

# CAVES OF MACIZÓ CHIMANTÁ AND RORAIMA TEPUY IN LA GRAN SABANA AREA (ESTADO BOLÍVAR, VENEZUELA)

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## Abstract

The paper describes the speleological discoveries of several international expeditions to the table mountains in Gyana Highland, in the border area of Venezuela, Brasil and Guyana. Three table mountains (tepuis) were attended – Macizó Chimantá, Kukenán, Roraima and we discovered more than 30 caves in total length of more than 30 km. After the last expedition, “Tepuy 2007”, which scientific tasks were geological, geochemical and biological field research, the longest one – Cueva Ojos de Cristal is 16 140 m long and it is the longest cave in silicious rocks in the world. Nowadays, the 4.8 km long cave Cueva Charles Brewer with the hall “Gran Galería Karren y Fanny” (400 000 m<sup>3</sup>) and the passages of average 30 × 60 m, is the largest cave in quartzites in the world.

**Keywords:** caves, Venezuela, Cueva Charles Brewer, Cueva Ojos de Cristal, Chimantá, Roraima, speleology, tepuis, quartzite karst.

## INTRODUCTION

In february 2007, four experts for Venezuelan table-mountain caves, Charles Brewer-Carías, Branislav Šmída, Federico Mayoral and Marek Audy organized an expedition with duration of one month, to the underground of the Chimantá and Roraima massifs in Guyana Highlands of northern South America – southeastern Venezuela, State Bolívar (Fig. 1). The team of speleologists and scientists consisted of 16 persons from Venezuela (SVCN/Grupo Espeleológico de la

Sociedad Venezolana de Ciencias Naturales, Caracas), from Slovakia (SSS/Slovak Speleological Society and Comenius University, Faculty of Natural Sciences, Bratislava), from the Czech Republic (ČSS/Czech Speleological Society), Croatia (KS HPS/SO PD Željezničar Zagreb) and also three journalists (TV, press). The longest and biggest quartzite caves of the world were again explored during the stay, discovered by us in 2002 and 2004 (Cueva Charles Brewer, nowadays its known length is 4.8 km and the Cueva Ojos de Cristal cave system with known length by now more than 16 km). Beside standard speleological exploration, topography, photodocumentation also focusing on complex evaluation of natural phenomena, survey, measurement, sampling (rock material, biospeleothems, water, minerals, microbiological and biospeleological material) also new big cave sites were discovered.



*Fig. 1: Location of the studied table mountains*

EXPEDITION “TEPUY 2007” – EXPLORATION AND

## RESEARCH

On the one of the 10 partial mesetas (tepui) of the Chimantá massif with areal extent of 1470 km<sup>2</sup> the Czech subgroup discovered new cave Sistema de la Araña in length 2.5 km and the central Slovak-Venezuelan-Croatian team accomplished mapping of the cave Cueva Cañon Verde in length 1.2 km, discovered and partially explored by Slovak-Venezuelan team in the year 2005. Both of the cave sites, which have several cave entrances located in megadepressions (e.g. the Cueva Cañon Verde have a southern entrance located in depression with extent of 80 × 150 m and approx. 60 m of depth) consist of extensive fossil corridors (to the 50 m of width and 20 m of height), as well as a little bit lower situated canyon-like galleries with heights 10 to 15 m and widths 10 to 30 m, with rivers in their bottoms. In the first above mentioned cave is well developed including also the lowest situated, juvenile and probably periodically flooded zone of corridors with hundreds of sandstone pillars (Fig. 2), in the second one is situated a big dome with dimensions 50 × 100 m and also numerous dangerous collapses (chokes) and labyrinths. In both caves numerous clusters of young (“alive“) and older, already opalized “Champignones“ (special speleothems, built up by cyanobacterias, first time recognized by us in the Cueva Charles Brewer cave; Šmída et al. 2004) as well as other unique speleothem forms, e.g. the “muñeco“ type, in enormous clusters built up on the bottom by thousands of individual pieces, or curtain-like gypsum speleothems so-called “crepe paper“ type. New attitude to genesis of those speleothems, base on our geological, geomorphological, hydrogeochemical and speleological observations, brings the papers Aubrecht et al. (2007; 2008)



*Fig. 2: The sandstone pillars – the key to genesis of the caves in karst on table mountains – Cueva de la Araña, Macizó Chimantá. Photo: M. Audy – R. Tásler & R. Bouda*

The next of the new discovered caves, the Cueva Juliana (Fig. 3) at length 1 km having smaller height, maximum to 5 m and 10 – 20 m wide corridor, is a young karst spring, active during flooding events, with numerous lakes. This site is situated approx. 70 m below the active river in the Cueva Charles Brewer, aside from attractive, 30 m high waterfall. This cave was not explored to the end, because lack of time – is continued further. The next two caves (Cueva Croatia and Cueva de Bautizo de Fuego) are forming cascade-abyssal systems, with length 200 m and 400 m and depth -50 m. They are younger caves, very similar to caves recognized on the plateau of the Auyantepuy. The first one of them was explored by the Croatian team, the next one, with more extensive horizontal gallery near the bottom and smaller river was discovered by the Slovak-Venezuelan team.



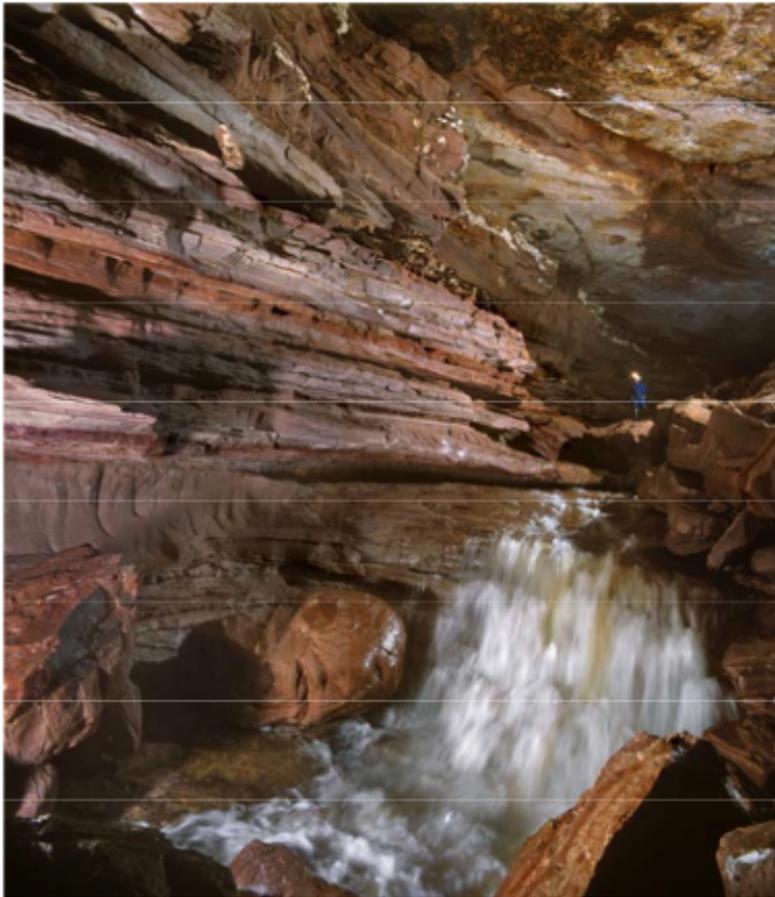
*Fig. 3: Biospeleothems of “champhignones” type in Cueva Juliana, Macizó Chimantá. Photo: L. Vlček*

The Cueva Zuna is formed by 300 m long, relatively straight, 30 m wide fossil gallery. Slovak- Croatian team took together also an extensive half-open -100 m deep abyss (dimensions of the entrance are 80 x 100 m). However it leads through its bottom, among collapses and jungle only to the 150 m long cave fragment named Tetris. Within other newly mapped and known sites the remarkably one is the almost 150 wide cave portal, temporarily named as “Cueva el Diente“, localized only from the air, during helicopter flight. The continuation behind the portal is collapsed (approx. 100 m of smaller cracked areas), on the opposite direction is eroded to the amazing, luminous, approximately 50 m wide bridge (Puente de Diana).

Now the third longest cave of the Chimantá massif remains the Cueva del Diablo (2.3 km long and - 80 m deep), with corridor width in some places up to 50 m and two more than 80 m wide domes, discovered and explored in 2005. The deepest known and explored site remains the Sima Noroeste (- 130 m), with crack collapse by dimensions of 60 ×

400 m. It is remarkable that this site is continuation down at least next 30 m and we assume that it is connection to the big horizontal cave.

During expedition repeatedly tried to break through the end collapses of the monstrous cave of Cueva Charles Brewer, against the river current (the length of the cave lengthened up to 4782 m, the vertical distance remain +110 m), but without remarkable progress. This cave with commonly 50 – 80 m wide corridors (Fig. 4) and the monumental hall of “Gran Galería Karen y Fanny” by volume approximately 400000 m<sup>3</sup> remains further the biggest quartzite cave in the world. Cueva Charles Brewer was localized first time in 2002 and explored in 2004 under the leadership of Charles Brewer-Carías and friends (e. g. Šmída et al. 2005a; b; c; d; e).



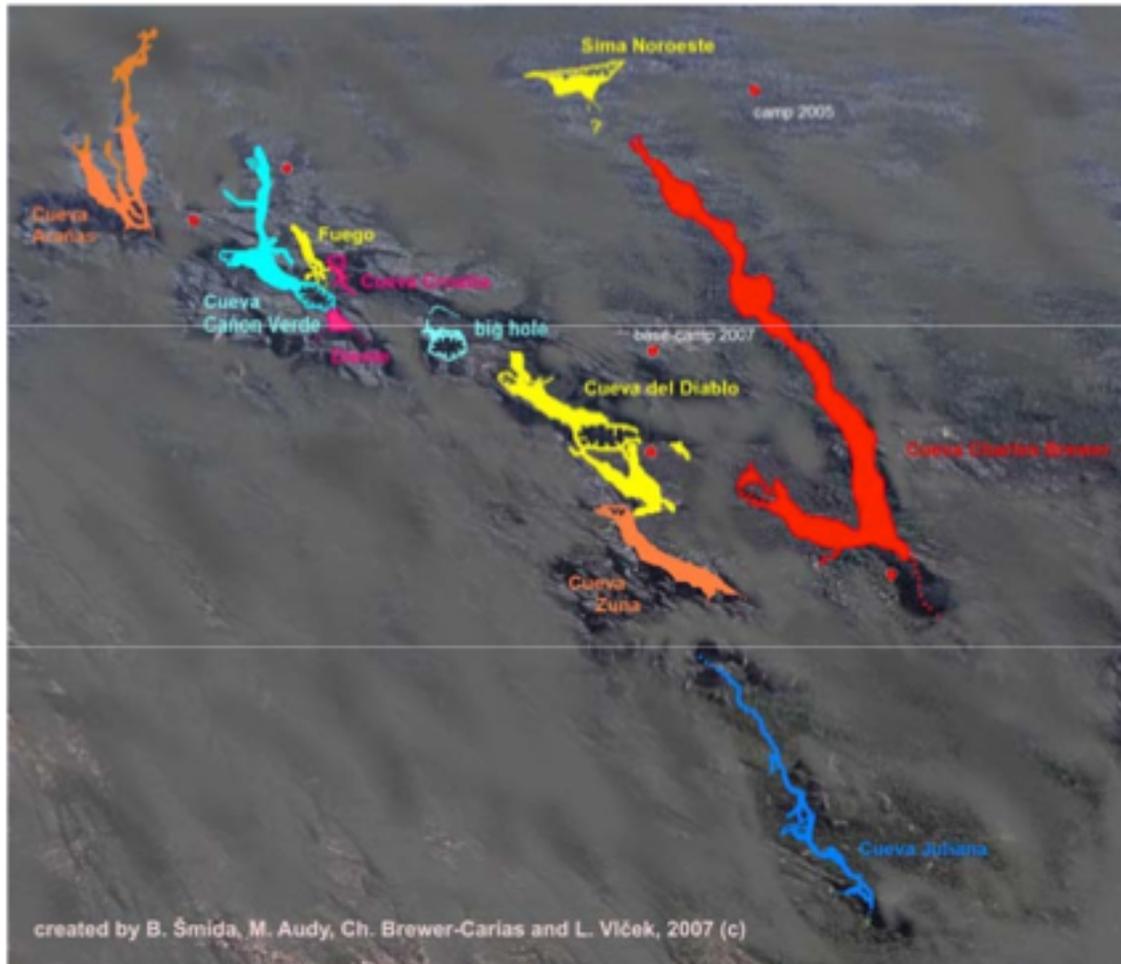
*Fig. 4: The waterfall Cascada Vanessa in Cueva Charles Brewer – the picture shows the common size of corridors in this cave. Photo: M. Audy.*

During the “Tepuy 2007” expedition more than 5 km of cave spaces was documented on the Chimantá, further exploration perspectives are more than promising. Remarkably, that since the year 2004 during several stays we explored almost 15 km of caves on this plateau (Fig. 5). During our last stay a numerous geological documentation was done, as well as rock samples for thin sections (investigations in microscope) and geochemical analyses were taken, from different positions and layers in quartzites in the walls of the Cueva Charles Brewer itself as well as from the surface. Moreover water samples were taken from the underground river from this and other caves, also from creeks and swamps on the plateau and field measurement were performed: pH, conductivity, water and air temperature, discharge. The same day spectrophotometrical analyses of the water samples were performed, the following items were measured: Fe,  $\text{SiO}_4^{4-}$ ,  $\text{PO}_4^{3-}$ , Al,  $\text{NO}_3^-$ , Cl and total acid capacity, analyses of stable isotopes of H and O will be done later using the taken samples (Lánczos et al. 2007).

The expert for herpetofauna of tepuis, C. Barrio, caught and identified small endemic frogs (Ecaudata), lizards (Sauria) and snakes (Serpentes). Ethological observation and extensive cave fauna collecting were performed by all members of the team: e.g. flatworms (Turbellaria), miniature snails (Gastropoda), numerous species of spiders and harvestmans (Araneida, Opilionidea), millipedes (Diplopoda) and centipedes (Chilopoda), colossal cave cicadas from the *Hydrolutos* sp. family, two species of scorpions, within insects e.g. troglobiontic ground beetle-like beetles or white flies. Finally, expert for speleothemes, geologist R. Aubrecht further explored in details and sampled different types of speleothemes, organic red mud (so-called barro rojo), various opal-sinters, microbiocoatings and biomaterials (also alive materials in agar), as well as cyanobacteria from the surface of the plateau and creeks (in identification of these we will continue) and together from Ch. Brewer-Carías continued in elaboration of typological system of the spelethems occurring locally. Samples taken in caves and on the surface which were transported to Europe will be further investigated in laboratories by the participants of the expedition “Tepuy 2007”, scientists of the Faculty of Natural Sciences, Comenius

University in Bratislava, as well as other invited experts in natural

sciences, apparently with international participations. The well-known Slovak film-maker P. Barabáš prepared an adventurous- documentary movie dedicated to discoveries and exploration in the caves of the Chimantá mountain titled as „Tepuy“ (K2 Studio, Bratislava). This movie is presented on several world festivals dedicated to mountain themes.



*Fig. 5: Schematic location of the new-discovered caves on Chimantá table mountain. Created by B. Šmída, M. Audy, Ch. Brewer-Carías & L. Viček*

The second part of the exploration programme of the expedition was again dedicated to the Roraima Mountain, where the Slovak-Czech couple M. Audy and Z. Ágh discovered in the 2002 year up-to-day the longest cave system of the world developed in sandstones, names as

Cueva Ojos de Cristal (Kryštálové oči in Slovak, Crystal Eyes Cave in English). This action, 5<sup>th</sup> in row expedition (with Slovak, Croatian and Venezuelan participants) in the second half of February 2007 elongated this cave to 16 140 m, by connecting with two other caves – Cueva de Gilberto and Cueva Fragmento Marginal. The labyrinth-like cave system of originally independently discovered and explored, today connected parts consist of lower (max. 5 to 8 m of height, in average only 2 m), in some places only 30 – 40 cm up to 15 – 20 m wide corridors, which are densely interconnected to each other. Today are known several entrances to the cave, they are standard cave entrances, some of them located in closed hole basins, in vertical walls of the mountain and also as 20 – 30 deep abysses, genetically named by us as “pokemon” (e. g. Šmída et al., 2003). The biggest room of the cave is the “Hall of Mother SSS”, with dimensions of 40 × 50 m. The essential progress was reached here during our expedition Kukenán/Roraima 2006, when a team of Slovak speleologists by 6 members under leadership of B. Šmída discovered and mapped more than 4 km of new corridors. This year we explored more in details also a 100 m long cave Cueva Lago Gladys (Fig. 6), discovered in the past by Ch. Brewer-Carías. The Cueva Ojos de Cristal with its length more than 16 km became the second longest cave in Venezuela (the longest one is the Cueva del Samán, developed in limestone).

Similar geological and biological research (including sampling) as on the Chimantá we performed on the Roraima (moreover we probably discovered new mineral species), thus we can compare two of the table mountains, also the biggest quartzite caves of the world discovered by us based on scientific data. This fact will push the knowledge forward about the origin, age and development of them, in their amazing variety. P. Barabáš is preparing a next movie about discovering and exploring of caves on the Roraima, titled „Matawí“.



*Fig. 6: Entrance to Cueva Lago Gladys in Guyana part of Roraima Mountain. Photo: B. Šmída*

## SUMMARY OF RESULTS

During 7 expeditions performed by us since 2002 to 2007 each year or half year to the table mountains Chimantá, Roraima and Kukenán we discovered more than 30 km of quartzite caves. 16140 m long Cueva Ojos de Cristal cave on Roraima Mountain represents the longest cave in silicic rocks and simultaneously the second longest cave in Venezuela. Cueva Charles Brewer cave on Macizó Chimantá Massif is the most spacious cave in quartzite karst and one of largest caves in the world. One of the main goals is that the new genetic types of opal biospeleothems were discovered, sampled and studied.

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