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The longest quartzite caves of the world : Cueva Ojos de Cristal (16.1 km) and Cueva Charles Brewer (4.8 km) and other giant caves on Venezuela table-mountains tepuy Roraima and Chimantá discovered by our 7 expeditions in 2002 – 2007

Les plus grandes grottes de quartzite du monde : Cueva Ojos de Cristal (16.1 km) et Cueva Charles Brewer (4.8 km) et autres grottes géantes sur les tepuy Roraima et Chimantá découverts lors de nos explorations en 2002 – 2007

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Abstract

The latest discoveries in these virtually inaccessible (often only by helicopter) Proterozoic plateaux around the catchment of the Orinoco ("The Lost World" according to a novel by Arthur Conan Doyle)were made by our team in2002 when we found Cueva Ojos de Cristal on the Roraima plateau (near the border with Brazil and Guyana). Also in 2004 we explored the Cueva Charles Brewer on the vast plateau of Chimantá – both caves are in so-called *silicate karst*. We surveyed, in detail, the sloping passages of Cueva Ojos de Cristal to a total length of 16.1km. This is currently the longest cave in the world formed in quartzite. The huge Cueva Charles Brewer is now 4782m long and 110m deep – the largest cave in quartzite. In this area we also found several other large new caves in quartzite over a relatively short period of time.

Keywords : Cueva Ojos de Cristal, Cueva Charles Brewer, the longest caves of the world in quartzite, silicate karst, biospeleothems, Roraima, Chimantá

Résumé

Les dernières découvertes importantes sur les très inaccessibles (souvent par hélicoptère seulement) tepuys, ces formidables montagnes tabulaires protérozoïques situées autour du fleuve Orénoque (Le Mode Perdu selon le roman d'A. C. Doyle) ont été réalisées lors de nos expéditions : en 2002, la grotte Ojos de Cristal, sur le plateau Roraima (à proximité de la frontière avec le Brésil et le Guyana) et en 2004, la Cueva Charles Brewer, sur une partie du vaste plateau de Chimantá, les deux dans des karsts siliceux. La première grotte développe 16 140 m, topographiés par nos soins, constitués de passages subhorizontaux et de petits écoulements intermittents. C'est ainsi la plus grande grotte dans des grès. Nous connaissons désormais environ 30 entrées pour un réseau occupant une surface d'environ 500 m sur 1000. Elles ont le même aspect que des entrées de grottes traditionnelles, parfois dans les parois même de la montagne et quelquefois sont des canyons de 15 à 30 m de profondeur, que nous appelons pokemon.

La Cueva Charles Brewer, développant actuellement 4782 m pour une dénivellation de 110 m est la plus grande cavité dans des quartzites. Cette réellement très vaste grotte mesure en général, dans l'axe de la rivière principale 60 à 100 m de large pour quelquefois jusqu'à 40 m de haut, avec même un superdôme de 400 000 m^3. L'entrée mesure 120 m de large et fut découverte depuis l'avion par le 2eme auteur de cet article en 2002. Depuis 2002, notre équipe internationale Venezuelo-Slovaquo-Tchéquo-Croate, composée de spéléologues et de scientifiques, a exploré sur ces montagnes tabulaires vénézueliennes plus de 30 km de passages souterrains (de nombreuses cavités dépassent les 1 à 2 km) : des chambres géantes, des chaos, des rivières sauvages, de puissantes cascades, de spectaculaires biospéléothèmes "vivants" (construits par des colonies de cyanobactéries), des dolines d'effondrements d'un diamètre et d'un style connu en exploration tropicale, comme par exemple en Papouasie-Nouvelle Guinée.

Mots-clés : Cueva Ojos de Cristal, Cueva Charles Brewer, Plus grande cavité dans la quartzite, karst siliceux, biospéléothèmes, Roraima, Chimantá

INTRODUCTION

In february 2007 four experts in Venezuelan quartzite caves, the first four authors of this article, organized an expedition with a duration of one month, to the caves of the Chimantá and Roraima massifs, named as „TEPUY 2007", and our 7th to these wild mountains since 2002. The international team of speleologists and scientists consisted of 16 persons. The longest and biggest quartzite caves where again explored during the stay, known and discovered by us first time in 2002 and 2003: Cueva Charles Brewer and Cueva Ojos de Cristal (AUDY & ŠMÍDA, 2003; CHACÓN *et al.*, 2006; ŠMÍDA *et al.*, 2003, 2005a, d, e, etc.) Beside standard speleological exploration, topography and photodocumentation we also focussed on complex evaluation of natural phenomena, surveying, measurement, sampling (rock material, biospeleothems, water, minerals, microbiological and speleozoological materials) also several new big cave sites were discovered.

RESULTS

On one of the 10 partial mesetas of the **Chimantá** massif with areal extent of 1470 km^2 the Czech subgroup (M. Audy, R. Tásler, R. Bouda) discovered a **2.5 km** long cave **Sistema de la Araña** and the central Slovak–Venezuelan–Croatian team (B. Šmída, Z. Ágh, F. Mayoral, L. Vlček, J. Schlögl, M. Kuhta) accomplished mapping of the **Cueva Cañon Verde** cave in length **1.2 km**, discovered and partially explored by the team of E. Kapucian, J. Mesa, and M. Majerčák in 2005. Both of the cave sites, which have several cave entrances located in megadepressions (e.g. the Cueva Cañon Verde was a southern entrance located in a depression with extent of 80 x 150 m and approx. 60 m depth) consist of extensive fossil corrridors (50 m width and 20 m height), as well as at slightly lower level canyon-like galleries with heights 10 to 15 m and widths 10 to 30 m, with rivers in their bottoms. In the first of the above-mentioned cave is well developed and also the lowest situated, juvenile and probably periodically flooded zone of corridors with hundreds (!) of sandstone pillars (AUDY *et al.*, 2008, in press), in the second one is situated a big dome with dimensions 50 x 100 m and also numerous dangerous collapses (chokes) and labyrinths (ŠMÍDA *et al.*, 2008a). In both caves numerous clusters of young („alive") and older, already opalized „Champignones", speleothems built up by *Cyanobacteria* (AUBRECHT *et al.*, 2008), first identified by us in the Cueva Charles Brewer cave, as well as other unique speleothem forms, e.g. the „Penis" type, in enormous clusters built up on the bottom by thousands of individual pieces, or curtain-like gypsum speleothems so-called „Crepe paper" type.

The next of the new caves **Cueva Juliana** has a length of 1km (the last day of the stay on the Chimantá in 2007 explored by two members of the Slovak team, B. Šmída and L. Vlček) having less height, maximum to 5 m and 10 – 20 m wide corridor, is a young karst spring, active during flooding events, with numerous lakes (ŠMÍDA *et al.*, 2008b). The next two caves (**Cueva Croatia** and **Cueva de Bautizo de Fuego)** take the form of cascade–abyssal systems, with length 200 m and 400 m, respectively, 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 tandem M. Kuhta and R. Dado, the next one, with more extensive horizontal passages near the bottom and smaller river was discovered by the following team: B. Šmída, Z. Ágh, F. Mayoral, J. Schlögl and T. Lánczos.

Fig. 1. Giant Gran Galeria de los Guácharos in Cueva Charles Brewer has a volume of 320.000 m^3, photo by M. Audy

The **Cueva Zuna** explored by L. Vlček a E. Kapucian is formed by 300 m long, relatively straight, 30 m wide fossil gallery (ŠMÍDA *et al.*, 2008b) . E. Kapucian, L. Vlček, M. Kuhta and R. Dado took together also an extensive half-open, -120 m deep abyss (dimensions of the entrance are 80 x 100 m). However it lead 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 from the air, during helicopter flights. The continuation behind the portal is collapsed (approx. 100 m of smaller cracked areas), on the opposite direction

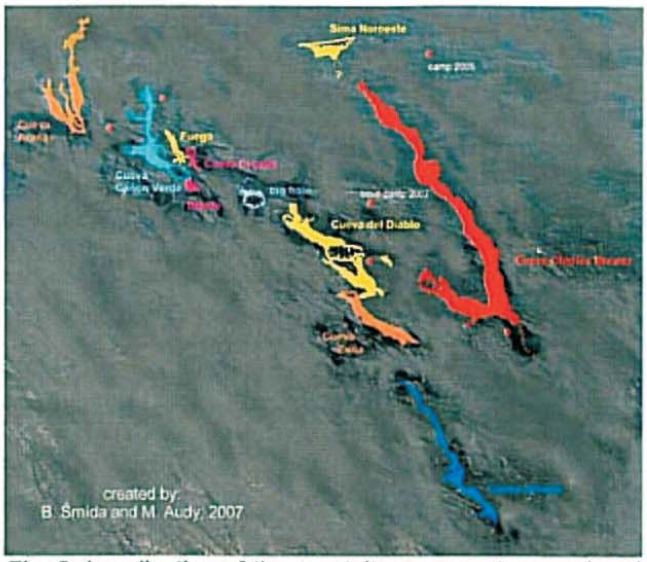

Fig. 2. Localisation of the quartzite cave system explored by us on Chimantá massif from the year 2004, created by B. Šmída & M. Audy, 2007

is eroded to the amazing, luminous, approximately 50 m wide bridge (**Puente de Diana**), documented by B. Šmída and F. Mayoral.

The second longest cave of the Chimantá massif remains the **Cueva del Diablo** from **2.3 km** long and -80 m deep (AUDY & ŠMÍDA, 2006; ŠMÍDA *et al.*, 2008b) with corridor width in some places up to 50 m and two more than 80 m wide domes, discovered and explored in 2005 by B. Šmída, M. Griflík, E. Kapucian and P. Barabáš. There are up to 3 m long (!), very massive stalactites, built by organic material. The deepest known and explored site remains the **Sima Noroeste (-130 m)**, with crack collapse by dimensions of 60 x 400 m (the first descent and exploration was realized in the same year by B. Šmída, M. Griflík and P. Barabáš (ŠMÍDA *et al.*, 2005c, d).

During this 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 denivelation remain **110 m**), but without remarkable progress. This cave with commonly 50 – 80 m wide corridors and with the monumental hall of Gran Galería Karen y Fanny by volume approx. 400.000 m^3 remains further the biggest quartzite cave in the world. Its entrance portal is 120 m and more wide. This cave was explored first time on 28th February 2004 by Charles Brewer-Carías and his 11 friends and scientists. The next already very well organized and unusually action we performed here commonly from him not much later, in the days from 28th May to 2nd June 2004 (ŠMÍDA *et al.*, 2005a, b, d, e, etc.). At the time of absolutely dry weather at least 300 l/sec. flows through the cave, but we suppose that at the sudden inflows of water the capacity of the river can take much more (maybe up to 20 – 30 m^3/sec.? in rain season). There are turbulent waterfalls in the cave and a unique diversity of biospeleothems: Champignones, Muñecos (Pupets), Carrots... for example the big hard white balls (diameter up to 15 – 30 cm), in the form as if „mushrooms" are created as alive (!) accumulations of *Cyanobacteria*, creating in aphotic conditions big wall collonies; after their growth layers opal stromatolith appears (AUBRECHT *et al.*, 2008). In the cave is too a lot of giant (up to 8 – 12 cm long) scorpions or big crickets *Hydrolutos* sp.

During the expedition TEPUY 2007 more then 5 km of cave space was documented on Chimantá massif, further exploration perspectives are more then promising. Remarkably, that since the year 2004 during several stays we explored here almost 15 km of caves. 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, SiO_4^{4-}, PO_4^{3-}, Al, NO_3^-, Cl^- and total acid capacity, analyses of stable isotopes of H and O will be done later using the the taken samples (LÁNCZOS *et al.*, 2008, in press). Finally, expert for speleothems further explored in details and sampled different types of speleothems, organic red mud (so-called *barro rojo*), different sinters, microbiocoatings and biomaterials (also alive materials in agar), as well as

Fig. 3. Inside the Cueva Charles Brewer is strong underground river from many beautiful waterfalls, photo by M. Audy

Cyanobacteria from the surface of the plateau and

streams (AUBRECHT *et al.*, 2008). 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 of the Comenius University in Bratislava, Slovakia, as well as other invited experts in natural sciences, apparently with international participation. Well-known Slovak film-maker Pavol Barabáš prepared an amazing adventure-documentary movie dedicated to discoveries and exploration in the caves of the Chimantá mountain titled as „Tepuy" (61 minutes).

The second part of the exploration programme was again dedicated to the **Roraima** mountain, where on 4th February the Slovak-Czech couple M. Audy and Z. Ágh found and first time explored the longest cave system developed in quartzites, named by them as **Cueva Ojos de Cristal**, the Crystal Eyes Cave, or Kryštálové oči (AUDY & ŠMÍDA, 2003; ŠMÍDA *et al.*, 2003). Our visit, the 5th in a row on Roraima already (with the following participants: B. Šmída, L. Vlček, E. Kapucian, T. Lánczos, R. Aubrecht, J. Schlögl, M. Kuhta, R. Dado and I. Elorza) in the second half of February 2007 extended this cave to 16 140 m, by connecting with two other caves, **Cueva de**

Fig. 4. Descent of one from the abyss-entrances to the Cueva Ojos de Cristal cave system, photo by P. Medzihradský

Gilberto and **Cueva Fragmento Marginal** (ŠMÍDA *et al.*, 2008 a, b). This labyrinth-like cave system was originally independently discovered and explored, today it is connected to 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 the cave has about 30 known entrances: they are standard cave entrances, some of them located in closed hole basins, in vertical walls of the mountain and also as 20m – 30m deep abysses, genetically named by us as ***pokemon***. The area below the surface is roughly 500 x 1000 m. The biggest room of the cave is the Hall of Mother SSS, with dimensions of 40m x 50m. The best progress was made last year during our expedition Kukenán/Roraima 2006, when a team of Slovak speleologists of 6 members under the leadership of B. Šmída, (further L. Vlček, P. Medzihradský, J. Ondruška, P. Masarovič and P. Barabáš) discovered and mapped here more than 4 km of new passages. On the expe 2007 we explored more in details also a 100 m long cave **Cueva Lago Gladys**, discovered in past by Ch. Brewer-Carías. The Cueva de Ojos de Cristal with its length became the second longest cave in Venezuela too (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".

CONCLUSION

From the year 2002 to this time our international team of the speleologists and the scientists explored on the table-mountains (***tepuy***) Chimantá, Roraima and Kukenan in Venezuela already more than **30 km** of the underground passages in very old sandstones. Two from discovered caves are really extraordinary: the **Cueva Ojos de Cristal** is from **16.140 m** by us very detaily mapped subhorizontal passages in its flat 2D-labyrinth from the smaller intermittent streams – the longest cave of the world in the sandstone now, and the huge cave **Cueva Charles Brewer**, now **4782 m** long and from 110 m of a denivelation is – the largest cave in quartzites on the other hand. Several other explored caves is more than 1 – 2 km long; they have very large channels, chambers from volume more than 50- or 100.000 m^3 and breakdowns, wild rivers and strong lower waterfalls, spectacular „live" biospeleothems (builded by the colonies of ***Cyanobacteria***) and their entrances are on the floors collapsed-dolines of the diameters and in a style of the tropical exploration as we know at example from Papua-New Guinea.

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REFERENCES

AUBRECHT, R., BREWER-CARÍAS, Ch., ŠMÍDA, B.,

AUDY, M. & KOVÁČIK, Ľ. (2008) Anatomy of biologically mediated opal speleothems in the world's largest sandstone cave Cueva Charles Brewer, Chimantá Plateau, Venezuela. *Sedimentary Geology*, 203 Elsevier, Amsterdam, p. 181–195.

AUDY, M. & ŠMÍDA, B. (2003) Krystalové oči (československá výprava do křemencového krasu venezuelské Guyany). *Speleofórum*, 22, Praha, p. 60–63.

AUDY, M. & ŠMÍDA, B. (2006) Tepui 2005: 4. expedice objevů největších kvarcitových jeskyní světa. *Speleofórum*, 25, Praha, p. 25–28.

CHACÓN, A., MESA, J. & MAYORAL, F. (2006) La Cueva Charles Brewer. *Faces. Ecotourism & Adventure*, 3, 13, Caracas, p. 28–53.

ŠMÍDA, B., AUDY, M. & VLČEK, L. (2003) Expedícia Roraima, Venezuela, január 2003: Cueva Ojos de Cristal (Kryštálové oči). *Spravodaj SSS*, 34, 2 (special issue, monograph). Slovenská speleologická spoločnosť, Liptovský Mikuláš, 192 p.

ŠMÍDA, B., AUDY, M. & MAYORAL, F. (2005a) Cueva Charles Brewer – la plus importantne grotte du monde creusée dans les quartzites (massif du Chimantá, Venezuela). *Spelunca*, 97, Paris, p. 27–35.

ŠMÍDA, B., AUDY, M. & MAYORAL, F. (2005b) Cueva Charles Brewer: largest quartzite cave in the world. *NSS News*, 63, 1, National Speleological Society, p. 13–14, 31.

ŠMÍDA, B., AUDY, M., BIORD, H. & MAYORAL, F. (2005c) Cueva Charles Brewer (Chimantá), Cueva Ojos de Cristal (Roraima) – the greatest quartzite caves of the world (table-mountains, Venezuela). *Bulletin of the SSS* (special edition for the 14th Speleological Congress UIS in Greece), Liptovský Mikuláš, p. 3–10.

ŠMÍDA, B., AUDY, M., BIORD, H. & MAYORAL, F. (2005d) Cueva Charles Brewer (Chimantá) and Cueva Ojos de Cristal: the greatest quartzite caves of the world (table-mountains, Venezuela). *Proceedings* of the 14th International Congress of Speleology (electronic version), Athena.

ŠMÍDA, B., BREWER-CARÍAS, Ch. & AUDY, M. (2005e) Cueva Charles Brewer – najväčšia kvarcitová jaskyňa sveta. Speleoexpedície do masívu Chimantá 2004, Venezuela. *Spravodaj SSS*, 36, 5 (special issue, monograph), Slovenská speleologická spoločnosť, Liptovský Mikuláš, 178 p.

ŠMÍDA, B., BREWER-CARÍAS, Ch., MAYORAL, F., VLČEK, L., AUBRECHT, R. & LÁNCZOS, T. (2008a) Speleoexpedícia TEPUY 2007 (stolové hory Chimantá a Roraima, Venezuela). *Speleofórum*, 27, Praha, in press.

ŠMÍDA, B., BREWER-CARÍAS, Ch., AUDY, M., VLČEK, L. & MAYORAL, F. (2008b) TEPUY 2007 speleoexpedition (Chimantá and Roraima table-mountains, Venezuela): official report. *Spravodaj SSS*, 39, 1, in press.

http://audy.speleo.cz/Chimanta
http://audy.speleo.cz/Roraima
http://www.tepuy.eu
http://www.suk.sk
http://www.k2studio.sk
http://www.sss.sk
http://www.speleo.cz