is 1,352 m long, including its Cueva de los Cristales branch. Due to the unique nature of these caves, two expeditions explored this site within a short period. The first expedition was led by Charles Brewer-Carías. who, together with his team, described their work in papers written in the 1970s (e. g. Brewer-Carías, 1973b, 1976 b) and in a beautiful popular-scientific book (Brewer-Carías, 1983).

Descent to the Sima Kukenán. Photo: B. Šmída

Several additional caves have been discovered on other Venezuelan table-mountains Guaiquinima Tepui, Sierra Pacairima (Pacaraima), Kukenán (Matauí) Tepui, Uruaní Tepui, Sierra Marutani, Acopán and Amurí

tepuis, Cerro Chirikayén, Ilú Tepui, Chimantá and Roraima, as well as the short caves in the Río Aponguao River Basin. Several different caves were discovered on mountains and partial massifs of Sarisariñama, Eutobarima, Aonda, Urutany, Auyán Tepui Norte, Tramén, Aguapira, Kukenán, Roraima and Yuruaní, in the foreground of the table-mountains near Santa Elena de Uairén – El Paují and on the mountain of Aponguao, Serrania Pereña, Wei-Assipu and massif of Chimantá. Just at the end of 1980' there were known 60 quartzite caves with 14,504 m overall length located in the Estado Bolívar and Territorio Federal Amazonas, according to Galán (1988).

An important year for quartzite speleology was 2002, when a unique cave was discovered by Slovak and Czech cavers Zoltán Ágh and Marek Audy on the meseta of the Roraima Tepui – Cueva Ojos de Cristal (Šmída et al., 2003). This meseta has a highest peak of 2,810 m a.s.l., and it borders three countries: Venezuela, Brazil and Guyana (Guayana Essequiba, the Reclamation Zone claimed by Venezuela). Although Roraima is very well-known due to Charles Brewer-Carías' text (Brewer-Carías, 1978), the real boom in quartzite cave discoveries began with the Czech-Slovak expedition in 2003 (Audy, 2003, 2008; Audy & Šmída, 2003; Šmída et al., 2003; Vlček, 2004). This team discovered a very unique extensive continuation of the cave, together with other horizontal underground passages on the table-mountain. This discovery was a historical breakthrough, because it presented a much better approach to understanding the quartzite karst phenomenon in the Guyana Highland. Such an extensive inlet/outlet cave system, with its huge variety of morphological forms as described by the Czech-Slovak team is unique on a world scale. Besides the Cueva Ojos de Cristal, no other fluvial active system of horizontal passages measuring several kilometres was known in any massif in the world. This cave was explored in great detail during the 2003 and 2007 expeditions. For a time, it was regarded as the longest in Venezuela (surpassed recently by the discovery of the 18,200 metre long Cueva El Samán limestone cave), and it was classified as the longest quartzite cave in the world shortly after its discovery. After 2006, its dimensions were documented at 15,280 m long and 73 m deep (Vlček & Šmída, 2007). Shortly after presentation of exploration results from the Cueva Ojos de Cristal in 2004/2005, a Venezuelan-Spanish-English speleological team re-mapped the same cave at 10,580 metres and renamed it Cueva Roraima Sur. This was despite the name Cueva Ojos de Cristal having been codified since 2003 and already quoted in all English-language literature (Šmída et al., 2005a, b). Their exploration results were published (with fore-date) in the Bulletin of the SVE (Galán & Herrera, 2005; Galán et al., 2004a-c; Carreño & Urbani, 2004; Carreño & Blanco, 2004) and also in short notes in publications such as the Bulletin of the South American Speleological Federation (FEALC; as in Pérez & Carreño, 2004; Carreño et al., 2005; and Galán & Herrera, 2005).

While Venezuelans documented caves on on the Aprada Tepui, a Slovak team found shorter horizontal fluvial active caves on the Kukenán Tepui in 2006 (Vlček & Šmída, 2007). Shortly after the discovery of Cueva Ojos de Cristal, other caves were also described on the Chimantá Massif (2,698 m a.s.l.). Although exploration of the mesetas of this massif commenced in the early 1990s (Briceño & Schubert, 1992a, b), these newly discovered caves were explored and documented between 2004 and 2007 by Venezuelan and Czech-Slovak speleological teams led by Charles Brewer-Carías. The Charles Brewer Cave (Cueva Charles Brewer) with its two gigantic branches measuring 4,800 metres was volumetrically the largest quartzite cave in the world (Brewer-Carías, 2005a). The quadratic profiles of its domes are typical for quartzite caves, and these are up to 100 m wide and up to 40 m high. The volumes created in this manner are comparable with the biggest chambers in the limestone systems of Borneo, Vietnam and New Guinea. Several papers have been dedicated to this cave, and while most of these were published in prestigious speleological journals (Šmída et al., 2005a-e), some also appeared in popular-scientific literature (Audy et al., 2004; Šmída et al., 2004; Audy & Šmída, 2005a, b; Šmída & Brewer-Carías, 2005). A special monographic issue of the Bulletin of the Slovak Speleological Society (Spravodaj Slovenskej Speleologickej Spoločnosti) has also been dedicated to this cave (Šmída et al., 2005h).

In addition to the Charles Brewer Cave, other relatively large caves were also discovered and documented on the Chimantá Massif during both the 2007 expedition (Audy et al., 2008; Šmída

et al., 2007; Šmída et al., 2008a,b; Vlček et al., 2008) and the 2009 expedition (Audy et al., 2010; Lánczos et al., 2009a, b, 2010a, b; Šmída, 2009, 2010; Šmída et al., 2009, 2010a-c; Vlček & Šmída, 2009; Vlček et al., 2009a-e). The following new caves were also discovered and documented in the Chimantá Massif during these two expeditions; Cueva Juliana (3.0 km long), Cueva Zuna (2.52 km long), Cueva Yanna (1.08 km long) and Cueva Colibrí (4.0 km long). At the same time, a cave system 7.5 km long was formed by connecting the Cueva Charles Brewer and Cueva del Diablo caves. The Czech members of the 2007 expedition discovered and explored the 2.5 km long Sistema de las Arañas, and this has been described by Audy & Tásler (2007), Audy (2008) and Brewer-Carías & Audy (2010). The last two expeditions in 2009 discovered the important Muchimuk Cave, which was connected to the previously discovered Cueva Colibrí to form the Sistema Muchimuk-Colibrí cave system. Its dimensions then were 8.0 km long with 160 m denivelation (Šmída, 2009). This cave system is genetically connected with Cueva Charles Brewer. Since results from the last survey show that the ends of their main passages are located just a few metres apart, the explorers led by Charles Brewer-Carías consider that all these caves are interconnected in the one 17.8 km cave system (Audy et al., 2010; Brewer-Carías & Audy, 2010). This system has recently been distinguished as the largest quartzite cave system in the world. It has been eponymously named the Charles Brewer Cave System, and it contains the 400,000 m^3 Gran Galería Karen y Fanny, and with passages, in the Cueva Charles Brewer sector, averaging 30 × 60 metres as well.

A new survey of the Cueva Ojos de Cristal extended the cave length to 16,140 m (Šmída et al., 2008a, b) and the Charles Brewer Cave System was likewise revised to 17.8 km (Audy et al., 2010; Brewer-Carías & Audy, 2010). This later revision created a new world record.

Research summary shows that approximately 50 speleological expeditions have been so far conducted to the Venezuelan table-mountains. Therein, 20 quartzite-karst areas were explored and documented, together with over 160 quartzite caves with a total length of 60 km (Vlček, 2010). Slovak cavers realized 9 expeditions to the tepuis and the speleological findings and research activities in main two karst localities are described below.

CHARLES BREWER CAVE SYSTEM

Localization: Chimantá Massif, partial massif Churí Tepui

Height a.s.l.: 2,100 m

Length: 17.8 km (formed by several cave sectors connected to each other on the Churí Tepui (sensu Brewer-Carías & Audy, 2010). However, the caves over the collapses to the west of Cueva Charles Brewer and also caves to its south do not form part of this cave system)

Depth: 160 m

Exploration: 2003 - 2010

In 2002, Charles Brewer-Carías discovered an interesting depression with an underground entrance on top of the Chimantá Massif. In the following year, the Grupo Espeleologico de Sociedad Venezolana de Ciencias Naturales (GE SVCN - The Speleological Group of the Venezuelan Society of Natural Sciences) organized a scientific expedition to this site under the supervision of the Comisión Nacional para la Protección de los Tepuyes (National Comission for the Protection of the Tepuis). The leader of this expedition was Charles Brewer-Carías, who organized the following team of Venezuelan scientists and cavers; Charles Brewer-Capriles, Federico Mayoral, Alberto Tovar, Luis Alberto Carnicero, Fernando Tamayo, Alejandro Chumaceiro, Eduardo Wallis, Alfredo Chacón, Ricardo Guerrero and Francisco Delascio. After descending into the cave through the huge passage, they reached the first lake near the Cascadas de las Arañas waterfalls. Here, to their great astonishment they discovered the most amazing large quartzite cave. This cave, 4,482 m long and 110 m deep was eponymously named Cueva Charles Brewer. Several more expeditions led by Charles Brewer-Carías followed, and he invited experienced cavers to join him. These included Charles Brewer-Capriles, Federico Mayoral, Luis Alberto Carnicero and John Brewer together with Czech caver Marek Audy and the Slovak caver Branislav Šmída. Several

Charles Brewer Cave System, Cueva Charles Brewer. Photo: J. Stankovič

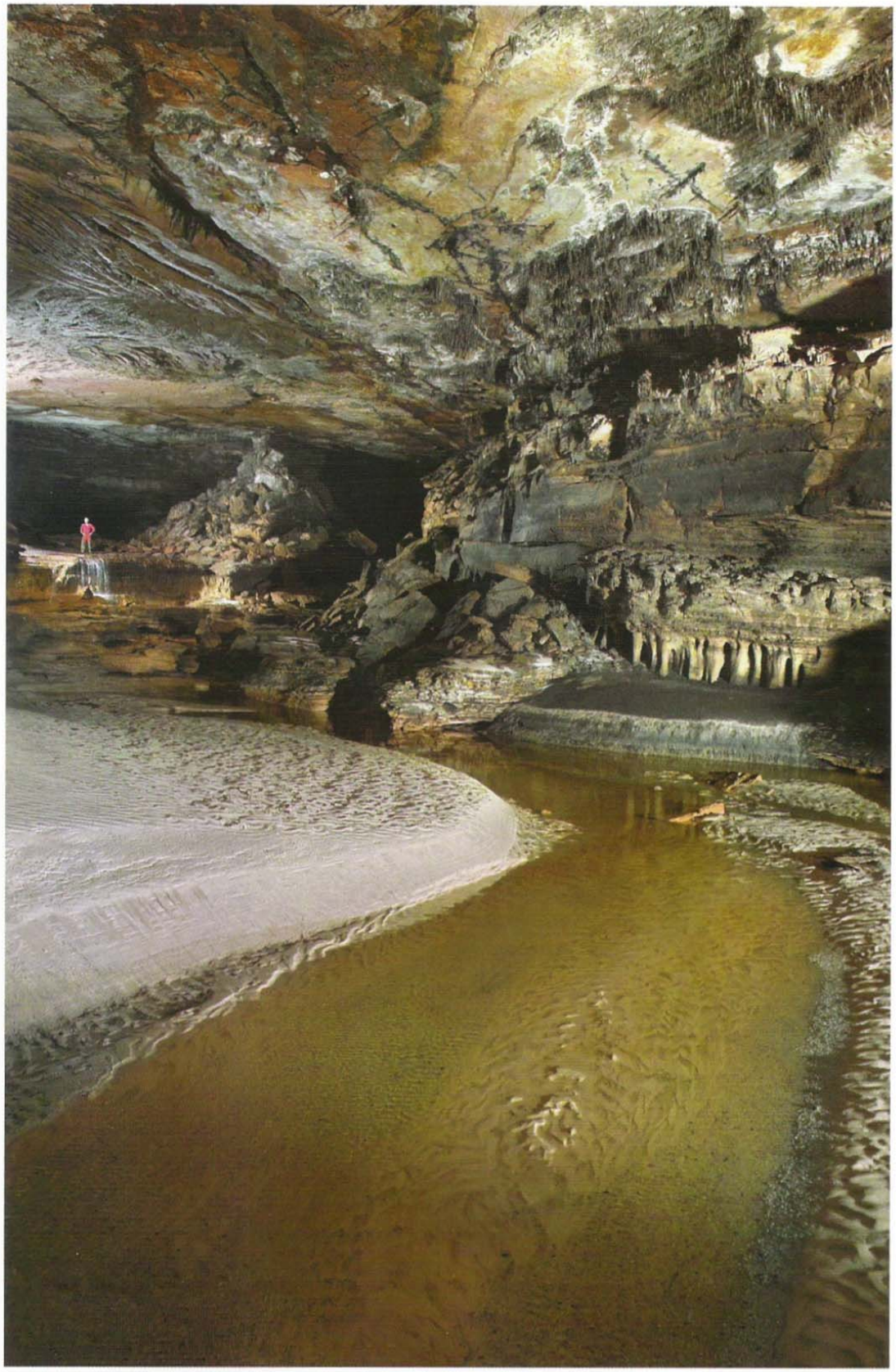
scientific publications contained results from these expeditions (Audy et al., 2004; Šmída et al., 2004; Šmída & Brewer-Carías, 2005) and this unique research was highlighted in a special issue of the Bulletin of the Slovak Speleological Society 3/2005 (Šmída et al., 2005h). Some of these studies met with criticism such as that from Urbani (2005), who had not explored this cave, and

Charles Brewer Cave System, Cueva Muchimuk. Photo: M. Audy

moreover, he had never visited it. Due to the many interesting discoveries, Charles Brewer-Carías organized several larger scientific expeditions, inviting additional members and scientists, not only from Venezuela (Federico Mayoral, Charles Brewer-Capriles, John Brewer, Roberto Brewer Martínez, Cesar Barrio-Amorós, Vicente Capriles, Hernán Biord, Luis Alberto Carnicero, Juan Carlos Godayol, Robert Cristobal, Francisco Delascio Chitty, Vincente Marcano, Roberto Brewer Mendoza, Francisco Delascio Chitty, Robert Rafael Eraso, Javier Mesa and Ben Williams), but also from other countries including Slovakia (Branislav Šmída, Marián Majerčák, Erik Kapucian, Marcel Griflík, Zdenko Hochmuth, Ján Pavlík and Pavol Barabáš), and the Czech Republic (Marek Audy and Richard Bouda). The 2005 expedition discovered several new caves in the area near Cueva Charles Brewer. These included the 2.3 km long Cueva del Diablo, the 0.8 km long Cueva del Cañon Verde, and the 170 m deep Sima Noroeste. Deeper explorations into Cueva Charles Brewer and Cueva del Diablo revealed additional spectacular discoveries including interconnections with a branch of Gran Galería de los Guácharos which increased the cave length by several hundred metres, to a total length of 4.8 km (Audy & Šmída, 2005a, b; Barabáš, 2006; Brewer-Carías, 2005 a, b; Šmída et al. 2005a-h). Many results from this expedition were widely popularized by the following researchers; Chacón et al. (2006); Chiappe (2006a, b); Marbach & Fage (2006); Mayoral (2006); Hernandez (2005); Palmitesta Riveros (2006a-c); Ramos Zibert (2006); Sánchez & Carnicero (2005); and Šmída et al. (2005a, b, c).

A further expedition was organized in 2007 by the following speleologists; Branislav Šmída, Zoltán Ágh, Erik Kapucian and Lukáš Vlček from Slovakia, Marek Audy, Richard Bouda and Radko Tásler of the Czech Republic, Mladen Kuhta and Robert Dado from Croatia, and the Venezuelans Federico Mayoral and Igor Elorza. In addition to these, several other experts joined this team. These included Roman Aubrecht, Tomáš Lánczos and Ján Schlögl from the geological-geochemical team at the Comenius University in Slovakia, the Spanish herpetologist Cesar Barrio-Amorós and also a group consisting of Charles Brewer-Carías with a BBC film crew led by Roger Santo Domingo and Ian James representing the American Press. The aim of this expedition was to explore the northern part of Churí Tepui. This succeeded beyond expectation when several new caves were discovered on the Churí Tepui plateau. These supplemented those observed during a helicopter flight by Charles Brewer-Carías the previous year. The newly discovered caves were: Cueva de la Araña - Cueva la Cortina (2.5 km long), Cueva el Diente - Puente de Diana Cave (0.05 km long), Cueva Bautismo del Fuego (0.4 km long), Cueva Juliana (1 km long), Cueva Tetris (0.15 km long), Cueva Croatia (0.1 - 0.2 km long), Cueva Zuna (0.31 km long), Cueva con Columnas (0.2 km long), plus the Cueva Eladio and Cueva Colibrí which were merely observed from helicopter. All of these caves constitute different parts of a complicated cave system located parallel to Cueva Charles Brewer and west of its main passage. However, these are all isolated by different types of rock collapses of pre-existing cave ceilings. The results of these expeditions were described in several publications (Aubrecht et al., 2008a, b; Audy et al., 2008; Barrio-Amorós et al., 2010; Lánczos et al., 2009a, b, 2010a, b; Šmída et al., 2007, 2008a-c; Vlček et al., 2008, 2009a-e). Some caves in this area, and particularly the Cueva Eladio, were also explored by other caving expeditions in parallel with the above expeditions.

Several expeditions explored the Churí Tepui plateau in 2009. These expeditions were organized by collaborating teams: a Slovak speleological team (Branislav Šmída, Erik Kapucian, Lukáš Vlček, Jaroslav Stankovič and Viliam Guľa), a general scientific team from the Slovak Comenius University (Roman Aubrecht, Ján Schlögl, Tomáš Lánczos and Tomáš Derka), a Croatian caver team (Darko Bakšić and Ana Bakšić) and the Venezuelan caver Javier Mesa. The tasks of the speleological team were to land on the northern part of the meseta and reach the area expected for the logical continuation of Cueva Charles Brewer. Although some intended research could not be carried out as initially planned, this team made the following important discoveries; i) the junction between Cueva Charles Brewer and Cueva del Diablo was mapped, so that the total length of the system was extended to 7.5 km; ii) two caves were discovered to be longer than previously believed: Cueva Zuna with 2.52 km total length and Cueva Juliana with 3 km;



Charles Brewer Cave System, Cueva Muchimuk. Photo: M. Audy

iii) several new caves were discovered including the 0.2 - 0.3 km long Cueva de dos Machetes, the 1.08 km long Cueva Yanna and the 4.6 km long Cueva Colibrí. The most important of these is the giant Cueva Colibrí located in the northern part of the tepui. Since the water in the cave stream flows from the northern edge of the tepui southerly towards the Cueva Charles Brewer area, there was a distinct possibility that these two caves are joined.

Further evidence for this theory was obtained during the next expedition to Cueva Eladio by the team of Branislav Šmída, Marcel Griflík, Charles Brewer-Carías, Federico Mayoral, Marek Audy, Richard Bouda, Pavol Barabáš and Ben Williams. In this expedition, another connecting giant cave was discovered that extended the Cueva Colibrí into the 8 km Cueva Muchimuk - Cueva Colibrí Cave System (Audy & Brewer-Carías, 2009; Šmída 2009, 2010; Šmída et al. 2009, 2010a-c; Vlček & Šmída, 2009). Although a physical connection with the Cueva Charles Brewer was not possible because the southern end of this cave ended in a huge cave-fall (Šmída et al. 2010c), topographically, this cave-fall appears identical to the one at the end of Cueva Charles Brewer. Therefore, Audy et al. (2010) and Brewer-Carías & Audy (2010) inferred that these caves should be regarded as one cave system. This particular cave-fall was thereupon inserted into a detailed map published by Audy et al. (2010). After these expeditions, the total length of the cave system named Sistema Muchimuk; sensu Audy et al. (2010) or Sistema Charles Brewer; sensu Brewer-Carías & Audy (2010), was registered at 17.8 km (±230 m). Herein, it is referred to as the Charles Brewer Cave System, and this is currently recognized as the longest and most voluminous quartzite cave system in the world (Hernandez, 2010). However, these observations and conclusions are not indisputable. For example, Šmída (2010), Šmída & Vlček (2010) and Šmída et al. (2009, 2010a-c) did not accept this junction, because not all interconnections had been physically proven. Therefore the maps and papers of Šmída & Vlček (2010) and Šmída et al. (2010a-c) present the Muchimuk - Colibrí Cave as 8 km long and the Sistema Charles Brewer - Cueva del Diablo as 7.5 km long. The expedition also surveyed Cueva Eladio, which had been visited the previous year by Italian cavers who named it Cueva Auchimpé (Mecchia et al., 2009). According to research by Audy et al. (2010) and Brewer-Carías & Audy (2010), the 4 km ±120 m Cueva de las Arañas Cave System was created by the physical junction of the following three caves: Cueva Cortina, Cueva de la Araña and Cueva Eladio.

Numerous scientific results and new biological research resulted from all expeditions, including those undertaken by Audy & Kalenda, 2010; Breure & Schlögl (2010); Derka & Fedor (2010); Derka et al. (2009, 2010); Robovský et al. (2007), and popular reports on this huge cave system on Chimantá were published by Ochoia Breijo (2011) and Rodrígues (2011).

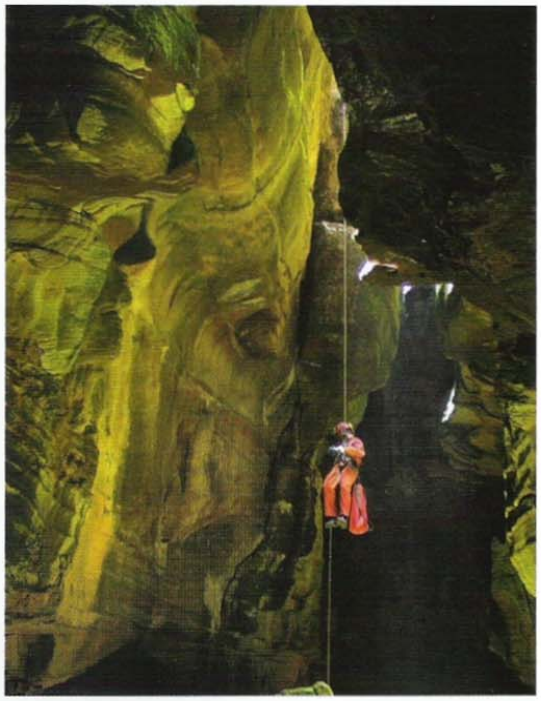
OJOS DE CRISTAL CAVE SYSTEM

Localization: Roraima Tepui
Height above a.s.l.: 2,630 m
Length: 16.14 km
Depth: 73 m
Exploration: 2002 - 2007

During 2002 two cavers, Zoltán Ágh of the Slovak Speleological Society and Marek Audy from the Czech Speleological Society, discovered an inconspicuous entrance to an inlet cave on the Roraima Tepui. Since they lacked equipment required for more extensive exploration, they were only able to reach a horizontal passage approximately 300 m into an area with a lowered passage profile. This site was quite inaccessible and demanded tedious crawling for further advance. Since this cave contained numerous pot-holes on the floor, filled with rounded quartz crystals, it was named "Cueva Ojos de Cristal" (Crystal Eyes Cave, Jaskyňa kryštálových očí). Compared to previous descriptions of quartzite caves in other parts of the world, this cave proved to be quite unique, due to its unusual parent rocks and its horizontal course. Previously described quartzite caves were mainly characterized by deep vertical crevices which normally obtained water from the mountain surface, with this water then draining into external springs through the vertical

outer mountain walls. Moreover, since this cave is situated close to the southern edge of the table-mountain and the cave water flows from south to north, there is at least the theoretical possibility of the existence of a cave traversing the entire mountain and ending at the springs situated in the northern walls of tepui.

A short Slovakian-Czech speleological expedition to the Roraima Tepui was organized in 2003 to explore this notion. The members of this group were Branislav Šmída, Erik Kapucian, Marcel Griflík, Lukáš Vlček, Marek Audy, Zoltán Ágh and Marián Majerčák, and they had Venezuelan guides led by Antonio José Arocha Gonzales. During this week-long expedition, the cavers explored not only the Cueva Ojos de Cristal in greater detail, they also mapped 3.5 km of underground passages in the following 15 caves connected to this area; Cueva debajo del Hotel Principal, Cueva Asfixiadora, Cueva de Gilberto, Cueva Fragmento Marginal, Cueva con Bloques de Piedra, Cueva del Hotel Guácharos, Cueva 007, Cueva Papua, Cueva con Cataratita, Cueva 009, Grieta de Diablitos Volantes, Cueva con Puente, Cueva de Arañas Hidrófilas, Cueva Hipotética, Tuná Deutá, and Cueva El Foso. Fluvial corridors in the water flow direction in Cueva Ojos de Cristal measured an astonishing total length of 2.41 km. It had an elevation of 24 m, and contained an underground anastomosing passage system where the passages converged at the main water outflow in the vertical crevice. This particular site is named Pokémon (Šmída et al., 2003). These findings, together with the fact that this cave is characterized by a rather unique relatively horizontal direction, clearly suggested that Cueva Ojos de Cristal represented a new morphogenetic quartzite cave type, and also that it is one of the most prominent large quartzite caves in the world (for general scientific descriptions, see Audy, 2003, 2008; Audy & Šmída, 2003; Vlček, 2004; for a general overview see the special monographic issue of the Bulletin of the Slovak Speleological Society by Šmída et al., 2003). This discovery evoked heated debates about its legitimacy in several associations, including the International Union of Speleology – UIS and the Speleological Federation of Latin America and the Caribbean – FEALC (see Geospeleology Commission of FEALC Newsletter – No. 60). However, the Czech-Slovak team gained respect thanks to expedition led by Charles Brewer-Carías to Cueva Charles Brewer on the Chimantá Massif in 2004. Marek Audy and Branislav Šmída also accompanied this expedition. This expedition then initiated fruitful cooperation between the Czech-Slovak and Venezuelan cavers associated in Grupo Espeleologico de Sociedad Venezolana de Ciencias Naturales – GESVCN. Another large cave, with 4,482 m length and 110 m denivelation, was discovered on this expedition to the Chimantá Massif, thus surpassing the acknowledged length of Cueva Ojos de Cristal (see last chapter).



Cueva Ojos de Cristal. Photo: P. Medzihradský

Another Venezuelan-Czecho-Slovakian expedition was organized in 2005 by Charles Brewer-Carías, Federico Mayoral, Branislav Šmída, Marek Audy, and others. The goal of this expedition was to further investigate both Cueva Charles Brewer and Cueva Ojos de Cristal. Exploration of Cueva Ojos de Cristal was undertaken by the smaller team of Branislav Šmída, Erik Kapucian, Marcel Griflík and Marián Majerčák. They clarified the cave's continuation over the Pokémon crevice, and then recorded the length of the nearby Cueva de los Pémones at an astonishing 5.3 km. These results from the Chimantá Massif were published in several papers (Šmída et al., 2005a-e; Šmída et al., 2004;

Cueva Ojos de Cristal, Roraima. Photo: P. Medzihradský

Audy & Šmída, 2005a, b; Šmída & Brewer-Carías, 2005), and in a special monographic issue of the Bulletin of the Slovak Speleological Society dedicated to these discoveries on the Chimantá Massif (Šmída et al., 2005h). This edition was published in both Slovak and Spanish languages. Exploration results from Cueva Ojos de Cristal have been published in papers by Šmída et al. (2005a, b).

Cueva Ojos de Cristal was renamed Sistema Roraima Sur by the Venezuelan-British-Spanish team in 2004. During their 2004 and 2005 expedition, this team also remapped the Cueva Ojos

de Cristal Cave, and measured extensions of the Cueva de los Pémones passages at 10.82 km. Since the map published by this team contains some discrepancies, this caused confusion. For example, Young et al. (2009) unfortunately defined Sistema Roraima Sur and Cueva Ojos de Cristal as being two different caves. For completely reliable tracking of the order of events and the cave descriptions, please see the monographic issue of the Boletín de la Sociedad Venezolana de Espeleología (SVE) in 2005 (this issue was antedated to 2004; Galán et al., 2004a-b; Carreño & Urbani, 2004; Carreño & Blanco, 2004). Shorter notes are also contained in scientific papers by Galán & Herrera (2005); Pérez & Carreño (2004); Carreño et al. (2005); Galán & Herrera (2006), and Barton et al. (2009).

A new expedition was organized to Kukenán and Roraima tepuis in 2006 to settle various disputes. This was undertaken by the Slovak cavers, Branislav Šmída, Lukáš Vlček, Peter Medzihradský, Jozef Ondruška, Peter Masarovič and Pavol Barabáš. They explored a few of short horizontal caves and descended to the Sima Kukenán shaft. After this, the group was divided into two parts on Roraima Tepui for detailed studies of Cueva del los Pémones and Cueva Ojos de Cristal. This led to the discovery and survey of several passages which increased the total length of the cave system to 15.28 km. Several interesting cave connections were discovered. The main was the interconnection of the above mentioned two caves through the Cueva del Hotel Guácharos, and the second was the discovery that Cueva del Gilberto and Cueva Asfixiadora were physically connected to this large cave system. The results of this expedition were published by Vlček & Šmída (2007), and also in a documentary movie called Matauí (Barabáš, 2007).

After the expedition to Chimantá Massif, a Slovak-Croatian-Venezuelan expedition to Roraima was organized in 2007 by the cavers Branislav Šmída, Lukáš Vlček, Erik Kapucian, Zoltán Ágh, Igor Elorza, Mladen Kuhta and Robert Dado. They also invited a Slovak scientific team from the Comenius University in Bratislava consisting of Roman Aubrecht, Tomáš Lánczos and Ján Schlögl. During this expedition, interconnections of Cueva Ojos de Cristal with Cueva de Gilberto (including the former independent Fragmento Marginal Cave) and with Cueva Asfixiadora were discovered, thus the total lenght of the Cueva Ojos de Cristal was finally registered at 16.14 km with a denivelation of 73 m (Šmída et al., 2007, 2008a-d; Vlček et al., 2008).

A further expedition was specially organized by Slovak and Croatian cavers, comprising Slovak cavers and scientists, Lukáš Vlček, Viliam Guľa, Ján Schlögl and Tomáš Derka and the Croatian cavers Darko and Ana Bakšić. Its main goals were to visit Roraima and Cueva Ojos de Cristal and to take samples for scientific research (Šmída, 2010; Vlček & Šmída, 2009; Vlček et al., 2009a-c).

The summary of current discoveries and their status in the history of cave explorations read as follows; the 16.14 km length established in 2006 for Cueva Ojos de Cristal surpassed the length of the limestone Cueva el Samán located in the neighbouring state of Zulia, and thus became the longest cave discovered in Venezuela. However, the prolonged mapping of Cueva el Samán completed by Venezuelan cavers the following year reversed this, and Cueva el Samán was re-established as the longest cave at 18.2 km (Herrera et al., 2006). Since a complete detailed map of Cueva Ojos de Cristal has not yet been published, its total length is use to be still discussing; as in Audy (2008), and Brewer-Carías & Audy (2010)**.

References

Although the text you read contains a huge number of references, we do not mention them at this place. Full list of references you can find in the printed book Aubrecht R., Barrio-Amorós C. L., Breure A.S.H., Brewer-Carías C., Derka T., Fuentes-Ramos O. A., Gregor M., Kodada J., Kováčik Ľ., Lánczos T., Lee N. M., Liščák P., Schlögl J., Šmída B. & Vlček L. 2012: Venezuelan tepuis: their caves and biota. Acta Geologica Slovaca - Monograph, Comenius University, Bratislava, pp. 168 or on web-page of AGEOS magazine http://www.geopaleo.fns.uniba.sk/ageos/monograph/aubrecht_et_al_2012_en.php, containing full the book for free downloading.

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