Issued for the purpose of 16th Congress of the International Union of Speleology, Brno 2013

BULLETIN 2013

of the Slovak Speleological Society

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Photo: Lukáš Vlček

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Introduction

Dear readers, dear cavers!

In the opening of the bulletin You read, I would like to introduce our organisation.

The Slovak Speleological Society (SSS) was created in September, 1949. It belongs to the constituent members of the International Union of Speleology (UIS) and it was the co-organiser of the 6th International Congress of Speleology in 1973. Since 2008 it belongs among members of the European Speleological Federation (FSE).

Nowadays, the SSS represents a platform for more than 50 basic organisational elements: regional groups and speleoclubs, with total number of more than 800 members. The main mission of the SSS is exploration, discovering, registration, documentation and protection of caves and karst within Slovakia, where the area of karst consists of more than 2,700 km^2. Their worthiness caused, that more than 6,700 caves are known in Slovakia at present time. The longest one reaches 36 kilometres, the deepest one has its elevation span 495 metres. Several caves were nominated to the National Natural Monuments and they are inscribed in the List of World Heritage of UNESCO or Ramsar Convention. Slovak cavers operate in abroad too, mainly in karstic areas of the Balkans and table-mountains karst of Venezuela.

The SSS annually organizes several speleological events with international attendance: Speleomíting (more than 20 volumes), Caving Week (more than 50 volumes), as well as events oriented to the education or speleo-alpinistic training. Since 1970 it edites a speleological bulletin Spravodaj SSS, quarterly and speleological books, occassionally.

That are the main facts about the SSS and their activities. Further information about the important discoveries in Slovakia, in Europe and around the world, where Slovak cavers played the first role, You can find inside this bulletin. If You decide to visit some of Slovak karst areas or their caves in the future, You will be warmly welcomed.

Bohuslav Kortman
chairman of the SSS

List of the longest caves of Slovakia

1. DEMÄNOVÁ CAVE SYSTEM
Low Tatras Mts., Demänovské Hills
Length: **36,333 m**
Depth: 196 m

2. MESAČNÝ TIEŇ CAVE
Tatras Mts., High Tatras
Length: **30,436 m**
Depth: 451 m

3. STRATENSKÁ JASKYŇA
– PSIE DIERY CAVE SYSTEM
Spiš-Gemer Ore-mountains, Slovak Paradise
Length: **22,264 m**
Depth: 194 m

4. JASKYŇA MŔTVYCH NETOPIEROV
(Cave of Dead Bats)
Low Tatras Mts., Ďumbier
Length: **20,195 m**
Depth: 324 m

5. ŠTEFANOVÁ CAVE
Low Tatras Mts., Demänovské Hills
Length: **14,468 m**
Depth: 104 m

6. JAVORINKA CAVE
Tatras Mts., High Tatras
Length: **11,230 m**
Depth: 480 m

7. JASKYŇA ZLOMÍSK CAVE
Low Tatras, Demänovské Hills
Length: **11,034 m**
Depth: 147 m

8. SKALISTÝ POTOK CAVE
Slovak Karst, Jasovská Plateau
Length: **7,983 m**
Depth: 373 m

9. HIPMAN'S CAVES
Low Tatras, Demänovské Hills
Length: **7,554 m**
Depth: 495 m

10. DOMICA
– ČERTOVA DIERA CAVE SYSTEM
(a part of Domica – Baradla Cave System)
Slovak Karst, Silická Plateau
Length: **5,368 m**
Depth: 70 m

List of the deepest caves of Slovakia

1. HIPMAN'S CAVES
Low Tatras Mts., Demänovské Hills
Length: 7,554 m
Depth: **495 m**

2. JAVORINKA CAVE
Tatras Mts., High Tatras
Length: 11,230 m
Depth: **480 m**

3. MESAČNÝ TIEŇ CAVE
Tatras Mts., High Tatras
Length: 30,436 m
Depth: **451 m**

4. SKALISTÝ POTOK CAVE
Slovak Karst, Jasovská Plateau
Length: 7,983 m
Depth: **373 m**

5. JASKYŇA MŔTVYCH NETOPIEROV
(Cave of Dead Bats)
Low Tatras Mts., Ďumbier
Length: 20,195 m
Depth: **324 m**

6. JAVOROVÁ ABYSS
Low Tatras Mts., Demänovské Hills
Length: 2,322 m
Depth: **313 m**

7. JASKYŇA V ZÁSKOČÍ – NA PREDNÝCH CAVE SYSTEM
Low Tatras Mts., Demänovské Hills
Length: 5,034 m
Depth: **284 m**

8. ČIERNOHORSKÝ CAVE SYSTEM
Tatras Mts., High Tatras
Length: 2,360 m
Depth: **232 m**

9. KUNIA ABYSS
Slovak Karst, Jasovská Plateau
Length: 933 m
Depth: **203 m**

10. TRISTARSKÁ ABYSS
Tatras Mts., Belianske Tatras
Length: 600 m
Depth: **201 m**

Exploring of the deepest cave system in Slovakia continues: what are the next perspectives?

Marián Jagerčík
Speleo Detva

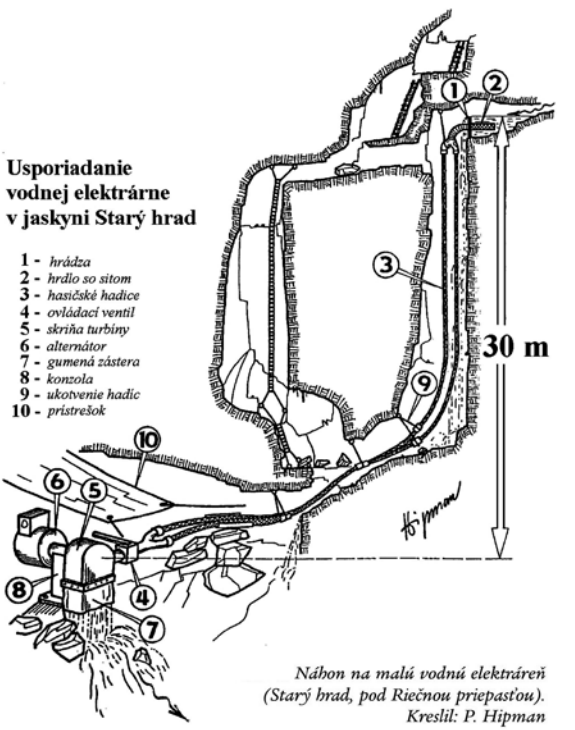
Naturally yes, it continues, in spite of plenty of obstacles by "mother nature" breaking the cavers' plans...

The exploration began in 1964, when Petr Hipman together with Hanka Kynclová penetrated into the underground of the Starý hrad (Old Castle) Cave. Till 2003 the cave has been prolonged and deepened to the –432 m. Then another cave – Večná robota (Eternal Work) Cave has been attached to the cave system, which reached the today's length of 7,554 m and depth of –495 m. This way, the deepest cave system of Slovakia was discovered – its name was created in honour of the discoverer of most of the caves of Krak's Mt. – Petr Hipman (†1999): the Hipman's Caves.

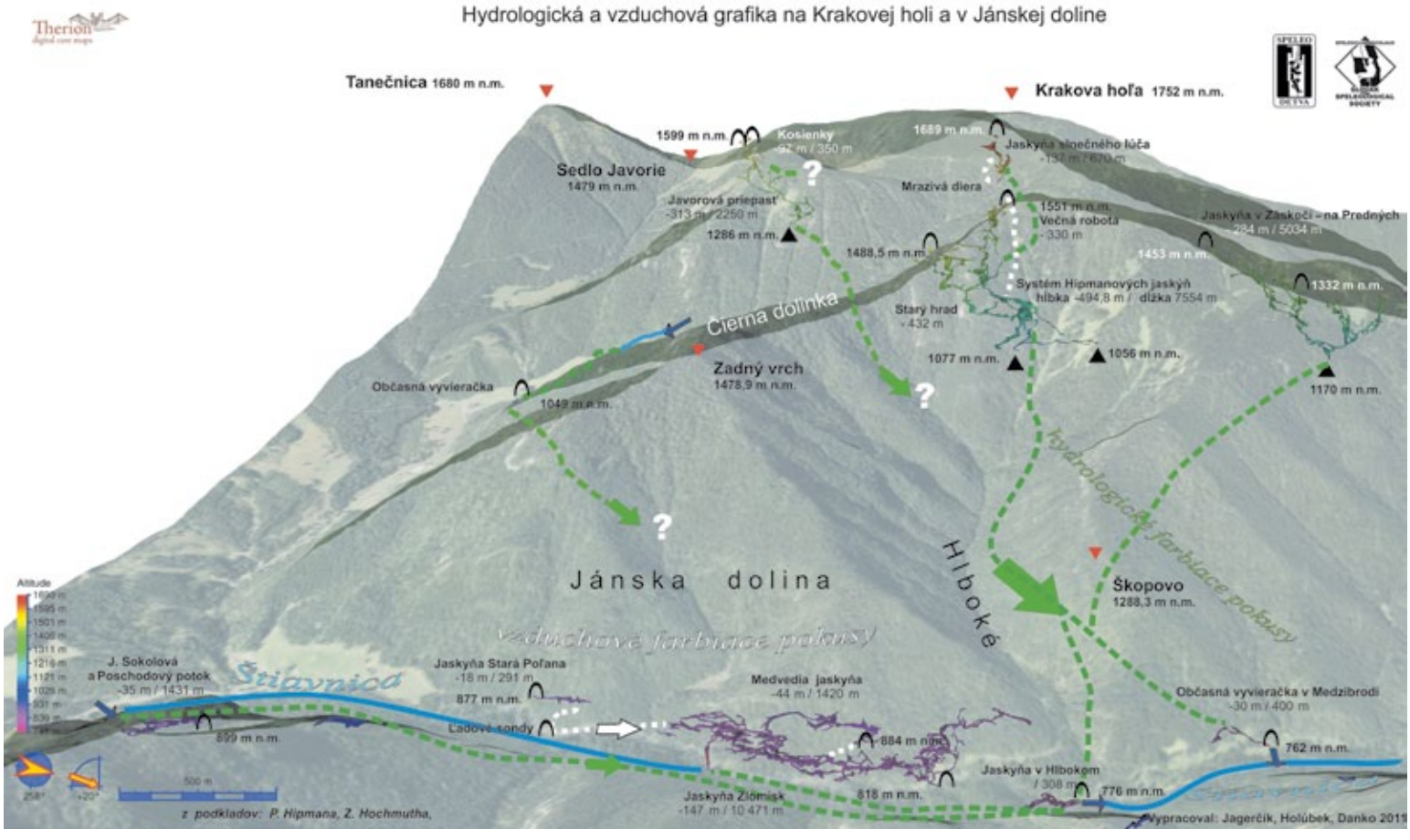
Resurgence in Hlbokô with homonymous cave. Photo: M. Jagerčík

Since the cave system represents an fluvially active cave flown through by lots of underground streams connecting into one impressive cave river named Krakovka, of course, there are many of possibilities of further exploration. One of them is located on the site where the underground river sinks to the narrow passage Krkvanica. The water continues to the resurgences on the bottom of the Jánska dolina Valley: Resurgence in Medzibrodie (a homonymous cave as well) and Resurgence in Hlbokô (dtto).

Another chance for prolongation of cave system is a possible connection with the –137 m deep Jaskyňa slnečného lúča (Sun Beam) Cave. Its entrance is located above the system, colorimetrically-proofed connected with. In case of physical interconnection of these two localities there would be possibility of discovering a –630 m deep cave system. For better access to the workplace on the



Sketch of small hydroelectrical plant, drawn by P. Hipman



Interconnection of caves between Krak's Mt. and Jánska Valley proved by hydrological (green dashed line) and air tests (white dashed line)

Hipman's Caves: The Hall of Explorers. Photo: E. Hipmanová

cave bottom, in 2012 the cavers digged trough the new entrance; this way they shorted the access time for 45 minutes. The workplace in the deepest part of cave brought approximately 60 m of new spaces, but mostly in hard conditions of rocky cave fall in.

Petr Hipman was a famous constructor and inventor, who implemented his know-how to the technical stuff of caves. Various of his technical inventions are used till present time in caves. Among others, the most important stuff are the fix Ø 8 mm ladders with steel ropes and dural rings. Nowadays we can find in the caves of Krak's Mt. More than 35 of these ladders in the cumulated length of approximately 0.5 km, whereas the longest one reaches 45 m with 164 stepps. The Old Castle's shaft equipped by this ladder was named Studňa radosti = Well of Joy. This way has allowed passing of more than 1.5 km of deep spaces in the underground of Krak's Mt. It has lot of advantages: the ladders allow a very fast descent and ascent through the caves – well trained cavers can reach the depth of 400 m in 1.25 hour of descent and they need cca 2 hours for ascent. Life time of ladders exceeds 40 years without an important losing of quality. Of course, it depends on quality of used material.

There is also a small hydroelectric plant with power of 1000 Watts in the Hipman's Cave System. Its construction was helpful since 1993 in the depth of more than 400 m, where the deepest working place took place. The electric plant is usually used for the charging of batteries (drilling machines, lights) or for the direct drive of electrical machines (for example also the cooking devices – a cup of hot coffee, tea or soup, or short break for sausages with mustard always fall in handy). Moreover, in the "Bivouac" – small wooden cottage standing in the entrance part of Bivaková Cave, close to the entrances to the Hipman's Cave System, there is a solar panel with electric accumulators as well.

As it was written in the beginning, the caves of Krak's Mt. hydrologically communicate with the caves in Jánska dolina Valley. The spatial interconnections, as well as the colorimetrical experiments shows the figure on the previous page. The vertical span of the colorimetrically proven localities between 1689 m a.s.l. (the Sun Beam Cave) and 742 m a.s.l. (Jaskyňa zlomísk Cave, more than 11 km long) consists of 947 m of only partially known spaces of underground. Well, we suppose, there will be lot to do and lot to explore in the next years for sure!

Does the largest cave system in Slovakia achieve the length of 50 km? Fairy tale about Demänovské caves

Pavel Herich
Caving Group Demänovská Dolina

History of Demänovské caves is a history of a man in some ways. Parts of this large cave system have appeared in the form of mysterious black holes on the surface. They fascinated human souls desiring for knowledge long before J. Buchholtz junior wrote the first words and drew the first map of Dragon´s (Black) Cave in 18th century.

In the underground of Demänovská Valley. Photo: L. Vlček

The caves in the Demänovská Valley are not older than two million years, at least those we have discovered and explored yet. The intense uplift of core mountains, Low Tatras, began in that time. Wild rivers, concentrating their power on the crystalline basement, have created canyon on the surface underground labyrinth of caves in more or less horizontal levels by penetrating the ductile rocks. However, there are older caves as well. Many holes and old caves relics are exposed in higher altitudes. The Krakova hoľa Mt., bordering the Demänovská Valley from the east, was hiding deep cave system until recently. The Demänovské caves are witnesses and parts of different land relief as we know it today. We suggest their age millions years further into the past.

Hellenic land is a symbol of lands with human existence. Not as infinite as vast deserts, where a human mind is captured more by transcendence than a strong point, not even as romantic land as northern tundra with lakes, the homeland of creatures from fairy tales. Are there any caves that meet criteria of the human dimension? Those in the Demänovská Valley go on in small, slit tunnels, which stop everything bigger than mysterious underground creatures made up in human minds. Immensity and infinity of wastelands carried in a rock is massive and endless in the underground world. However, the work of art, which the rivers Demänovka, Zadná voda, and others created, carries "humanity" in it. "You can see the roof, touch it from time to time, or lean down in humbleness, knee on the ground in order to straight up again. The domes are just as wide, you can understand your companion on the other end. Shafts are as deep, you can see the other´s lights on the bottom. You can make it through the main corridors from side to side in one day. The elevation of the system is 200 meters only, so you don't hang on the ropes for hours."

The Demänovské caves, all together with the old caves in the Mount Krakova Hoľa, are the same age as a man. Our destinies have blossomed out independently at first. As the time came and our paths crossed, a man began to visit caves, use them as a shelter, and gave them the cul-

Dripstone decoration of Cave of Peace. Photo: L. Vlček

Rare dripstone drums, Cave of Peace. Photo: L. Vlček

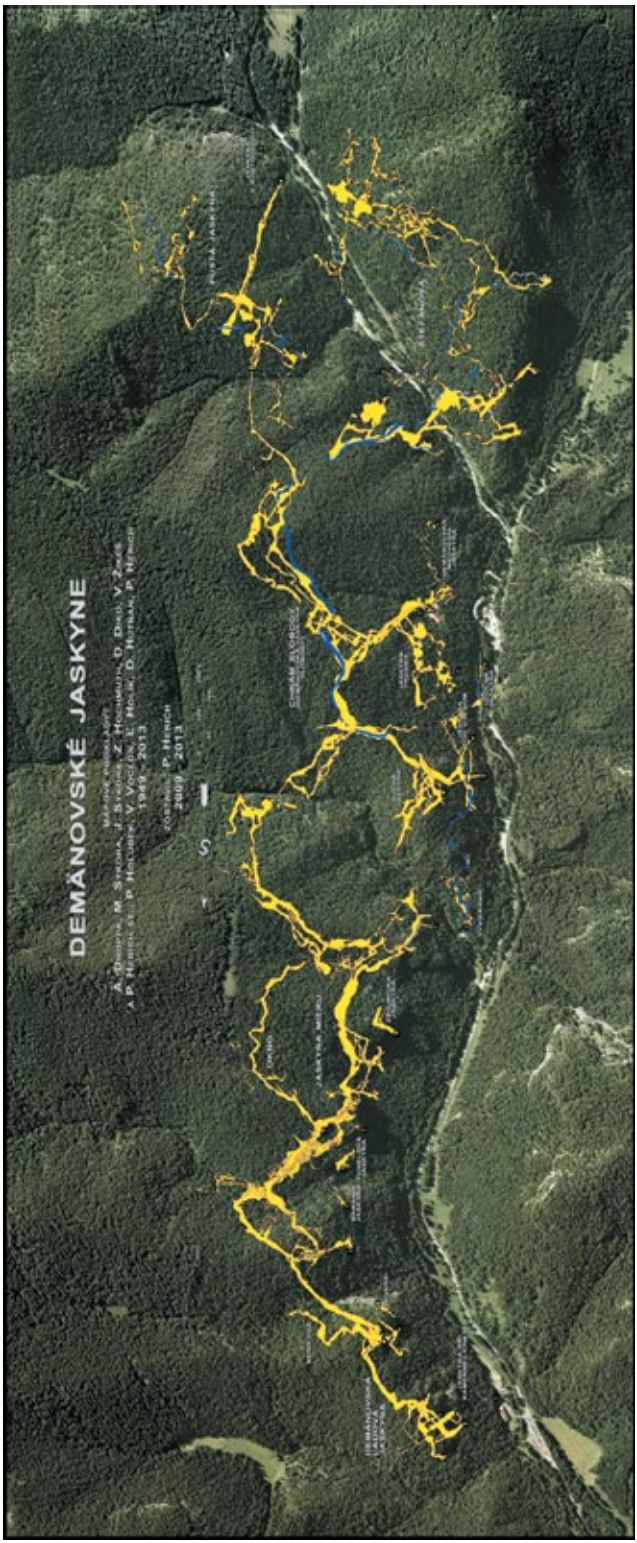
tural and spiritual dimension in revenge. He stored caves in his mind, hid secret treasures and dragons in them. Caves gave them an existential back-up.

They witnessed outlaws from time to time. Human desire for the knowledge of unknown gave those names: Dragon´s and Black Cave. In the 17th and 18th century the approach has changed and the science began to determine our relationship to the caves. Since then dragons almost disappeared, there was no place left for them. The breaking point in discovering of the Demänovské caves is dated in 1921. Alois Král discovered the first parts of the cave Chrám Slobody on 3rd August 1921. Later on, the 7 km long labyrinth was discovered by him and other surveyors. Amazing natural piece of art is captured in many lyrical descriptions of the underground beauty as well. Two years later, an exploration of the Pustá Cave through the abyss known as Psie diery (The Dogs Holes) (shepherds used to throw their old and sick dogs in it). The Pustá Cave opened itself for explorers. After overcoming of an 80 m deep hole the stunning spaces (about 2.5 km) and the river Demänovka that appeared lower in Chrám Slobody were discovered. The ideas about the connection between these two caves began in that time, but succeeded after many attempts three decades later, on 2nd July 1951. Six months later, on 26th January 1952, three cavers: S. Šroll, P. Revaj senior and P. Droppa made it from the Ice Caves (Dragon´s, Black Cave) to the Cave of Peace (as they named it), which dimension looked alike the cave Chrám Slobody – its length reached about 7 km as well. It filled up the empty space, the missing link between main underground rivers in the cave Chrám Slobody and Ľadová Cave. Thirty years of exploration of the underground world in the Demänovská valley were completed in the 1950s. On the face of it, all tunnels, main corridors, and levels were discovered and the neighboring Jánska Valley gained more attention.

The first known attempt to measure and document the Demänovské caves is the map of J. Buchholtz junior from the

year 1719. Even though his methodology stays unknown, he lined idealized extended section. To get more accurate maps, it was necessary to wait another two centuries. Measurements in the cave Chrám Slobody began almost immediately after its discovery, and continued in 1928 and 1930. The documentation of the Pustá Cave helped to connect those two caves, and to find a new very southern entrance to the whole system. However, the documentary effort varied, so the necessity of a new, high-quality mapping increased. A. Droppa with other surveyors and explorers mapped the major areas of almost all known caves in the Demänovská Valley within 5 years (1949 – 1954). The book Demänovské jaskyne (The Demänovské Caves) was published in 1957. It is the only publication, which describes details and overall karst situation in the Demänovská Valley.

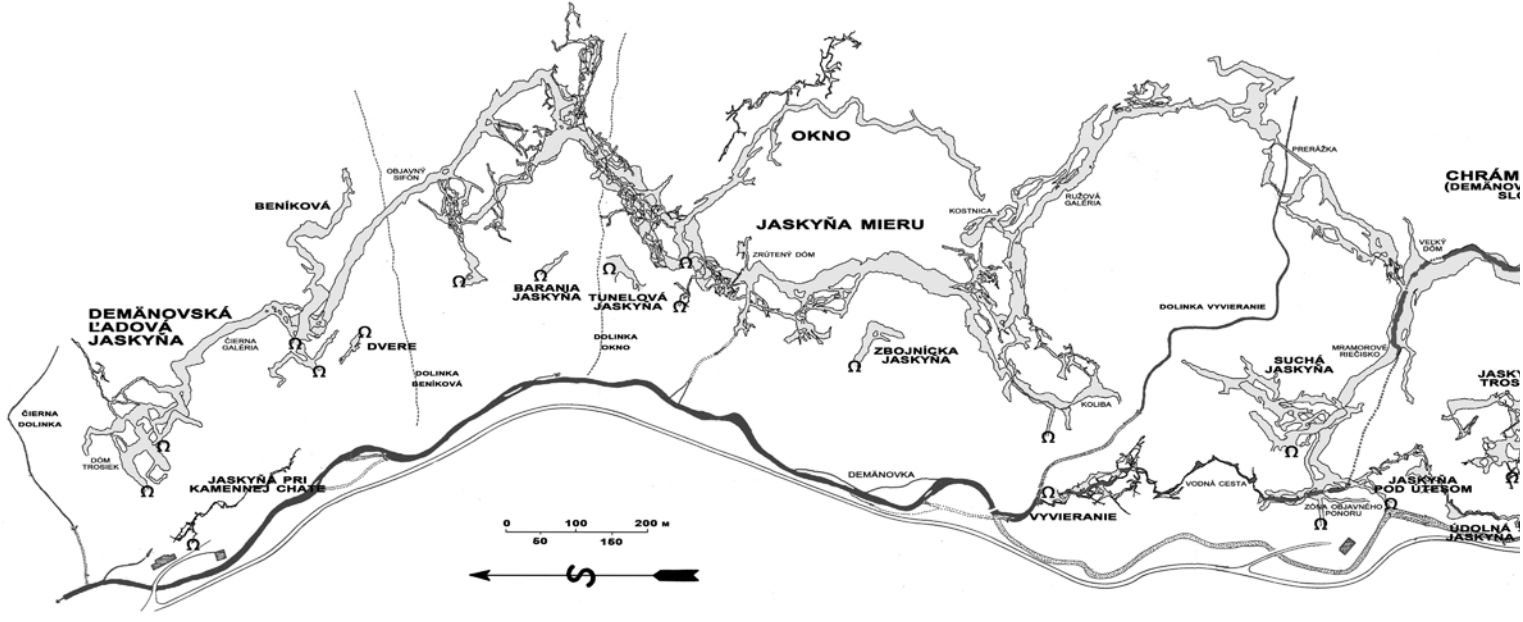
After completion of this work the interest in further research descended for the next 20 years. In the years 1965 – 1967 the mapping works focused on significant side corridors in the Demänovský Cave System. In 1970s and 80s the Ľadová Cave and the cave Chrám Slobody were mapped again. This revival occurred thanks to the explorer V. Žikeš. Together with other young adventure seekers started the exploration of the Demänovská Valley left side with any known caves. Step by step these activities became a serious mapping and getting to know the whole karst area newly. The Caving Club Demänovská dolina was established. V. Žikeš started the systematic diving exploration as first and succeeded. He connected the cave Vyvieranie to the cave Chrám Slobody. The connection between the Cave of Peace and Freedom became an is-



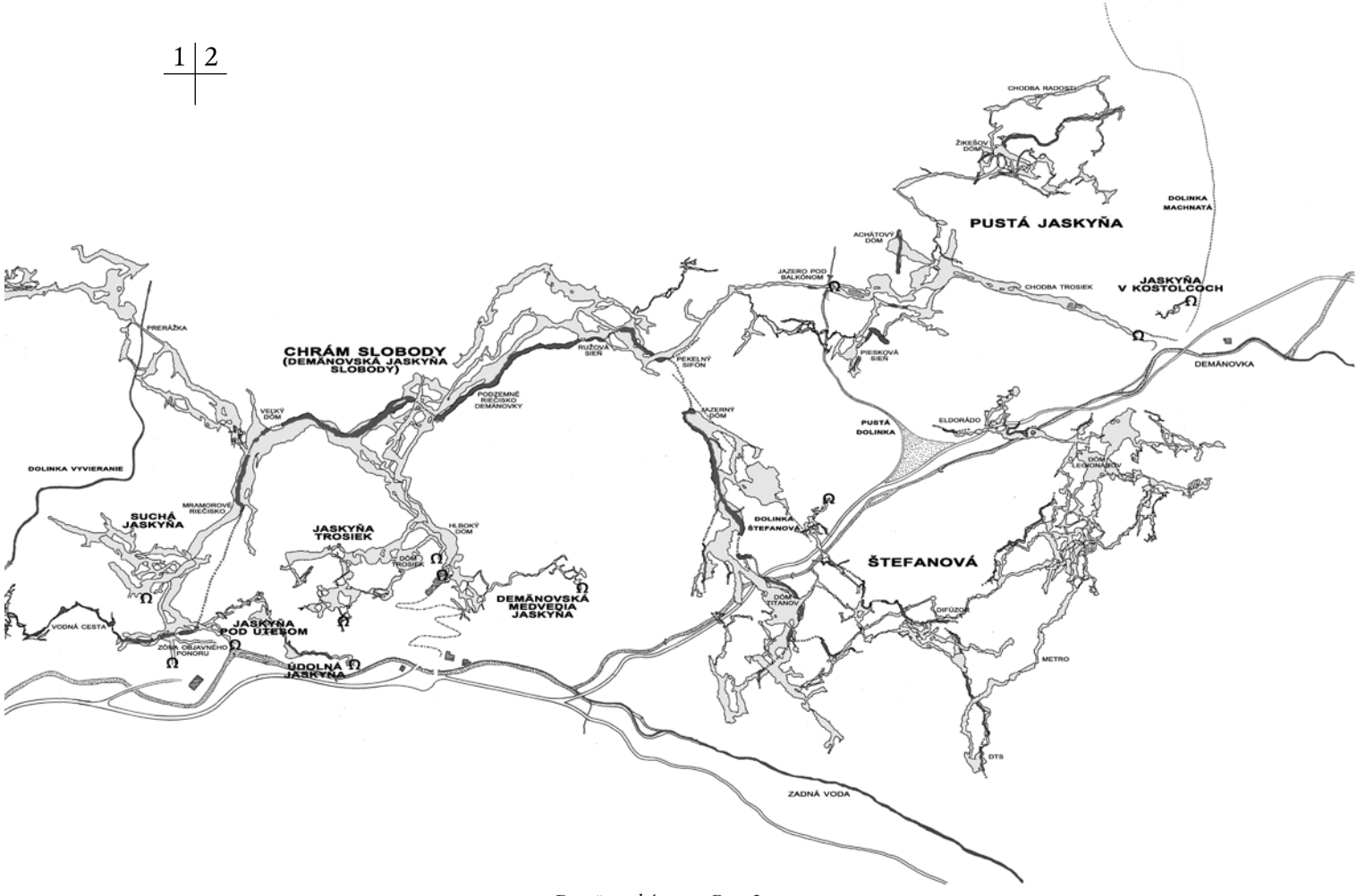
DEMÄNOVSKÉ JASKYNE

MAPOVÉ PODKLADY:
A. DROPPA, Z. HOCHMUTH, D. DIKO, P. HOLÚBEK, V. VOCLON, Ľ. HOLÍK, P. HERICH 1949 - 2013

SPRACOVANIE A KRESBA: P. HERICH 2009 - 2013



Demänovské caves, Part 1



Demänovské caves, Part 2

One of the many of flowstone pools in Chrám Slobody Cave. Photo: L. Vlček

sue again. Several corridors have got the right direction, but it seemed that the valley Vyvieranie is too deep for a connection. On the one side, Cave of Peace and Ice, about 10 km, and the southern half of the system is so long as well, caves Chrám Slobody and Pustá. Finally, the fifth attempt was successful on 2nd January 1987. 58 cavers within nine days of continuous work achieved it. The 24 m long tunnel was dug out in the liquid mud from the bottom of the pumped Těsnohlídek's Lake. Finally, they achieved the connection and created the Demänovský Cave System (DCS).

Mapping works were led by P. Holúbek in the 1990s. Side tunnels of all major caves in DCS, especially in the Cave of Peace with added 8 km, were documented. Also smaller caves have been documented systematically. The cavers had got into new parts of the Štefanová Cave with the length of 1.3 km in 1992. The other explorations were made in a spirit of last decade – new tens or hundreds of meters of side corridors, fragments of levels and so on. However, the new millennium had started and new knowledge of the underground world had to be joined.

The 90 m long Klaus siphon was dug out after a long and hard work in the Pustá Cave in 2002. The era of discovering of old corridors of the river Demänovka began to its ponor on the south. Under the leadership of J. Dzúr and Z. Chrapčiak the present length of the cave reached nearly 3 km over the years. In 2003 the initiative of J. Šmoll led to smaller, but important discovery of the cave Jaskyňa pri Kamennej chate (Cave by the Stone Hut). Between 2003 and 2004 the Demänovská Bear Cave was born for humans, with its length of 1.6 km. It became a part of the DCS in 2012 (Seven years after its discovery, it was found out according to the map, that it´s located 5 m only from the cave Chrám Slobody. The connection was dug out within four hours right next to the educational path used by visitors for the last 80 years). In the Okno (The Window) (still not connected to the DCS, 35 m still missing to the Cave of Peace) P. Staník and J. Psotka uncovered old pass to the new areas in 2005, so the cave grew up to over 1.5 km. However, the biggest surprise brought the 20th January 2007. Under the leadership of Ľ. Holík, who operated in the cave Štefanová in the nineties, new spaces in the cave were discovered. This discovery is comparable to those in the mid-20th century. After six years of the continuous exploration the cave grew up over 13.5 kilometers and now approaches the length of 15 kilometres..

Measurements according to the new standards continue, trying to document less important corridors of discovered caves, and to provide an overview and good orientation following a

map. While the map scale of the large caves were between 1:700 and 1:1,000 in the past, from the beginning of the 1980s the scale is between 1:300 and 1:500, and 1:200 in case of smaller caves. P. Herich (author of this article) initiated works on a new comprehensive map of the Demänovské caves since 2009. It includes all discovered and documented cave areas in the Demänovská valley.

The discovery of the cave Štefanová, as a large multi-level labyrinth of corridors, flood tunnels and main underground riverbeds of the river Zadná voda, showed further directions of exploration and discovery potentials in the Demänovská valley. In the cave Štefanová we came almost directly under the ponor, to the places, where the cave begins. The cave, as drainage artery of the rivers Stodôlka and Repiská, passes above the valley floor three times, above the active watercourse of the river Demänovka. The roof of the cave is located only 20 – 25 m below the bottom of the river. Though, there is no sign of noisy buses full of tourists heading into the hills.

Two of the places, which pass underneath the bottom of the valley, are close to DCS. The Jazerný Dome ends by a lake joining the main stream of the cave Štefanová. The siphon continues, thereby the further diving exploration is required. The distance is 90 m to the cave Chrám Slobody in air-line, but the tight siphon reaches the depth of 32 m. The cave Eldorádo is 120 m far away from the Pustá Cave, although without water, but with a lot of sediment. Since 2012 cavers from the Caving Club Demänovská dolina along with others from Slovakia, Moravia and Poland have tried to connect these caves in order to make the system longer than 50 kilometers.

Karst in the Demänovská Valley is large and reachable for humans (but not too much), the long-term perspective and hope for caving activities is still actual. Tens of kilometers of tunnels is bold predetermination, as well as another cave Štefanová, inverted delta rivers, to the south from the Pustá Cave. The caves could develop into the no-end labyrinth, because each ponor has created its own capillary through the nappe. The cold water melting from the nearby glaciers corroded and sharpened its walls carrying granite gravel stones. The existence of a cave was confirmed in 1952, as one ponor collapsed and the river Demänovka rushed into the shaft, and flooded the educational trails of the cave Chrám Slobody a bit later.

The caves story is the story of a man. Caves would exist without us as well, and probably will survive longer than we. But together we create something, we push our limits to the next level. Caves are our existential back-up. Paradoxically, after few days spent in their internals, they expel us a bit. Talking about their exploring by a man is talking about himself, his thinking, approach, fear and desire for knowledge, and hope. Talking about his technical possibilities, but also an education, and atmosphere in society and belief in a metaphysical reality.

As learnt from the decline of interest in local karst in the second half of the 20th century, man´s hope determines his next steps. The hope that cannot be clarified in some economic or financial values, partly irrational. The human hope.

Belief or fear once didn´t allow us to objectify abstract outlines areas of caves, that world was mysterious, obscure. It was an evidence of human´s humbleness. However, it has changed gradually. We gained more self-confidence, and penetrated physically deeper. But spiritually? The material was penetrated by physical force, which forced the spirit to remain on the surface... Who knows, but similar as Renaissance painters began to sign own names on their works and lost partly the act of creation in face of a higher principle, it infiltrated into the roots of a man, and consequently deeper, underneath the roots of trees.

Today, we are operating in the (local) caves and looking forward the hope – we have still a lot ahead. On the other hand, the question that annoys me: Is there a border better not to cross? It´s us, who create the limits. They were different for our ancestors, will they be different for our children´s children. Though, are we able to listen to the nature? Does it speak to us? If so, there are same restrictions, not only relative (ours). Returning to the human land – what brings us a discovery? Something we finally bring on a map, or a picture. Why don´t we care about caves elsewhere? Why is my cave, although smaller, more dear to me than the others? Sometimes it seems to me, it´s not important how much we discovered, how big is the cave finally, but what

we have experienced in it, what we felt, how it affected us. Our knowledge has changed us, the knowledge of karst phenomenon, and especially self-knowledge. The cave story is the story of a man, and how a man deals with it.

Following the current path, the 50 kilometers in Demänová Cave System seem to be achievable. We hope that the connection between the cave Štefanová and DCS will succeed earlier than in a decade. Furthermore, there are still significant opportunities to continue, limited in a distance of the ponor of the river Demänovka. Some of us believe that the caves continue gradually to the Mount Krakova Hoľa, 3 more kilometers (the DCS stretches 4 kilometers along the valley), and the possibilities here are inconceivable.

New path, thus traditional, although it appears contradictory, can bring someone to the consciousness of own shortness, fallibility and knowing that nothing is as clear and simple as it appears. Maybe it will leave a space to his soul, to not overbear it in the rock by a flexionless matter. Perhaps that someone won´t come to the end of all corridors, climb all corners of domes, perhaps he will stay still on the doorstep, so he can´t listen to the illusion of omniscience. Perhaps he will leave a space to all those fairy tales, ideas and hopes, where a cave opens its existential space to his own soul once again. To quantify the size, length, and scientific value will be less important. The mystery will dwell again. Let dragons nest in the caves again, we need them there for us...

In maze of erosional channels of Cave of Peace. Photo: L. Vlček

Štefanová Cave: a cave unsloving the mysteries of Stodôlka Massif, Low Tatras Mts.

Ľuboš Holík – Pavel Herich – Martin Rybanský – Lukáš Vlček
Caving Group Demänovská Dolina

Intro

The Demänová Valley belongs among the most important karst areas within the Slovak Republic, or Western Carpathians. It is situated to the north from the cristalline central mountain ridge of the Low Tatras Mts. and its lower part is built by carbonate rocks. A deep canyon has been created here under the influence of the Demänovka River; the river with its tributaries were the main factor of creating the underground karstic phenomena. The Demänová Karst represents a karst of monoclinal ridges with highly dissected surface, therefore the exokarstic phenomena occur occassionally only. The origin of endokarst is strictly connected to the rocks of Middle Mesozoic Carbonate Complex, mainly the Gutenstein Limestones of Gutenstein Formation, which are up to 200 to 500 m thick. An extensive complex of caves has been created inside them: nowadays, more than 150 caves are known within the valley, but also one 36,333 m long Demänová Cave System. In present time, the Demänovka River flow sinks into the underground using more than 30 ponors in whole the length of valley. Sinking brooks are its tributaries as well; the most important one – Zadná Voda Brook flows from the cristalline basement of Repiská Valley and connect the Demänová River inside the karstic area. These two flows are separated from each other by a cristalline-carbonatic massif of Ostredok Mt. – Stodôlka Mt. Inside them has been created the longest cave of karstic area of Demänová – the Štefanová Cave*.

Caving History

The cave's entrance has been opened at 857 m a. s. l. in the right-side slope of the Demänová Valley, 9 metres above the Demänovka River only. The 205 m long entrance parts of cave were discovered in 1953. Because there were plenty of more extensive caves in volume within the valley, cavers were not interested in further exploration here and the entrance rock wall fell down. In 1980' the cavers from speleological group Demänovská Dolina digged trough the breakdown and they worked in the cave for short time, however, without some special effect. The discovery came in 1991 only, when M. Rybanský and Ľ. Holík penetrated the senile narrow passage above the outflow siphon and they reached the upward branch of the cave. They surveyed the cave and found out the interesting results. The entrance sector is steeply declined to the erosion base in the depth of 40 m. A small brook flowing here came

Exploring of Eldorádo, Štefanová Cave. Photo: L. Vlček

*Slovak cavers usually differ cave with one entrance and cave system with few entrances, therefore connecting of two or several caves always creates a cave system.

Tens of meters steep slope with blocks of rocks in the mid-part of cave. Photo: L. Vlček

from the sinks of surface Demänovka River, therefore it has no perspectives of further exploration. The deepest point of cave was the outflow siphon, close to the other – inflow siphon, which played a trigger role of next discoveries. Behind the inflow siphon a meander continued to the upward branch with vertical span of 94 metres. Interesting and unusual is also the fact, the cave spaces cross the Demänová Valley in the underground, and moreover – the main part of cave is situated in the left side of valley, in the massif of Stodôlka Mt. The activity of cavers brought the discovery of the first-known really extensive cave in the left side of valley. Moreover, the upward branch of cave flows a small autochtonous brook through (provenience proven by in the conductivity test). Through the discoveries between 1991 and 1993 the total length of cave reached 1,552 metres. One of the most beautiful cave domes of Slovakia was explored, a dome called the Cavers' Dream. Then the exploring stopped for short time again and the next discoveries slept till the date of January 20th, 2007.

The first ten of kilometers of cave was surveyed! Behind the Sofia's Dome. Photo: L. Vlček

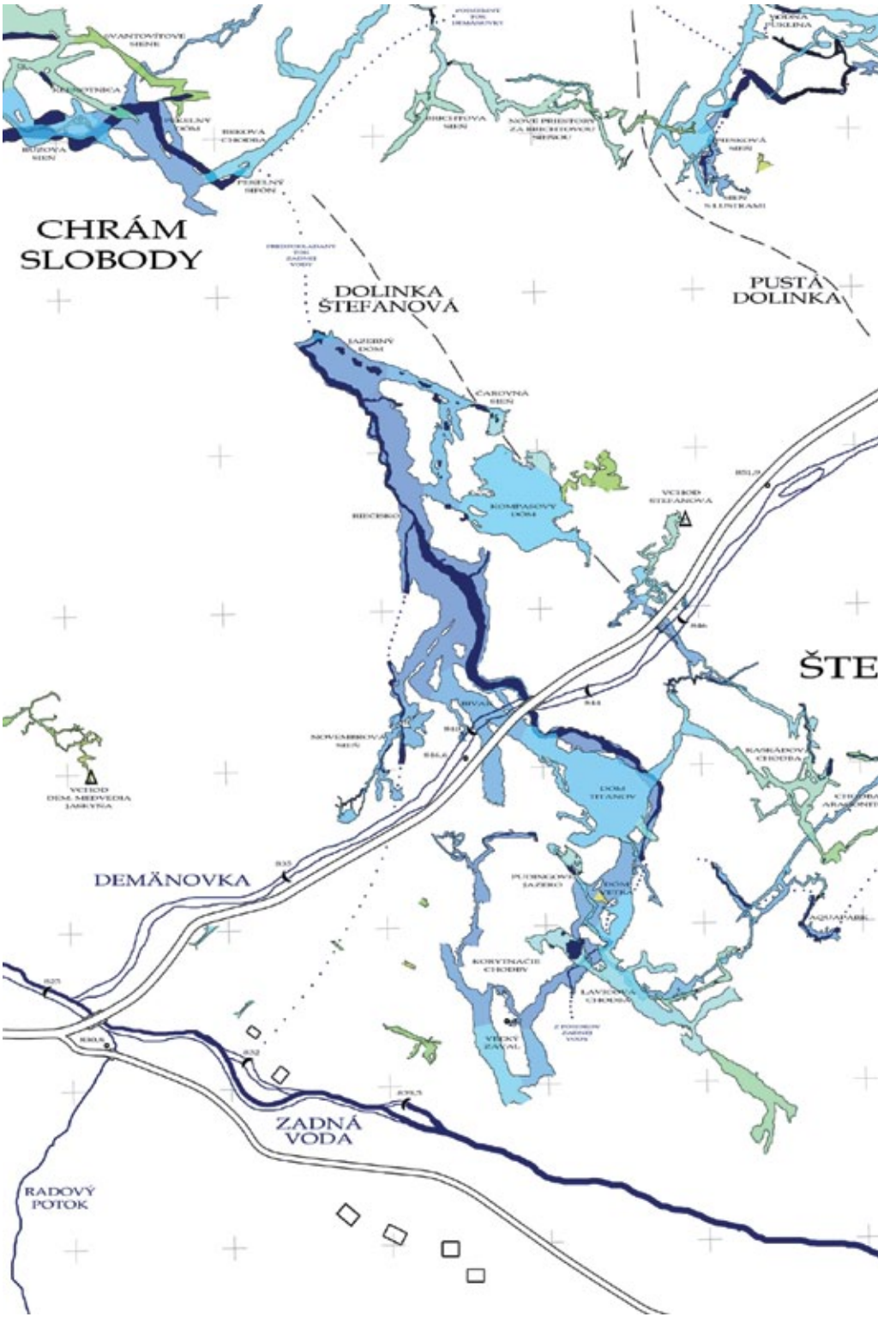
New Breath

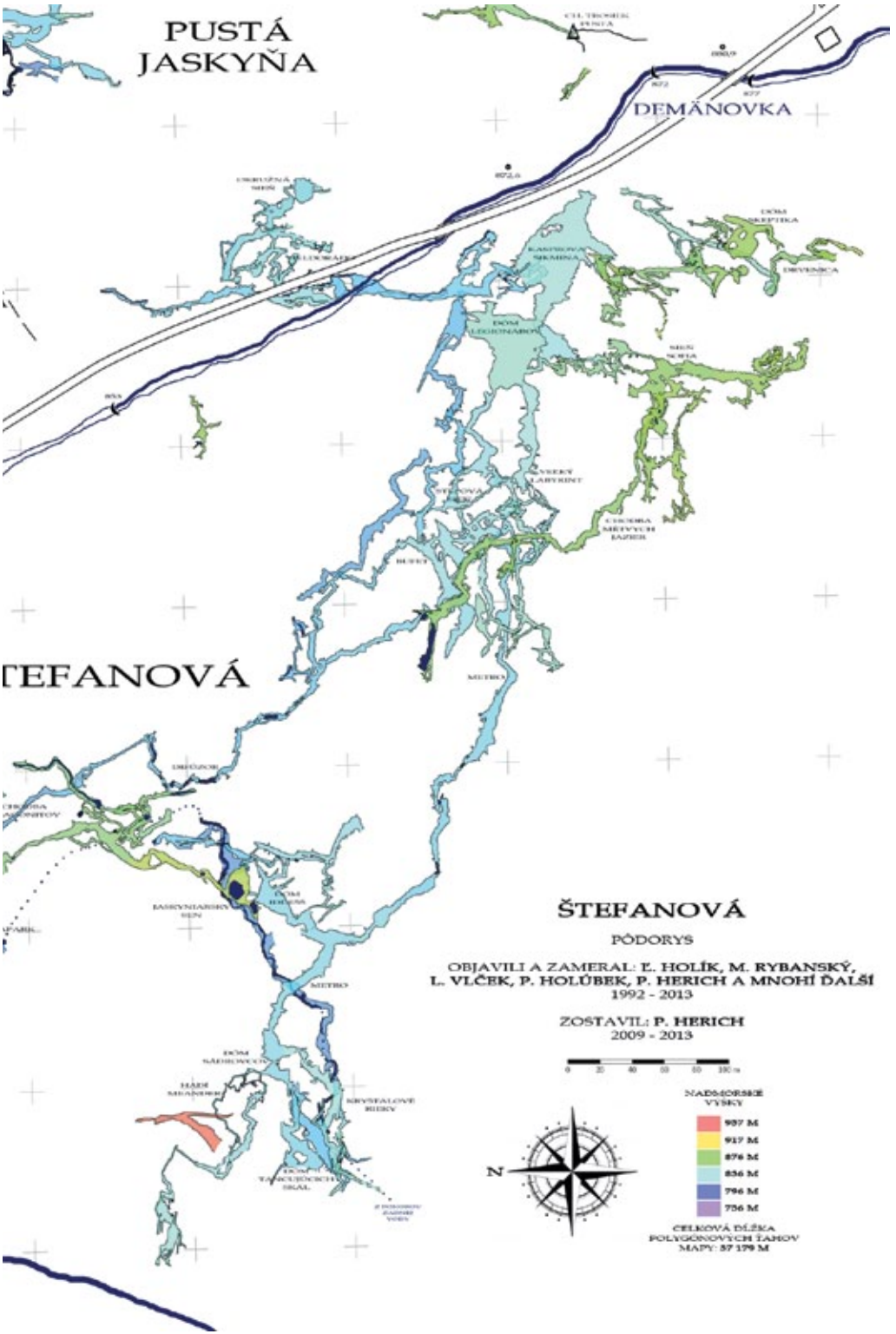
Because the cave represents a dynamic type of cave from climatological point of view, in 2006 the cavers came back here and started in excavation works following the air draught. It showed that the till-now known cave represents only a lower part of cave system lying under much extensive continuances. One working place had a pulsing air draught, so this one played an essential role in further exploration of cave. The 10 cm high corridor was filled by sands and pebbles covered by thick flowstone crust on the bottom, so the excavation here was needed. Already in 2007 the cavers passed through and they discovered the extensive labyrinth of great domes, huge corridors, lakes, siphons, chimneys and abbysses in three main developmental levels.

Dome of Titans and Dome of Wind

The parts discovered since 2007 are much greater than the entrance parts, there are lots of small brooks connected into two great underground rivers: Demänovka and Zadná Voda. Center of the new-discovered spaces represents the Dome of Titans with area of 100 × 35 metres, which is the greatest hall of cave till now. The cave continues trough two directions from here: to the NE and to the SW. The corridors of first direction collect the water and drain the cave to the Jazerný Dóm (Lake's Dome) with a siphon, which continues to the Demänová Cave System (Pekelný Siphon in the Pekelný Dóm = the Hell's Dome in the Demänová Cave of Liberty). SW parts of cave lead to the recent active ponors of surface river Zadná Voda and it's palaeoponors in the Repiská Valley. Between the Dome of Titans and Bivouac's Corridor cross the Zadná Voda River the riverbed of surface Demänovka River, so the cave cross here the Valley for the second time. Therefore, behind the Bivouac 1 goes the cave in the right side od Demänová Valley, as the whole Demänová cave System. Corridors here are low and wide: 0.4 to 1.5 m high and 10 to 15 m

Granite boulders ending passages on many places of cave: the Eldorado branch. Photo: L. Vlček


CHRÁM SLOBODY
DOLINKA ŠTEFANOVÁ
PUSTÁ DOLINKA
DEMÄNOVKA
ZADNÁ VODA
RADOVÝ POTOK


PUSTÁ
JASKYŇA
DEMÄNOVKA
ŠTEFANOVÁ
PÔDORYS
OBJAVILI A ZAMERAL: E. HOLÍK, M. RYBANSKÝ,
L. VLČEK, P. HOLÚBEK, P. HERICH A MNOHÍ ĎALŠÍ
1992 - 2013
ZOSTAVIL: P. HERICH
2009 - 2013
N
NADMORSKÉ
VÝŠKY
937 M
917 M
876 M
856 M
796 M
756 M
CELKOVÁ DĹŽKA
POLYGÓNOVÝCH ŤAHOV
MAPY: 57 179 M

wide, filled by granite pebbles. At the end of corridor is situated the Lake's Dome = the most NE space of cave. Water flows into a great lake, forming the water table of siphon. The Compass Dome (area of 50 × 30 m) connects to the Lake's Dome and it represents a higher, senile passage with richness of flowstones, lakes with cave pearls and subterranean aquatic animals. The end of dome directs to the surface and it is possible the connection with the Štefanová Cave II trough the break down.

Western direction from the Dome of Titans leads to the Dome of Wind, an important junction of cave. Here are passages leading to the ponors of Zadná Voda; unfortunatelly between the passages and surface occur an extensive tectonic fault causing the breaking the cave in. Another direction from Dome of Wind leads to the Ice Lakes – a dome with fantastic decoration of moonmilk forms. The most important directions from Dome of Wind goes trough the Sandy Crawling, behind continues the cave to the another branches of recent and also ancient Zadná Voda divergent flows: Turtles' Crawling, Great Rockfall – the marker of this collapsed space on the surface is a sinkhole below the Strieborná Cave (Silver Cave), siphonal and semisiphonal part Aquapark, Passage of Aragonites etc. At the end of the last mentioned passage the cavers penetrated in 2009 into the important continuance, which demanded the building of another two bivouacs.

Demänovka River flowing underground. Photo: L. Vlček

Measuring of polygonal net in traditional style. Photo: L. Vlček

Behind the Diffusor

The spaces behind the Diffusor were created along the bedding planes of Guttenstein limestones and along extensive tectonics, which caused here an occurrence of tectonic net representing a drainage system for water flows. A maze system of channels is interconnected by great domes, e.g. Dome of Legionaries, Dome of Chaos, Idešš, Dome of Sofia, Dome of Ballancing Boulders etc. The Bivouac II was built in the Column Hall close to the waterfall, water supplying the caves here. Bivouac III stands near Idešš Dome, in the passage called Metro (0.5 km long great passage generally of unusual W-E direction), as well as close to the dripping water. Lots of broken passages with active tectonic are here, mainly closed at the end by rockfalls. One branch of maze leads to the part called Eldorado. This one absolutelly differs to other

parts of cave, because since it is situated directly under the bottom of riverbed of Demänovka, there are lots of small brooks and waterfalls of dripping water here. Passages are divided by many of elipsoidal chimneys oriented to the surface. Except Eldorado, almost all parts of this sector of cave are filled by alochtonous sand and pebbles, usual are also granite boulders to 1,5 m big. Space is rich of dripstone decoration as well.

Caving Techniques and Science

Such a big cave as Štefanová is, the exploration with simultaneous survey is necessary. Since 2007, the cave was surveyed by a team of explorers with measuring tape, mining compass and clinometer. All the measuring points were stabilized into a rock. After 5 km of measured passages it turned out to be easier to use the digital equipment as Leica Disto × and SAP, occassionally with measuring tape as well. Another 10 km of passages were measured by polygonal net of stabilized measuring points too. Interesting is, that in whole the cave was not necessary the SRT, only someplaces were installed the rope traverses and ledders. Chimneys were explored by technical climbing, but without further continuances. Few tries of diving here were realized by speleodivers in the Lake's Dome, with partial results only. The semisiphons were explored through without diving equipment.

The hydrological tracing tests using the bacteriophags H40/1 have been realized in the cave. From the Lake's Dome to the Hell's Dome in DCS they needed 130 minutes. Another test was realized on the surface: from the riverbed of Zadná Voda came the flow to the cave in 120 to 150 minutes. The tests proved the interconnection between Štefanová Cave and Demänová Cave System, as well as the origin of cave water inside. Geomorphological research focused on the morphology of the ponor zone vs. the autochtonous parts of cave, including the dating of dripstones and sediments, was realized in the entrance sector of cave. Biospeleological research brought nothing special yet, except the invertebrates drift from the surface flows. Geological research is still in process here: tectonic mapping and litological interpretations can be useful in the proposition of further cave exploration here.

Conclusion

The Štefanová Cave represents a complicate cave phenomenon, still waiting for the complex scientific research. By the till-now surveyed length of 14,468 metres it represents the second longest cave in Demänová Valley (the longest known by the length of spaces, bcs. many of passages were not measured yet). Its corridors lie in the space of 700 × 890 metres with denivelation of 104 metres. The highest point of cave lies in the hight of 913 m a.s.l. The most of spaces is situated in the Stodôlka massif, which peak reaches 1213 m a.s.l. The karstic area of Stodôlka is about 1000 × >1250 metres. These factors show a great potential of further discoveries here. By the interconnection of Demänová Cave System and Štefanová Cave, which are genetically and hydrologically relative, could become real an existence of one of the most extensive cave system of central Europe. Using all the knowledge about the karst and caves in Demänová Valley, we assume an existence of cave system longer than 60 km.

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Mesačný tieň (Moon Shadow Cave): The Longest Cave of Tatra Mts.

Branislav Šmída – Igor Pap
Comenius University Speleoclub, Bratislava

Length: 30,436 m.
Denivelation: 451 m.
Entrance Level: 1,767 m a.s.l.
Entrance Location: The entrance 0,8 × 1,5 m is situated in the slope of the *Spišmichalova valley*. The cave was formed in the massif of *Javorinská Široká Mt.* between *Bielovodská* & *Javorová Valley*; it goes under the *Horvátov vrch Mt.*, *Široká Valley* & *Svišťovky Mt.* The karst massif is approx. 12 km^2 large with hydrological potential >900 m.

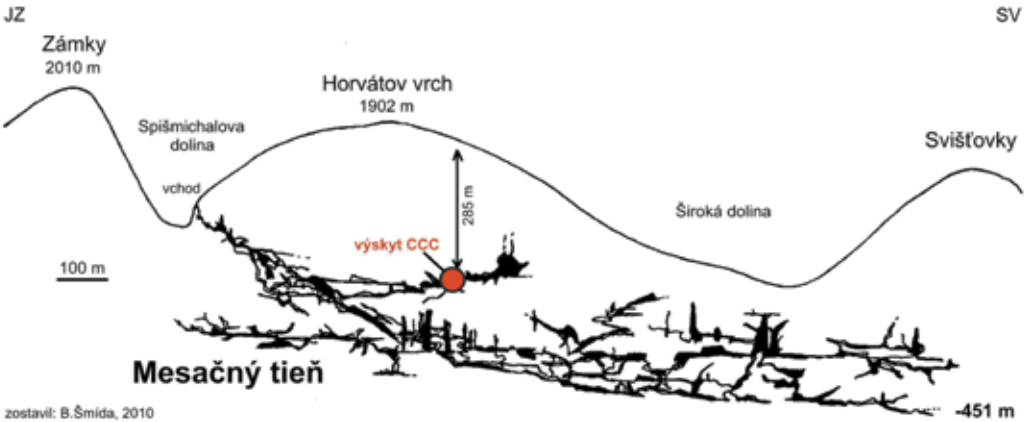
Exploration history

The inconspicuous entrance to the 25 m deep entrance shaft of the cave was discovered by I. Pap & B. Šmída on 26. 6. 2004. After the enlarging of narrowing on the shaft bottom, I. Pap, B. Šmída & E. Kapucian discovered the continuation of cave till the depth of 52 m. 20. 8. 2004 has been realized the substantial discovery in the cave´s history by I. Pap, B. Šmída & G. Majerníčková: more than 2,5 km long and 142 m deep cave spaces were found. From that moment the length of the new-discovered cave spaces increased by 3 – 5 km per year; nowadays there are cca 2 km new corridors per year. The Moon Shadow Cave represents the 2nd longest and 3rd deepest cave in Slovakia & the longest cave of the Tatras Mts. at this moment.

Cave description

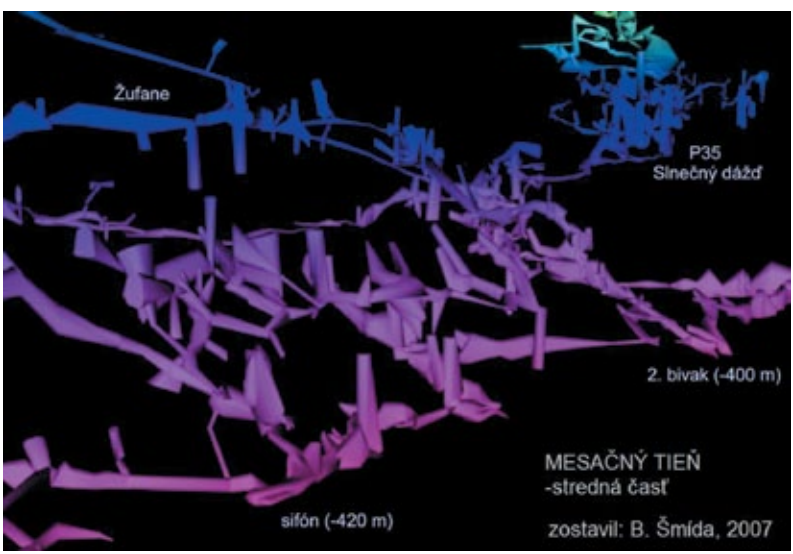
The upper parts of cave are fossil, brownish and orange coloured. They were created on the litological contact of Jurassic limestones with underlying violet to green coloured marls. Several of spacious parallel steep sloped corridors reach the depth of –270 m, where the *1st bivouac* is located. Several hundreds of meters long gallery *Pino10* (10 – 25 m wide, see the picture) and *Varhany Hall* with drinkable water pool are crossed. Subhorizontal passage of *Chodba kremenných vajec* is interesting by the foundings of granite and quartzite pebbles up to 0.5 m in diameter. The huge cave passages *Horný TatraOpen* (60 × 20 m) and *Spodný TatraOpen* (140 × 30 to 50 m) are the largest underground areas in the cave. The *1st bivouac* (a camp of tents), which has been destroyed by rocky avalanche during 2009/2010 winter season, is situated closeby. Behind the bivouac a 3D maze with 25

A typical look of upper parts of cave. Photo: M. Audy



Idealized cut trough the cave with occurence of cryogene calcite marked. B. Šmída, 2010

– 30 m deep shafts (*Slnečný dážď, Mesačná stvora, Les šácht* etc.) is located. The shafts are connected to the subhorizontal levels and pipe-like corridors (*Metro, Žufane, Zelený pes*). 2 active streams with cascadas and swumps (15 – 100 l/sec.; max. flow rates were not observed) and plenty of small tributary streams are known yet. The downermost part of cave is a canyon. It is grey to black coloured with fossils of *Belemnites* on the walls. The active and fossil corridors are interconnected by many of vertical shafts (chimneys), meanders and epiphreatic channels. Some chimneys are monstrous: *Mikiho dóm Hall* 20 × 30 m in diameter & 100 m high = volume of 45,000 m^3; climbed by Šuster Brothers. *Dóm Gigantov Hall* is a 50 m long dome with the 105 m high chimney climbed until now. There are 5 underground camps in the Moon Shadow Cave; the deepest one is situated close by the stream in the depth of 400 m. The cave is usually explored by 4- to 5-days speleocamps. There are quite low temperatures inside: in the upper parts about 3,5 °C and 1 °C in the lower parts, where flows the water from melting firn-snow fill in sinkholes situated on the surface close to these cave sectors. The neotectonics is quite often (tectonic mirrors, opened fractures, fallen roofs). Gypsum speleothems are interesting – crystalls, cotton-ball forms, hieroglyphs on the walls. The cave is important also as the locality of occurence of the "cryogenic cave carbonates" (CCC); its finding in the depth of –285 m under the surface is the deepest found site worldwide (Žák et al., 2011). However, the dripstone and flowstone decoration is poor. The speleological exploration and research in the cave led the cavers from Comenius University Speleoclub, Bratislava. More info: articles in *Spravodaj Slovenskej speleologickej spoločnosti 3/2004* & *4/2007*; *www.mesacnytien.sk*.



The maze of middle part of cave in 3D plan

Survey and topography of the Skalistý potok Cave (Slovak Karst) 2008 – 2013

Zdenko Hochmuth
Speleoclub of the P. J. Šafárik University, Košice

Skalistý potok (the Rocky Creek) cave is the longest and deepest cave of Slovak Karst according to the up-to-date surveys. The cave spaces follow the hill foot of Jasovská Plateau in the horizontal distance of 2.5 km. One branch of the cave rises parallel with the slope up to a considerable altitude. The upper parts of the cave are just 20 – 70 m below the plateau surface. Fossil cave palaeolevels situated about 250 m above the valley floor were surveyed in the length of 2 km. The cave is followed by a water stream in the upper parts as well as in other cave spaces in the lower parts, where fossil corridors were also formed.

Pre-Quarternary age is indicated by iron and manganese crusts, corroded speleothems, and calcite crystals. Paragenesis forms are highly located in cave entrances of fluvio-karst character and in canyons. It is difficult to explain the reasons why an active stream flows in such a high position - it seems likely to be rejuvenilisation of older corridors. Exact dating of speleothems, heavy minerals, and clays will provide more sound explanations.

These are accompanied by peculiar sediments and cave forms which support hypothesis of old age and complex genesis. A new entrance into the cave enabled more sophisticated survey, mapping and research. The presented paper summarizes new findings from 2008 – 2013.

Introduction

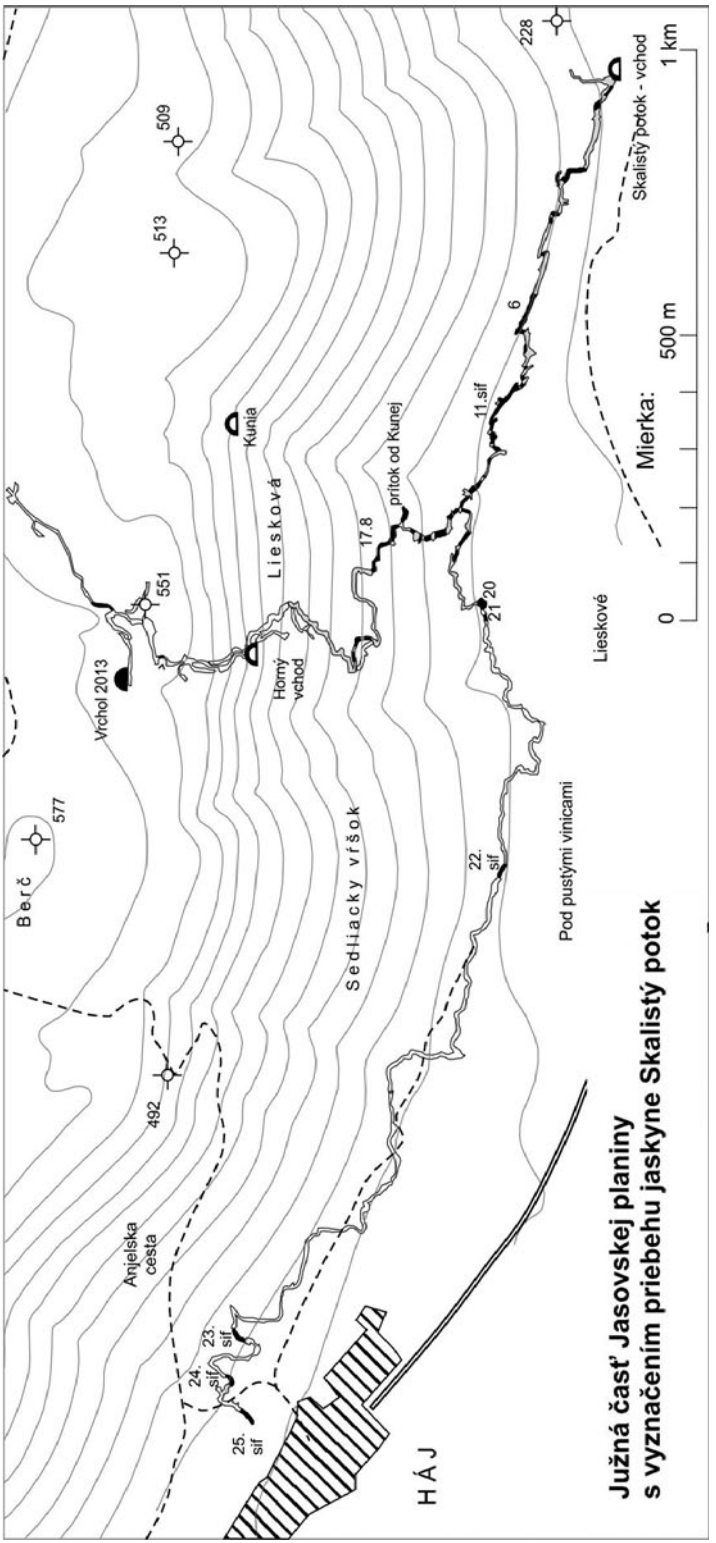
Skalistý potok Cave is the longest and deepest cave of the Slovak Karst today. The cave spaces follow the hillfoot of Jasovská Plateau in the horizontal distance of 2.5 km. One branch of the cave rises parallel with the slope up to a considerable altitude. A water stream flows in the cave. The fossil corridors are situated in the upper parts with peculiar sediments and cave forms, which support hypothesis of its old age and complex genesis. A new entrance into these spaces, created in the year 2007 from the surface, enabled more sophisticated survey, mapping and scientific researches. Several new discoveries led to the length of 7,936 m and elevation span (denivelation) of 345 m.

Shaft P 31. Photo: R. Husák

Brief history of explorations

Associated with a survey of water sources in 1968 a part of the cave was discovered and up its first 50 m were explored, until the explorers were stopped by water siphons. The diving research was realized by a regional group of the Slovak Speleological Society Trenčín in 1982. The diver, J. Kucharovič, came through two siphons step by step. Regional group from Ružomberok, later called Working Group of the Commission for Diving, renewed the survey in 1985. The intense exploring activity was in progress between 1986 – 1992. Thanks to it we came over 21 siphons and 12 others in rising line. In 2003 we stopped in the huge Hlinená sieň along to another siphon. To bring here the diving equipment seemed to be unrealistic, therefore we stopped the exploration there. We focused the activity of older divers on the straight direction. After overcoming of the 21st siphon they discovered dry parts, so the group was not able to continue their diving research.

Members of the ČSS Speleoaquanaut led by D. Hutňan performed the speleodiving research in the next years. They came to a place reachable from the surface by digging a tunnel in 2000. The following work was difficult, full of mistakes and successes. Finally on 11. 1. 2007, we got into the upper parts be-



Paragenetic part of the Kladenská passage. Photo: J. Stankovič

hind the siphons. Since then the research of interesting so called "upper parts" of the cave has begun.

The Speleoaquanaut group achieved interesting results in the so-called "straight direction". They discovered a continuance, but the last siphons (26th and 27th) are located too far and stopped the research.

Basic information with a map drawn in the original scale 1:500 were published in the Slovenský kras (Slovak Karst) (Hochmuth Z., 1989, 1992). In 1992 – 1993 the top level of the cave was reached. The most detailed description of the cave with its vertical projection and profile in relation to the slope and surface of Jasovská Plateau was published in Spravodaj (Hochmuth Z., 1994). The topic of the parts of the cave with siphons was published in the Monography (Hochmuth Z., 1999, p. 139–150), with integrated map of the cave upper parts to the siphon 17.13. The new discoveries in the upper parts of the cave were published with a map in a less detailed map scale (Hutňan D., 2000; Hochmuth Z., Hutňan D., 2001). The research of the active water stream on the siphon 17.14. is the matter of the Speleoaquanaut from Prague with the help of the local group.

New survey after 2008

We considered the sub-horizontal spaces as the "upper parts" beginning over the cave shaft P31 watered by a waterfall (with its height of 31 m). After the discovery of the part between the surface and this shaft, we changed our opinion about the morphology and genesis. We have found out that the cave does not stop, but continues further up 30 m, thus its total depth is over 60 m. Its width varies between 2 – 7 m, the walls are shaft typical. Currently we prefer the opinion, it is a sophisticated "Vadose Canyon" – meander.

The descent starts on a small balcony in Terasová sieň hall with the help of fixed ladders and steel steps to the bottom. The horizontal transfer over the shaft to the Meander 31 is fixed with iron rope (sections 8, 4, and 12 m) and two securing ropes. „Dankovský meander" is situated in the ceiling of the shaft about 20 – 30 m over the active riverbed.

Hlinená sieň (Earthen Hall) got its name according to the steep earthen slope with the 25 m difference between the bottom and the top edge of the hall. Its sizes are 35 × 15 m, and the

ceiling reaches 15 m here and there. The snow-white sinter decoration (stalagmites) is on the bottom, eccentrics and gravity sinter forms are on the walls and ceilings. The mid layers of the black sediments, partly joined, are located in the earthen sediments. They have been classified as psilomelan and rancieit.

The newly discovered section Dankovský meander is formed by sloping corridor created on a tectonic fault. At this level a low stream (up to 0.3 l/s) is active almost all year long. While the upper parts are 2 m wide, on the bottom of the sloping corridor the water had cut in and created the vertical meander with a width of 60 cm. At the end of the corridor the ceiling is reduced and continues to a meander with sinter decoration.

Corridor in front of the Tomášová hall with sinter decoration. Photo: J. Stankovič

Kamenná sieň (Stone Hall) is the continuance of the Hlinená hall. At its upper end the steep sinter-fall is located, useable to get to the similar level as in the Hlinená hall. More or less flat ceiling has developed in here. In the north side of the Kamenná hall several steep windows lead to an interesting 3 - dimensional labyrinth of inclined parallel phreatic passages. They suggest how passages, formed on a tectonic fault, collapse and create a huge space, for example Hlinená or Kamenná hall. An intense karst zone leads to the third similar space, which we called Srdce jaskyne – "Heart of the Cave".

The siphon 17.13. begins with a lake of elliptical ground with the size of 1.5 × 2 m. The tunnel was dug out over the siphon in 2011. The corridor behind the siphon is located about 40 m northerly from the edge of the plateau and leads to one of the largest cave passages – Sieň za sifónom (Hall behind the Siphon). It is formed on the same tectonic fault as the previous corridor, parallel to the edge of the plateau. It suggests it could be gravitational parting faults, primarily.

Tomášova sieň (Tomáš's Hall) is an interesting point in the bend of the main corridor of the system. The main stream flows here from the siphon 17.14. joining the stream from Kladenská corridor, which flows here along the eastern side of the corridor between falled stones. The hall has the size of about 20 × 10 m.

The main water stream from the siphon 17.14., 1.5 m wide and 1 m high, flows in the Tomášova hall. It sinks at an angle of 30° and gradually turns into a horizontal crack. In a depth of 4 m is a fault, which the divers had to break down by their first explorations. The whole siphon is 50 m long and ends on the level in 1 m high and 1.5 m wide hall. The siphon is almost sediment less.

The low and tight corridor with siphon deflections continues behind the siphon. After 70 m it spreads and forms a 12 m high waterfall with dry and water parts beyond.

Záverečná sieň (Final Hall) has chimneys heading to the surface, as well as siphon continuance in form of tubular phreatic corridors. The survey of these parts depends almost exclusively on the divers and it is the prolongation activity of today.

The cave continues in the upriver direction in form of the **Kladenská chodba** (Kladenská corridor) named according to the Kladno divers, who had discovered and explored it as first in 1999 – 2000. It has a collapsing character. Collapsed objects are especially huge sinter crusts creating bridges in various stages of destruction. The stream in the Kladenská corridor flows between the boulders, but sometimes it cuts into the rock, creating inaccessible cascades, as the cut is very small on the bottom – only 20 – 30 cm. The cave continues on the western edge of the hall. Passing through an area with shafts it is possible to reach the active riverbed (Kladenský potok). Unfortunately, only in a short passage, as the stream flows in a difficult tectonic fault, with no meaningful prolongation, because the stream is accessible elsewhere. At this point the diving research has finished in 2000.

The compact corridor has a promising direction over a fault at the end of the Kladenská corridor. It turns into a dimensional corridor with a total length of 40 meters and is strongly marked by collapses. The rising connection to the next level is located before the end of the corridor. This highest corridor ends by a fault as well. This is the highest point with the denivelation of 373.10 meters. Following the measurements, this place is about 20 m below the surface of the plateau only. A possible connection with the surface would improve opportunities for further research and traditional diving techniques in significant way.

Conclusion, thanks

The Skalistý potok cave opens up very slowly its difficult areas in the southern part of the massif on the Jasovská Plateau. Even after more than 25 years, we do not consider the basic caving problems solved. In a straight direction the Hájska Valley was almost reached, though very deep. The upper parts could reach the surface, but we have merely hypotheses about resources and collecting area of the permanent streams. Thanks for the help in mapping, exploring and building an infrastructure to: J. Kovalík, J. Mikloš, S. Danko, F. Chovanec, N. Lacko, S. Čúzyová, N. Danko, P. and Š. Šuster, team of divers from Prague and Brno: D. Hutňan, M. Manhart and R. Husák, Mr. and Mrs. Ondrouch for their radio-survey and others.

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Cave Javorinka – Nádejná Cave System, High Tatras: 2nd deepest cave of Slovakia

Ľubo Plučinský
Caving Group Spišská Belá

The largest and the deepest cave of the Slovak High Tatras celebrates the fortieth anniversary. Truly, the group of cavers from Spišská Belá has worked in karst areas in the northern parts of the High and Belianske Tatras for forty years. Members of our group, who explored mainly eastern parts of the Belianske Tatras previously, started to work in this speleological less known area in 1972. Their effort was rewarded one year later by the discovery of a large abyss and its horizontal, river level with strong draft in length of 500 meters, and extension. It was an extraordinary discovery in that time.

Introduction

The Cave Javorinka represents the two – cave system with regard on the connection with the cave Nádejná jaskyňa (Promising cave) with the length of 11,383 m and elevation of 480 m. It´s the second deepest and the sixth longest cave in Slovakia. The lower cave entrance is located on orographic right side of the Javorová valley in 1,218 m about 6 km southern from the village Javorina (1000). Javorina, as well as village Lysá Poľana (970), is located on the former border crossing with Poland. It´s the starting point for tourists heading to the northern valleys of the High Tatras – the Javorová and Bielovodská valley, eventually to the valleys Rybiego potoka and Morskie oko in Poland. The upper cave entrance through the Nádejná cave was discovered near to the current ponor of the Kolový brook in the Kolová valley.

Massif of the Kolový Úplaz with new cave system inside. Photo: I. Michlík

The actual cave system with its size 1,700 × 700 m is east-west orientated between Kolová and Javorová valleys at the northern side of the Kolový peak. The massif Kolový Úplaz (1,783.6) is formed by different types of carbonate rocks (Fudaly, Pavlarčík, Vadovský, 1983) in the triangle shape on the 2 km basement with 30 – 35° levels angel to the north. The basement of the triangle is created by the imaginary line between the current ponor of the Kolový brook (1385) and resurgences in the Javorová valley, eventually to the over flooded part of the karst with the deepest place of the cave – 1,125 meters.

The cave was declared as Natural Monument of unique value with the highest level of protection in 2001.

Brief genesis and hydrology of the cave

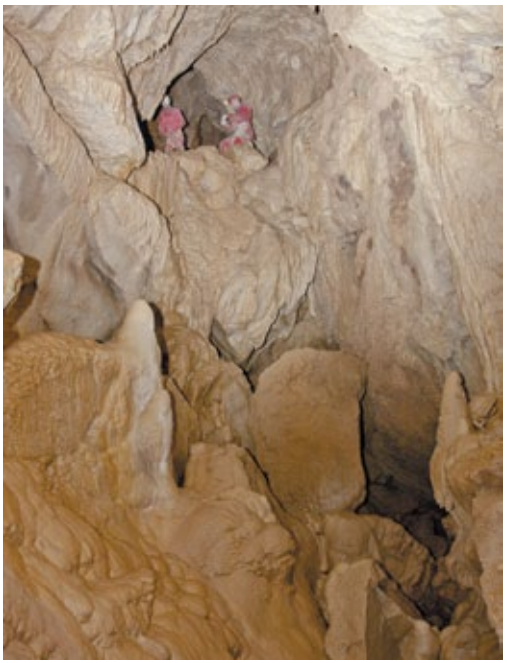
The cave has a corrosion-erosion character. The active watercourse has joined atmospheric waters, with a lot of granodiorite and quartz gravel. Eroded profiles of corridors, some of them marked by collapsing, confirm by their granitoid filling, that the top levels served as a drain for water melted from glaciers in the Kolová valley mainly. The evolution of these spaces was in process in several stages of development with regard to the overall geomorphological evolution during the Pleistocene (Fudaly, Pavlarčík, Vadovský, 1983).

Thunderous waterfalls add dynamism to the cave. Photo: I. Michlík

The most limiting factor for the cave exploring is its hydrological behavior. It determines the intensity of the exploring. The water flows through the bottom level of the cave, originated in the crystalline basement. Its part sinks into the cave through a ponor by a contact with limestone in the Kolová valley (1385). On its way it grows with help of smaller water inflows formed during rainfalls. In summer time, spring, and early winter by warm weather the brook over floods the entrance siphon Cerberus under the abyss Vstupná priepasť and continues to the siphon Morské oko in the section called Bludisko. These over flooded parts of the cave Javorinka are linked hydrologically with the 210 m long and 32 m deep siphon Mokrá diera. However, the connection of these caves has failed so far. The summer stream through the siphon Cerberus is estimated between 250 – 300 l/s. In the winter time, the stream is reduced to 25 to 30 l/s and joins siphon Hrdlo located 200 m far away from Cerberus. So the winter, or the lower entrance is accessible. Currently, we use both entrances depending on the season and the location we are exploring.

The discovering and exploring history

The discovery of the cave is related to the detailed exploring of the karst areas in the Javorová valley in 1972. During these exploring activities we received brief information about the existence of an abyss in a young spruce forest called Borcak near the brook Javorinka. 21. 10. 1973 the surface exploring activity was organized. J. Mika found the mentioned abyss with a strong wind. We overcame the 27 m deep abyss Vstupná priepasť into the dry riverbed. After the enlarging, securing against falling stones, and fixing, the only entrance (until the year 2010) was created. Now it´s called the winter or lower entrance. It is called "lower", because the whole cave has ascending trend, besides 300 m below the bottom of Vstupná priepasť. It is called "winter", because the cave (besides those mentioned 300 m) was accessible only in the winter months until recently. From the mid-December to end of February, when the 20 m long and 2 m deep siphon Cerberus opens for us on the riverbed under Vstupná priepasť. This restriction was caused by the over flooding of the entrance siphon by active water flowing through the youngest and lowest level of the cave. The cave opens sometimes during a very dry autumn for a few days. Its discovery was made in such a time also.



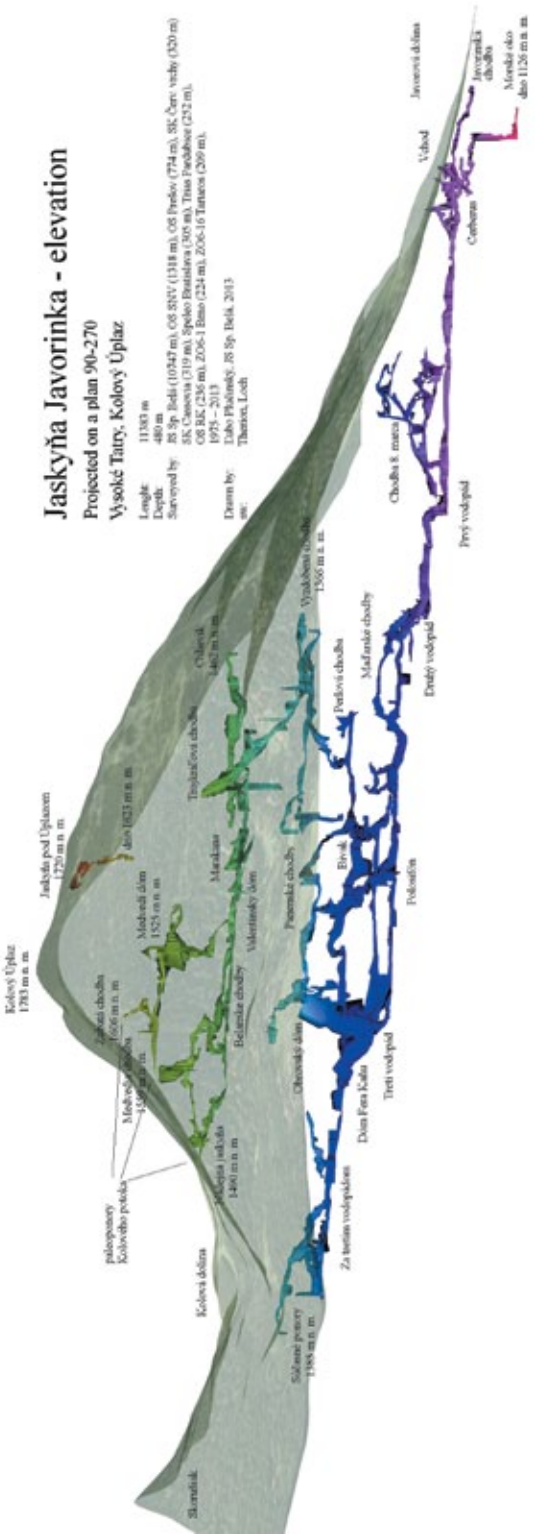
Dripstone decoration in Chlievik. Photo: I. Michlík

1st Waterfall of cave. Photo: I. Michlík

The first explorers made it over the dry riverbed to an active water flood and afterwards to the current hydrological measuring profile. A long several year's activity begun in this cave. Until 1980 the whole lower and the youngest levels of the cave were discovered. It divided the cave into four levels separated by three waterfalls with a height between 10 and 25 meters. The ¾ of this level is overflowed by the active watercourse with multiple deep sites. We made it through on the boat and by climbing and traversing of the caves walls. In the first years after the discovery the important corridor Chodba (The Corridor) was found over the river level Prízemie. It suggested that Javorinka is not a simple connecting channel of the waters in the Kolová and Javorová valley. In that time the cave Javorinka was 2484 m long with one more undocumented kilometer. The discovered areas were documented also in cooperation with the caving groups from Ružomberok and Spišská Nová Ves. The difficult places and traverses were fixed. Between the years 1980 – 83 another new parts of the cave were discovered – Heliktitová corridor with above areas and today's Hungarian corridors were documented later. At the same time our group documented the section from Polosifón through the Third Waterfall to the ponor in Kolová valley.

To prove the existence of cave higher levels it was necessary to climb the 30m high chimney before Polosifón. It succeeded in winter 1983 – 84. The climbing of another 20 m wall of Vysoký dome has opened the way to the new discoveries in direction Kolová valley in 1985. The climbing over the Tristometrové plates followed and we came to the 90 m high Obrovský dome. Over its bottom we discovered the walls of the Dome of Fero Kaňa with the Third Waterfall. In 1988 we managed to connect the Vysoký dome with Hlinený bufet (current bivouac) through the Vzdušný and Zablatený traverses. In years 1989 and 1990 the discoveries followed: Spojovacia, Martinská, Perlová, Sintrová corridors, the Igor dome, Netopieria, Terasová corridors and many other side-corridors and chimney connections between the various evolution levels.

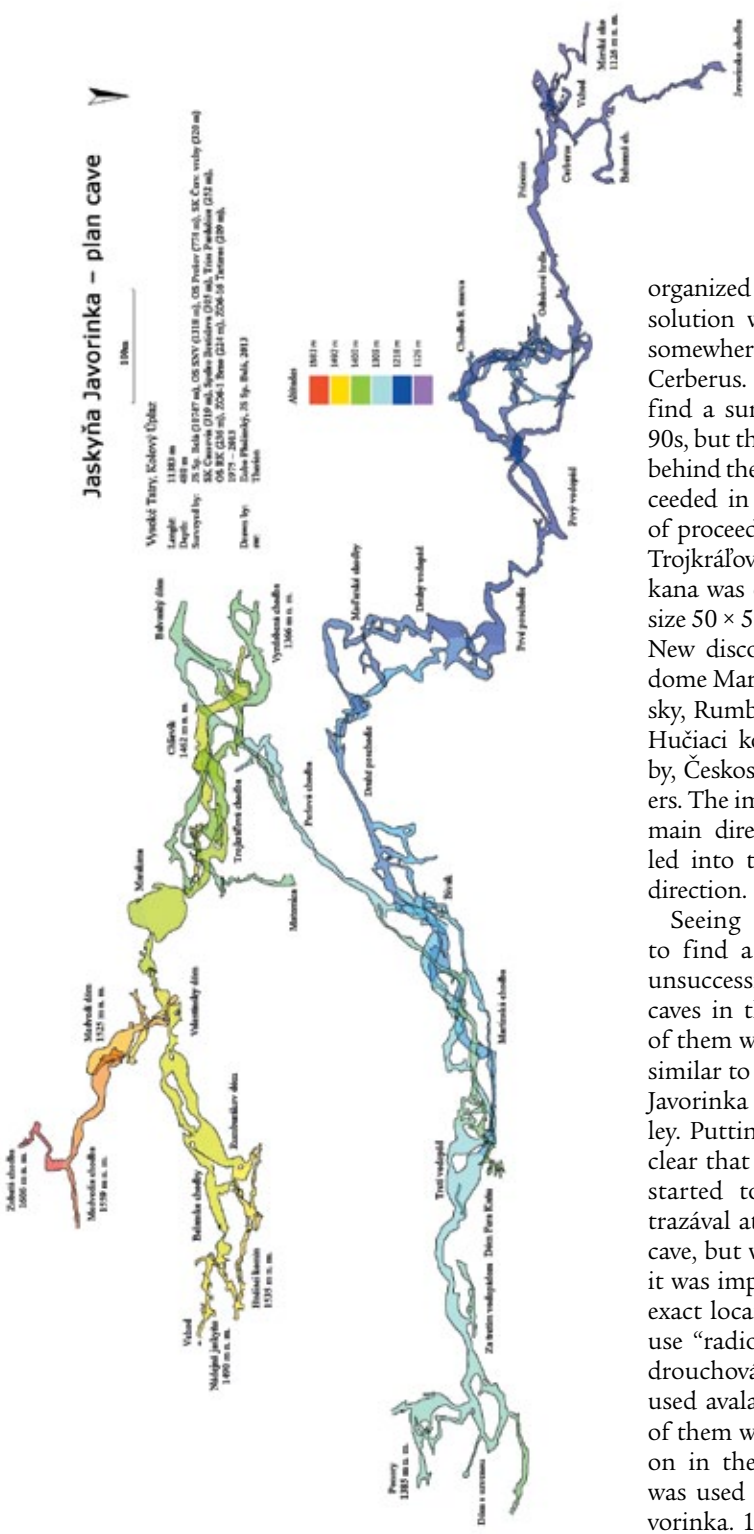
In 1991 it became clear, that the cave is large and it was necessary to proceed with the mapping of newly discovered spaces, because the orientation according to the drawings and descriptions in the technical diaries was insufficient. After two actions with cavers from Pardubice



(5-05 ČSS) and Speleo Bratislava, we began the mapping work by ourselves. The tempo of discoveries slowed down. We had little knowledge about the hydrology of the system. Together with the cavers from Bratislava we were mapping the upper levels in early March. The siphon Cerberus started to flood over after snow melting. Eleven cavers were rescued by speleo-divers from Prešov and other rescue groups within 24 hours. This incident forced us to shorten the already short period of exploring. Nevertheless, together with the mapping works, the new discovery was made. Till 1996 new higher levels were discovered by climbing on walls or chimneys: the Pruhovaná corridor above the Obrovský dome, Jožkove corridors, Polnočný dome, Vyzdobená corridor with Horný riverbed and huge corridors behind the Sintrová corridor, Balvanitý dome and Trojkráľová corridor. Trokráľová corridor with its width of 10 – 15 m, height of 25 m and a length of 200 m is one of the largest cave spaces. It rises in 30 – 35° angle to its end corridor with 30 m height. After the overcoming and connecting the cave Javorinka reached denivelation of 320 m and the length of 5,183 m.

Other serious exploring activities were ponor on Morské oko (Hochmuth, Pavlarčík, 1997). Morské oko is a siphon accessible in dry months of summer and autumn, when the entrance siphon Cerberus is over flooded. Its level is the same water level as the brook Javorinka in the Javorová valley and is hydrological related to the caves Mokrá a Suchá diera (Pavlarčík, 1986). V. Ďurček dived in as first on 15. 2. and 1. 3. 1997. He swam a siphon to the end of the horizontal part of the cave bottom. Reaching the deep of 40 meters the denivelation of the cave grew up at 360 m. In 2001 Krzystof Starnawski from Poland confirmed the impossibility of further progress in the siphon. On the other side of the valley in Mokrá diera Viktor Bolek from Poland and later Joseph Gliviak and Michal Megela (unpublished) tried to reach other connection in 210 m long siphon.

As new spaces were added, it was more difficult to get to the distant parts of the



cave and it took quite a long time. Our activities in the cave became less effective. Therefore a permanent bivouac was built in the central part of the cave in 2008. It improved the situation and activities were organized for 2 – 3 days. The best solution would be other entrance somewhere behind the over flooded Cerberus. We have been trying to find a summer entrance since the 90s, but the cave Javorinka closed us behind the entrance siphon. We succeeded in 2010 after the discovery of proceeding corridors behind the Trojkráľová corridor, as the Marakana was discovered – a space with size 50 × 50 m and a height of 20 m. New discoveries at the top of the dome Marakana followed: Valentínsky, Rumburakov, Cibuľový domes, Hučiaci komín, Zakopanské chodby, Československý komín and others. The important fact was that the main direction of these corridors led into the Kolová valley in east direction.

Seeing that previous attempts to find a summer entrance were unsuccessful, we got back to small caves in the Kolová valley. In one of them we found 200 meters, very similar to the end parts of the cave Javorinka under the Kolová valley. Putting on the map it became clear that caves direct towards. We started to dig at the great Tatrazával at the end of the Nádejná cave, but without right technology it was impossible to determine the exact location. First, we wanted to use "radio beacon" from Ms. Ondrouchová of ČSS, but finally we used avalanche transceivers. Three of them were located and switched on in the Nádejná cave and one was used to search in the cave Javorinka. 19. 2. 2010 we caught the

signal and came closer, 4.8 meters, we even heard us. The connection between the caves and new summer entrance was only a matter of time now. It succeeded on 26. 6. 2010.

Immediately after the connection on 17. 7. 2010 the Hučiaci chimney was climbed. The cave reached the elevation of 404 m. Its overcoming in January 2011 brought us 410 m. Since 19. 2. 2011 we mapped difficult Zakopanské corridors with a strong water in the summer. In March we finished it together with the Medvedí dome (1531) with sizes 60 × 20 m and height of 30 m. It got its name according the bears bones found here (Sabol, 2013). In 2011, after several climbing activities, we came to the overhanging "southern" wall of Medvedia corridor with cave bears fossils. From this corridor another chimney Zubatá chodba continues, which ends at the altitude of 1,605 m. The denivelation of 480 m was reached. Other chimneys haven´t been found yet. However, the presence of the nearby cave Jaskyňa pod Úplazom (1725) can bring us an interesting surprise. Also the discovery of the Lyžiarska cave in the winter of 2012 – 13 in 1,630 altitude, and the presence of other smaller caves can help our cave to become the deepest cave in Slovakia. It would reach the depth of 600 meters in the case of connection with the cave Jaskyňa pod Úplazom.

Perpectives

Javorinka is a cave with a lot of discovered, but undocumented areas and several perspective places. The highest places above the Medvedí dome with Medvedia corridor attract us most. It´s the highest point of the cave, and the cave bears fossils founded here are dated 51 thousand years ago (Sabol, 2013). They had to get to these places through a hole from the surface.

Other possibility is the connection with the cave Jaskyňa pod Úplazom (1720), although the coloring tests haven confirmed the hydrological connection so far. Though, the strong water flow even in dry periods, flowing into the central part of the Medvedia Cave through Zakopanské corridors, must come from higher undiscovered spaces.

The speleo-diving connection between caves Javorinka and Mokrá diera through Morské oko is a challenge as well. The water from coloring tests was noticed in the nearby Široká valley (Pavlarčík, 1986), under the peak Javorinská Široká, in which karst areas the 30 km long cave Mesačný tieň was found .

In the massif of Kolový Úplaz several small caves were located. In its western part there are more than 3 km of cave system Čiernohorské jaskyne and Jaskyňa verných. It is genetically unrelated to the cave Javorinka probably and a connection of these two systems would be quite difficult, but quoting a caver from Eastern Slovakia: "It's amazing what the time, water and stone can achieve." In other words, a lot of work and maybe also surprises are waiting for us and our followers in this part of the Tatras Mts.

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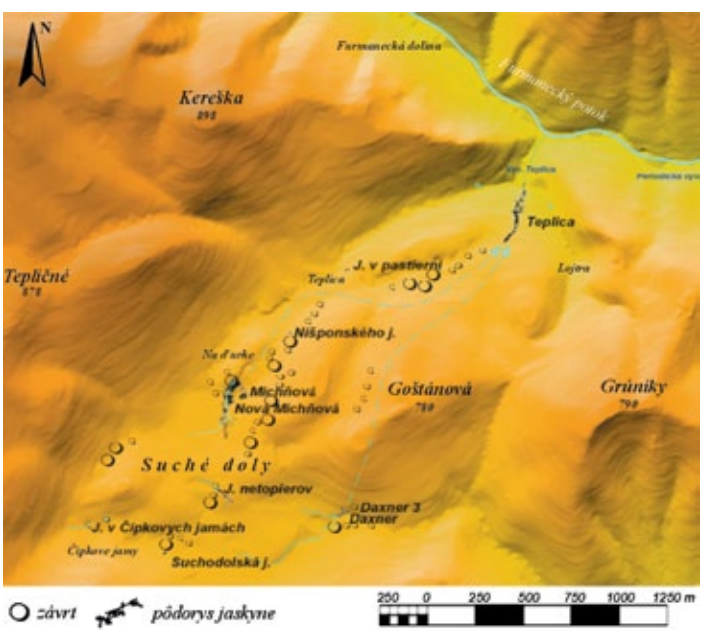
Technické denníky, Jaskyniarska skupina Spišská Belá, roky 1996 – 2013

Caves of Suché doly karst area: what do we really know about them at all?

Lukáš Vlček – Dušan Hutka – Ivan Kubíni
Speleoclub Tisovec

History of cave exploring in central part of Slovakia started more than two hundreds years ago. The caves on Muráň Plateau, a phenomenal karstic area with hundreds of caves, sinkholes, dolines, karren fields, dry valleys and other karstic features near Tisovec, were for first time shortly described just in 1787. In that time, J. Buchholtz jr. (1688 – 1737) mentioned a cave near Muránska Huta Village in a report *Abermalige Reise in die Karpatischen Gebirge und die angraenzenden Gestanschaften written in German*. Caves of the area of Suché doly mentioned G. K. Z. Laskomerský (1824 – 1908) in 1872 and Š. M. Daxner (1822 – 1892) in 1878. The beginning of speleological exploration in modern way started in 1951, when S. Kámen (1921 – 1992) founded a speleological group, which take place in this area till today: Speleoklub Tisovec.

Suché doly area. Photo: L. Vlček



Topographical situation of caves and hydrology of area

Cavers of this speleological group focus their own interests among the 300 caves in 7 main karst areas (or massifs) here, but mainly to the Suché doly area. It represents a tectonically depressed area between Rejkovo area and Furmanec River, surrounded by high hills from almost all sides: Hradová Mt. (887) and Goštánová Mt. (730) from the east, Javorina Mt. (873) from the north-west and to west and Červená Mt. (753) from the south. Only to the north the area decline following a deep cutted valley of Teplica stream to the Furmanec

Valley and to the south-east is the area open by the dry valley with short canyon to the Hlboký jarok Valley and Rejkovo area. In the Suché doly we can find almost all the forms of endo- and exokarst phenomena, which occur on the Muráň Plateau: dolines, uvalas, blind and dry valleys, springs and ponors located on the contact of karstic and non-karstic rocks, caves and abysses. The two last mentioned forms reach here impressive dimensions. Precisely because the long time of historical exploration of this site, they are also relatively well researched. 15 caves with the length of 2,5 km are known here; the longest one is almost 1,5 km long. This cave is also the deepest one in area: Nová Michňová Cave reaches the depth of 97,5 m. For more than 60 years cavers tried to find new underground spaces in hope of finding the answers to their questions – how extensive the caves are, what are the ways of water inside the karst massifs and where exactly does the water flow to?

Water flow in resurgence cave of Teplica.
Photo: P. Medzihradský

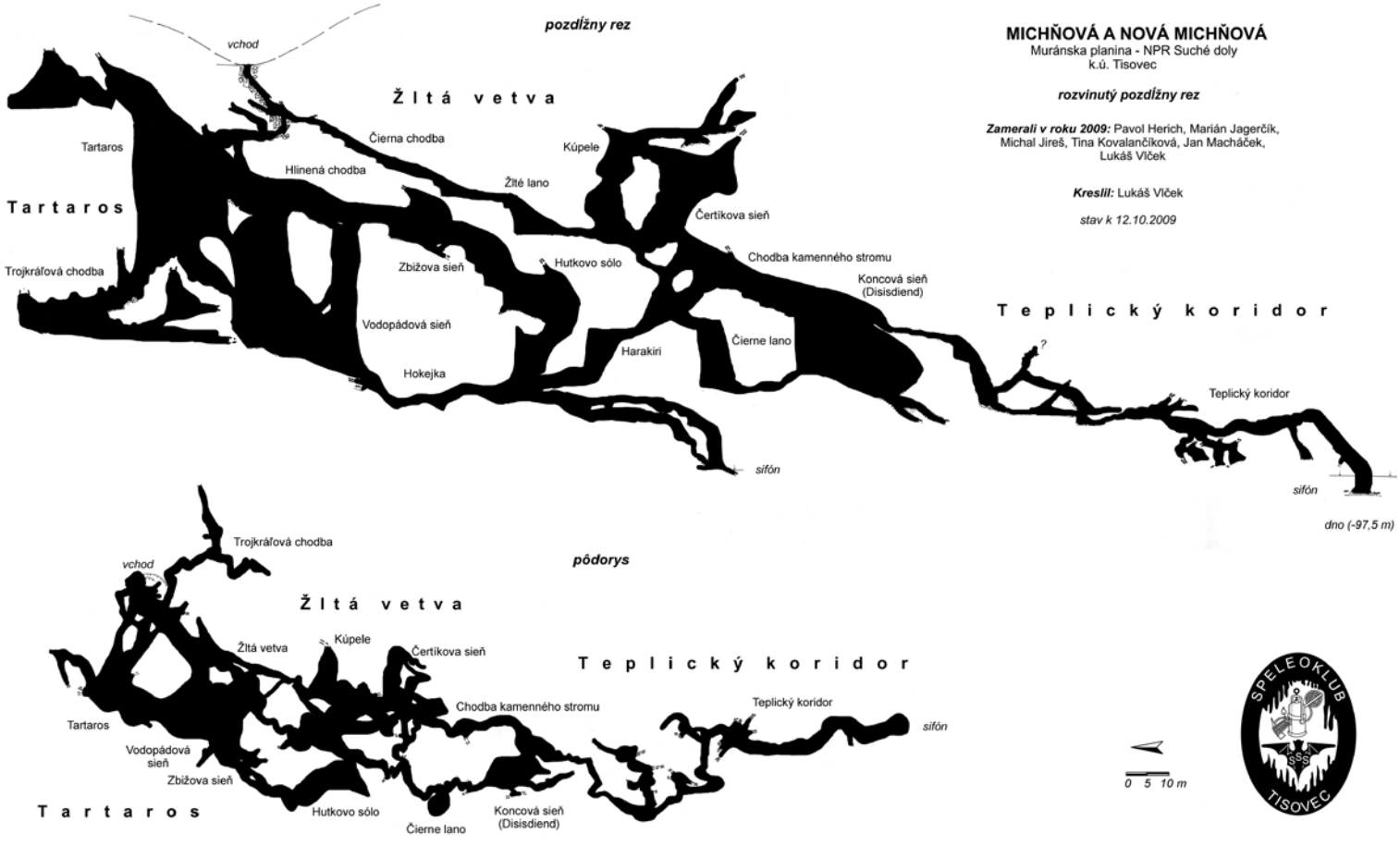
For this reason the cavers realized many of tracing tests using hydrocolorimetrical methods. The results show them, that:

a. water from Daxner I ponor flows to Teplica Cave & Resurgence in 22:30 h
b. from Daxner II ponor dtto
c. from Netopierov Cave negative results, but potentially dtto
d. from Čipkove jamy Cave negative results
e. from New Michňová Cave to Teplica Cave & Resurgence in 23:30 h
f. from Suchodolská Cave was not tested.

Using the study of geological mapping of area we assume, that the cave water of geologically complicated and dissected karst of Suché doly, flows to two main directions, or two main resurgences: The proven situation is in case of drainage to the north – to the Teplica Cave & Resurgence, another situation stands out in case of drainage of southern part of area – there is much possible connection to Bôrová resurgences, 2 km southerly from ponors. This case has not been proved yet, but geological mapping shows tectonic structures which could be the aquifers for this part of area. The caves discovered on Suché doly area – Netopierov Cave, Michňová Cave, Daxner Cave, Daxner III, Suchodolská Cave etc. – are mostly short or narrow spaced, ending by narrowings or sedimentary plug, except of one of them.

Till 2006 the cavers knew the caves on vertical span of hydrological system only partially. Since discovery of New Michňová Cave, there is discovered a full profile cave from the ponor to the basic water level in the deep.

The cave was discovered after not long-lasting digging in the heart of Suché doly area, following the ponor brook of Teplica, sinking into underground between the rocks at the rocky end of the longest blind valley of area. Between blocks of rock fall down an entrance corridor to the depth of 15 m, where a small hall occurs (Frog's hall). It is a key-point from which the cave enters to the complicated three-dimensional maze of passages, schafts and chimneys. The biggest one is named



Map of the Nová Michňová Cave

Tartaros, after the deepest point in Helenic Underground, reaches the biggest dimension of the Muráň Plateau karst. It is a pity that it ends by narrowing in the depth of 50 m, because if a flowstone hill was not there, the abyss would be almost 90 m deep. Spatially so big, that it could hold the whole Michňová Cave, an old known abyss of Tisovec Karst is located closeby. Great flowstone and dripstone decoration occur here, with flowstone drums, shields, pools, anthodites, excentriques, straw stalactites, stick stalagmites, columns etc. Many of chimneys were climbed up by cave climbers to the high just few metres from the surface, but blind. The chimneys represent in most cases the tributaries of undergroud streams, forming high waterfalls, cascades and riverbeds in the rocky relief. The deepest passage of cave ends by water siphon, possible to dive. This point of cave represents the last possibility of further exploration. We assume here 2 kilometres of flooded spaces till the water flows out in Teplica Resurgence. The fills of caves contain many of attractions inside: 250 million years old Megalodont shells inside the limestones, gypsum crystals on tectonic structures, fossils of 10 000 years old rhinoceros Coeleodonta antiquitatis in the muddy sediments – the remains of last Quaternary ice age...

Tartaros shaft in the Nová Michňová Cave. Photo: P. Medzihradský

In 2013 an extensive fluvially active branch of Daxner Cave was discovered, which falls down to the level of semi-siphon in depth of 45 m and still waits for further exploration... The discovering of caves in this area is still in process and we assume, that we are just only in first 1/10 of all the perspectives for caving exploration here. Well, see you soon, Suché doly!

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Prosiecka Cave, Chočské vrchy Mts.

Juraj Szunyog
Speleoclub Chočské vrchy

The Prosiecka Cave, located on the beginning of the well-known touristic accessible valley Prosiecka Valley, to the north from Liptovská Mara dam, represents the longest cave of the Chočské vrchy Mts. It was created in dark-grey to black coloured Gutenstein Limestones following the bedding plains discontinuities with declination of 45° to the west.

A part of cave before Občasný siphon. Photo: J. Szunyog

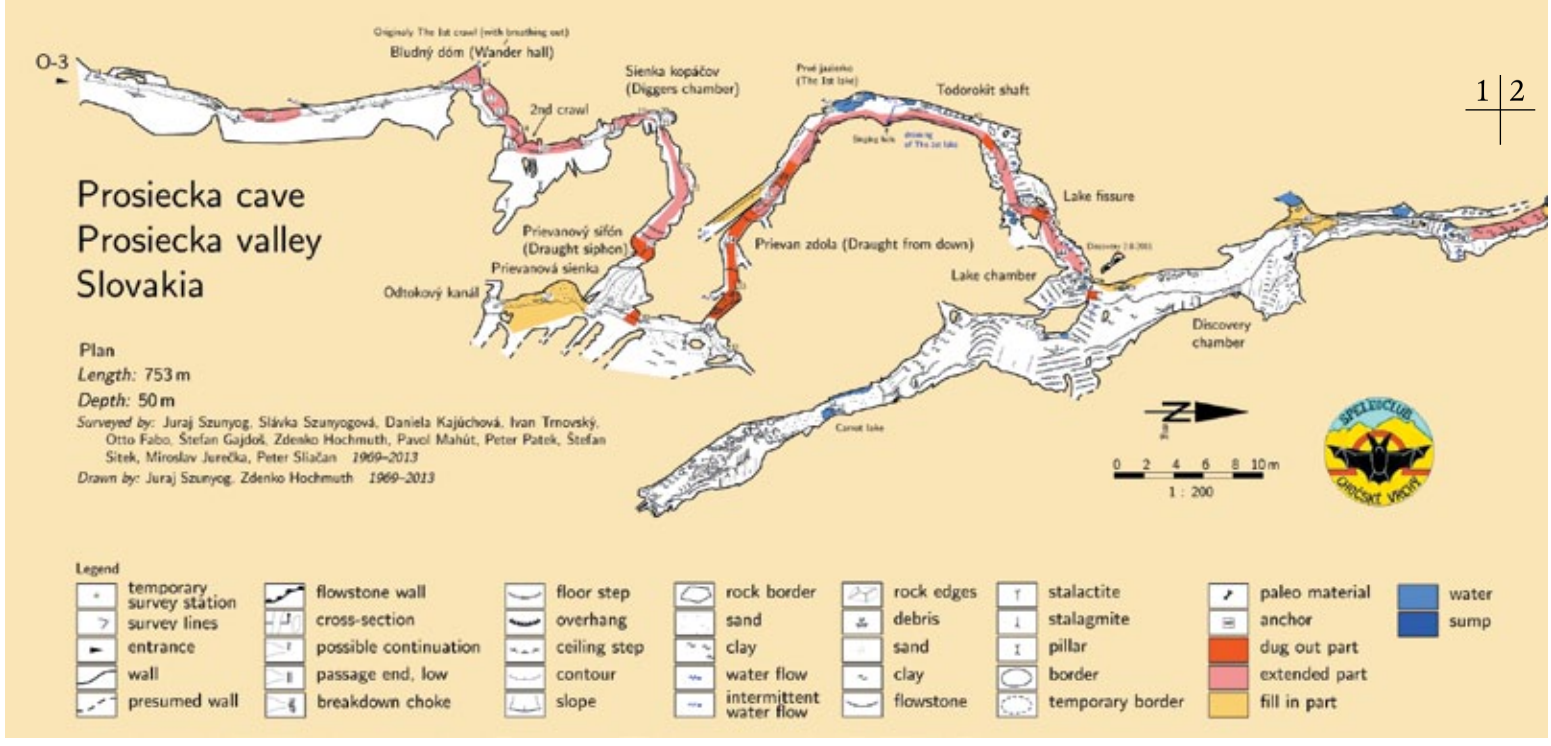
The tries of penetrating into underground of the Prosiecka Valley began in 1930' (Pavol Andaházy). Cavers have been motivated by existence of an underground river with its known resurgence not far away from the cave.

One of the pools in cave. Photo: J. Szunyog

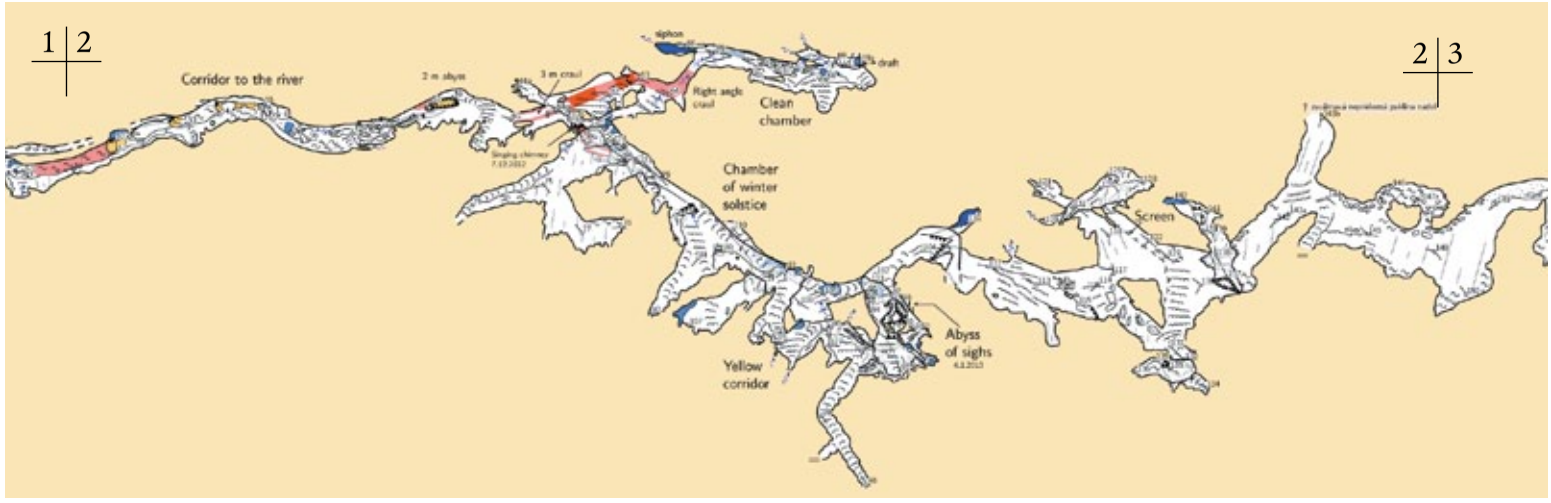
Digging works were realized on several places. The 57 m long Cave O-3 was considered as perspective, however the strong air draft occurs here (the cave behave itself as a lower entrance to bigger system). Challenging cave features includes declined narrowings, strong windy cave clima with temperature of 7°C and excruciatingly wet everywhere inside. The deepest place of cave, a hundred meters from the entrance, is periodically flooded during the spring period. Therefore the digging works and transport of muddy sediments with rocks out of the cave took long time by enormous deployment of human force. Already in 1997, after several cavers' generations working here, the cavers organized in the Speleoclub Chočské vrchy, stubbornly decided, they will discover here using excavation works a much bigger cave then they had known before. The stage of long-lasting hard works just started...

First three years we have just been enlarging narrow cave to side walls in its whole length of 57 m, without any further discovery. We did not have any idea about working here for more than 14 years realizing the widening of rocky passage to the length of 126 meters from the entrance. All the dredged material was transported out of the cave using four temporary stocks of rocks. For transportation has proven to be the best solution the 10- and 20-liters plastic can-

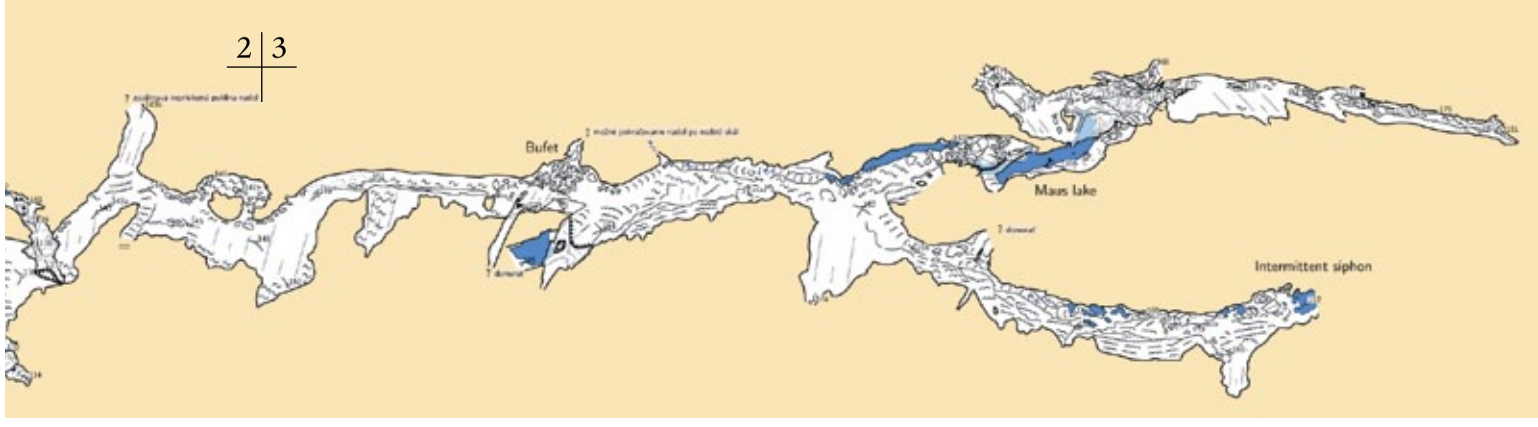
Prosiecka Cave



Prosiecka Cave, Part 1



Prosiecka Cave, Part 2



Prosiecka Cave, Part 3

isters pulled manually, on some places, between stocks, towed by the rope sling. Out of cave were emptied more than 4,000 canisters of 20 l volume... Statistics also show, that mainly woman-cavers were most helpful by excavation work. The way through the rock was built by more than 900 drills of drilling-machine powered by accu-batteries, using Ø 12 mm driller.

Much sought discovery came in August, 2, 2011, when we finally broke into a corridor big enough to possibility to stand up there! After survey, the cave reached the length of 286 m. Good news for diggers was, the cave showed already two ends with narrowings and strong air draft at a distance of 200 m from the entrance. The lower end, which ends in the Čistá sienka (Little clean hall) is flooded during the spring period, so we decided to work at the upper end of cave. Another reason was luring of air draft in the chimney. It was a new challenge: drilling a hole straight up, just 10 cm diameter at the beginning... So, material transport in 10 l canisters started again, this time to the 60 m distant Objavná sienka (Little discovery hall). Hučiaci komínik (Singing chimney) with length of 5 m was overcomed in December, 7, 2012. There were discovered hundreds of meters of passages without barriers, but, unfortunately, spatially for slim cavers only. All the passages are narrow and difficult to move. The whole cave tract is characterized by narrow same-inclined fissures-like corridors, where one advantage occurs – they are good for orientation: when during going through the cave you are falling to the right, you are coming to the cave and when you are falling to the left, you are going out of them. The 8 m deep slippery Priepasť vzdychov (Abyss of sighs), partly dressed up by rope ladders represents the most difficult obstacle of cave. The first place to relax, small hall called Buffet is located in the distance of 330 m from the entrance. The transport to here takes about one hour, what means the average move through cave equals six meters per minute only. Interesting is the dormouse nest built here, because we let here our cookies and foodstuff on previous action. The dormouse came here more than 50 meters into underground to eat them. In new parts, behind the Singing chimney, bats bones does not occur, but we have found here the old dormouse bones covered by calcite in a flowstone pool.

Abyss of sighs. Photo: S. Szunyogová

The cave survey is still running. So far, it was measured a 943 meters long polygonal net and more than 300 metres of passages are known till today. Also excavation works continue in several places. In addition of widening of narrow passages, there is a lower corridor with strong air draft in "excavation reserve", 200 meters from the entrance only. We tried to excavate even in the farthest site of cave, in the rock-fall near Buffet II, 450 m from the entrance, but we discovered here small cavern without air draft only. Drafts lose almost in all chimneys, therefore it will be difficult to find the right place for another breakthrough. Currently, we drill and widen the occasional siphon Občasný sifón, which is located on the main way through the cave and it dries only during winter period. It is possible to overcome it using the bypasses via long narrow passages and Lenka's fissure (where caver Lenka was jammed for three long hours).

The motivation is still huge – resurgence of the massif is located still about 100 meters and we have not found any active watercourse in the Prosiecka Cave yet...

Show caves in Slovakia*

Slovakia has a rich history of caves opened for public visitors. The first known realization was in case of Plavecká Cave under the Plavecký Castle in Western Slovakia, which was in the property of Graph Pálffy, before 1809. The use of the cave spaces as show cave had short duration only. From 1846 was partially opened for public the Jasovská Cave in south-eastern Slovakia by monks from a monastery nearby. Another case is known from Jánska Valley in Central Slovakia, where Graph Szentiványi opened the Sokolová Cave, but mostly for the storage of goods. As store space occassionally showed for tourists were used many of caves, but the first cave opened for mass tourism was the Belianska Cave in the Tatra Mts. in 1882. The Dobšinská Ľadová Cave in Central Slovakia, important for great amount of ice fill inside was open for public in 1887, just one year after

Dobšinská Ľadová Cave: ice skating in the cave's interior on an old postcard

Plavecká Cave entrance with a grotta on ancient litography

* The article was written using and thanks to the data from the State Nature Conservancy of the Slovak Republic – Slovak Caves Administration, Liptovský Mikuláš.

its discovery. In 1887 it was lightened by electricity as the first cave worldwide. From 1893 were realized here also the summer skating events on ice in their interior. Other caves were opened for public mainly after 1921, when the famous Chrám Slobody Cave in Low Tatras Mts. was found (Temple of Liberty = now renamed to the Demänovská Cave of Liberty). In short time horizon were realized the works on openings the Domica Cave, Harmanecká Cave, Bystrianska cave etc. and later, for example the Ochtinská Aragonite Cave in 1972, shortly after its discovery by miners. The show caves belong among real gems of Slovakia. Several of them are known in Europe and even in the world. Thus they are luring invitation to amazing quests for beauty and cognition.

Belianska Cave

Geomorphological unit: Tatry Mts.
Length: 3,829 m
Elevation span: 168 m

The Belianska Cave represents the only show cave within the Tatra Mts. The closeness of Poland state border caused the cave belongs among the most visited show caves in Slovakia. Except for bizarre rocky shapes, it is known by rich occurrence of calcite fills. Though the interest in natural attractions of the cave has been persisting for 125 years, the rules of its forming are not entirely clear by now.

Belianska Cave. Photo: M. Rengevič

Formed in Middle Triassic dark grey Gutenstein Limestones. The origin of the cave was conditioned by bedding planes of mother rock, less the tectonic faults, which the waters penetrated and flowed into the underground along. The primary caverns were entirely filled by water, which except for corrosion worked by slow pressure flow, caused the origin of large cupolas and smaller kettle hollows modelled on the ceilings. The primary caverns probably originated in connection with dissection of originally larger plateau of the Kobylí vrch Mt. above the cave, as well as with subsequent deepening of the valley of Belá River. The largest underground spaces were formed already before the main Quaternary glaciation of the Tatras Mts. The water penetrating into the cave at the time of ice ages retreats had only partially remodelled the before formed underground spaces. The seepage waters are presently concentrated in the lowest parts of the cave, where they form occasional streams.

The cave is 3,829 m long with elevation span of 168 m. The entrance parts, accessible through drilled tunnel, contain chimney spaces opening into them and leading from the upper original entrance situated 82 m above the present one. Ascending and descending parts of the show path, determined by interbed surfaces of limestone, are rising from the Crossroads and are in places widened by collapses into domes and halls. Oval shapes of water modelling are preserved in several places, remarkable vertical segmentation is supplemented by abysses and chimneys.

Attractive are the flowstone waterfalls and pagoda stalagmites; other forms of calcite fill are also abundant. Air temperature reaches 5.0 to 6.3 °C, relative humidity 90 to 97 %.

Seven bat species were determined in the cave; dominating is the Greater mouse-eared bat (*Myotis myotis*). Occurrence of other species such as Whiskered bat (*Myotis mystacinus*), Brandt´s bat (*Myotis brandtii*), Geoffroy's bat (*Myotis emarginatus*) is less frequent. Tiny invertebrates such as *Bathynella natans* can also be found in cave pools.

The cave entrance has long been known. The entrance parts were known by gold seekers as early as the first half of the 18th century, which is evidenced by the inscriptions of their names on the cave walls. However they had been unrevealed for many years. The entrance was again found by L. Gulden and gold miner Fabry in 1826, however they did not penetrate deeper into the cave. In 1881 the opening to underground was accidentaly found by J. Husz and J. Britz. Some days later, they dared to enter the unknown underground spaces. Further discoveries during 1881 – 1882 were shared by A. Kaltstein, I. Verbovszky and J. Britz. The financial support of the Spišská Belá town and thanks to A. Kaltstein, the cave was open for public through the original entrance as early as 1882 in a section to the Palm Hall, and in the end of the year they dug the present entrance. The cave was opened for public as far as the Dome of Ruins in 1884, from where by digging out a tunnel into the side passage from the Crossroads the path was circulated in 1885. Electrically lit is the cave from 1896. New spaces were discovered by K. Piovarcsy, G. Gabriel and other members of the Carpathian Convention in 1926 and by P. Klepáč in 1935. The cave survey was organized by V. Benický in 1939. Large reconstruction works were done in the fifties of the 20th century and during 1979 – 1980 the path was adapted by an adit shortcut. The cave has been used for healing speleoclimatic stays in the last years. More than 1,000 m with elevation range of +125 m is open for public at present.

Bojnická Hradná Cave

Geomorphological unit: Horná Nitra Basin
Length: 65 m
Elevation span: 26 m

The cave below one of the most beautiful castles of Central Europe – the Bojnice Castle.

Bojnice Castle. Photo: L. Vlček

Part of the culture tour of Bojnice Castle is also the visit of cave originated in the tufa hill on which the castle was in 12th Century. The travertine cave consisting of one great hall, 22 metres in diameter and 6 m high, is situated directly under the level of 4th courtyard. The connection with castle goes through the 26 m deep artificial well. The rest of water, which created the cave is located inside in two pools. There is an assumption of existence of further space in the underground of hill, which can be interconnected by the lakes.

The castle owners and inhabitants did know about the existence of cave from time immemorial. Cave represented a shelter but also a fresh water reservoir. The re-discovering of cave took

place in 1888, when was the castle rebuilt and the well was cleaned up. First visitors could visit the cave in 1967, when it was open for public.

Bystrianska Cave

Geomorphological unit: Horehronie Basin
Length: 3,531 m
Elevation span: 99 m

Bystrianska Cave. Photo: L. Vlček

Also Upper Hron region hides its underground beauty. The Bystrianska Cave is the most important cave of the valley of Hron River. It is known by remarkable rocky features and evolution of underground spaces, occurrence of flowstone fills as well as by favourable climatic conditions for speleotherapeutical treatment.

The cave was formed in the Middle Triassic dark grey limestones with chert intercalations and dolomites. The direction of cave passages is significantly predisposed by steep tectonic faults. It was formed by the ponor waters of Bystrianka Brook flowing into the karst territory from the southern slopes of the Low Tatras Mts. in several developmental stages in dependence to the valley bottom deepening. The so called Old Cave is the oldest part of the cave, with an entrance situated 70 m above the present flow of Bystrianka Brook. At present, the ponor watercourse is flowing through the lowest and youngest parts of the so called New Cave, which are situated 14 m lower than the 160 m distant ponor of Bystrianka in front of the cave. The water course appears also on the bottom of the nearby sinkhole Bystriansky Závrt, which has abyss spaces more than 650 m long and 165 m deep. The springs in Valaská Village are 3,300 m away from ponors with elevation difference of more than 70 m. The main spaces of the New Cave have narrow and high fissure passages widened by corrosion and erosion of the water course. Shorter oval passages are prevailingly predisposed by interbed surfaces and they connect the narrow fissure passages in some places. The upper parts of tectonic faults are widened by corrosion of percolating atmospheric waters in several places. Also larger halls and domes are present, mostly of breakdown shape. The abyss 56 m deep opens into the lower parts of the New Cave. Flowstone fill is dominated by curtains, which sometimes hang from the edge of flowstone crusts formed on previous and later washed out river sediments. Aragonite occurs someplaces.

Air temperature is from 5.7 to 6.7 °C, relative humidity 92 to 98 %. Eight bat species were determined in the cave with the most abundant Lesser Horseshoe Bat (*Rhinolophus hipposideros*) and Greater Mouse-Eared Bat (*Myotis myotis*).

Local people knew about the opening to the Old Cave for a long time. The first people daring to go underground were J. Kovalčík and E. Laubert in 1923. The abyss, through which the New Cave was reached later, was discovered in 1926. The lower entrance was opened in 1932; during 1939 – 1940 was opened a part of the cave for public but without electrical light. The Old and New Cave were connected in 1955 and the cave has been opened for public in today's shape since 1968 in length of 490 m. One of it's domes has been used for speleotherapy since 1971.

Demänovská Cave of Liberty
Geomorphological unit: Low Tatras Mts.
Length: 36,333 m (length of the whole cave system)
Elevation span: 196 m

The Demänová Cave System on the northern side of the Low Tatras Mts. is the longest cave system in Slovakia. The Demänovská Cave of Liberty belongs among its dominating caves. It has been captivating the visitors by its rich flowstone fill of various colours, magical flow of underground Demänovka as well as the charming pools for many years. It is the most visited show cave in Slovakia.

The cave represents morphologically the most varied part of the Demänová Cave System. It is formed in the Middle Triassic dark-grey Gutenstein Limestones along the bedding planes and tectonic faults by the ancient ponor flow of Demänovka River and its side hanging ponor tributaries.

Demänovská Cave of Liberty. Photo: M. Rengevič

The lower oval, river modeled passages of the cave represent four horizontal developmental levels. They are in places widened by collapses. Steeply descending passages lead into cave levels in hanging positions, mostly from the place of present cave entrance and exit. Except for the smaller oval passages they include also bigger domes. From among the flowstone fills, the water lilies and other lacustrine forms (sponge, coral, grapes forms) and also eccentric stalactites are unique. Mighty flowstone waterfalls and columns, sphaerolitic stalactites and many other forms of stalactites and stalagmites are captivating. A thick layer of white moonmilk can be found someplaces.

The underground water course of Demänovka, which springs in the non-karst territory under the main ridge of the montains, flows through the cave. It sinks underground in Lúčky and springs again through the Vyvieranie Cave northerly from the Cave of Liberty. Air temperature is from 6,1 to 7,0 °C, relative humidity 94 to 99 %.

The bones of cave bear (*Ursus spelaeus*) were found in the Bear's Passage. The finding of the palpigrade *Eukoenenia spelaea* means one of the most northern occurrences of this arachnids in the world, which ranks the cave among the biospeleological localities of European importance. From among the tiny invertebrates, mostly the multipede *Allorhiscosoma sphinx* (endemite of the middle Slovak caves) and amphipods *Synurella intermedia* and *Niphargus tatrensis* are important.

The cave was discovered by A. Král with the help of A. Mišura and other surveyors through the dry lowest ponor of Demänovka River in 1921. An interim electrical lighting was installed in 1923. A part of the cave was opened for the public in 1924. An expedition headed by A. Král and V. Benický with A. Lutonský discovered in 1926 – 27, 1929 – 30 further spaces. A new entrance to the cave was dug out in 1928 which was opened to public in 1930. A permanent electric lighting was installed in 1931 and the show path was prolonged simultaneously. A new exit from the cave was dug out in 1933 from the Bear's Passage. During 1948 – 1955 were the caves of the Demän-

ovská Valley surveyed and measured by A. Droppa. In 1951 the Cave of Liberty was connected with the Pustá Cave, and in 1983 the speleodivers found its connection with the Vyvieranie Cave. Afterwards, a connection with the Cave of Peace, Pod Útesom, Jaskyňa 27, Medvedia and several others was reached.

The length of path open to public is 1,800 m. Vertical difference between entrance and the lowermost riverbed is –66 m, and between the Ground Floor and exit +85 m.

Demänovská Ľadová Cave

Geomorphological unit:
Low Tatras Mts.
Length: 36,333 m (length of the whole cave system)
Elevation span: 196 m

The cave presents the northern part of world known Demänová Cave System. It stands out by occurrence of permanent ice fill, bizarre and mighty shapes of underground spaces, rare cave fauna as well as rich history.

The cave was formed in Middle Triassic dark-grey Guttenstein Limestones, along tectonic faults by the previous ponor flow of the Demänovka River, which flowed from the Cave of Peace. It presents the northern previously spring part of the system. Some upper parts of the cave are formed by waters of side ponor branch of Demänovka River, which penetrated from the adjacent Dvere Cave and from the caves in Bašta Cliff. The spaces of three developmental levels consist of oval, river modelled passages with ceiling and side channels and domes reshaped by collapses and frost weathering. The passages descend from the entrance to the depth of 40 to 50 m.

Demänovská Ľadová Cave. Photo: L. Vlček

Ice fill occurs in the lower parts of the cave. There is floor ice, ice columns, stalactites and stalagmites. The conditions for glaciation started after burying several openings to the surface in consequence of slope modelling processes, by which the air replacement was restricted. Heavier cold air is kept in the lower parts of the cave. Seeping precipitation water freezes in overcooled underground spaces. Air temperature in glaciated parts fluctuates around 0 °C and in direction to the back non-glaciated parts rises from 1.3 up to 5.7 °C. Relative air humidity is between 92 and 98 %.

Original flowstone fill was preserved in several places of the cave (stalactites, stalagmites, sinter covers on the walls, floor crusts and other forms), which is, however, considerably destroyed by frost weathering in the glaciated part of the cave. Sinter formations are coloured on the surface into gray up to black from soot of tar torches, oil burners and paraffin lamps, which were used for lighting until 1924.

The cave belongs among long known finding places of bones of various vertebrates including the cave bear (*Ursus spelaeus*), which were in the first half of the 18th century considered dragons' bones. That's why the cave was called Dragon's Cave in the past. By now, eight bat species were found in its underground spaces. It represents the most important wintering place of the Northern Bat (*Eptesicus nilssonii*) and the second most important one of the Whiskered/Brandt's Bat (*Myotis mystacinus/M. brandtii*) in Slovakia. Species representation of tiny cave fauna – invertebrates is substantially smaller in glaciated parts as compared with non-glaciated ones.

It is passed on that the Dem. Ľadová Cave is known from time immemorial. The first mention about the openings to caves in the Dem. Valley is recorded in document from 1299, the first written mention about the cave is related to the description of a cave, coming from 1672 by J. P. Hain who was interested in cave bear bones and took them for dragon's bones. Further mentions of the cave are connected with G. Buchholtz jr., who surveyed its spaces in 1719. He sent the description together with a sketch of the cave to M. Bel, who published them in 1723. Emperor's commission, which was surveying Tatras and adjacent mountains overlooked the cave in 1751. Plenty of inscriptions on cave walls and preserved rich literature show a great interest of then scientific circles and general public in the cave. There are also signatures of important persons of the Slovak history on its walls.

The primary opening the cave for public took place around the half of the 19th century, though an adaptation of its spaces to make descend easier mainly in the steep and iced entrance part was done earlier. A. Žuffa jr. discovered dome in the lower part of the cave in 1909. The interest in the Dem. Ľadová Cave was gradually falling down after opening the Cave of Liberty for the public in 1924. A. Král together with V. Benický, discovered the upper dripstone parts of the cave in 1926. The cave was reopened in 1950 – 1952, including installation of electric lighting. S. Šrol, P. Revaj and P. Droppa discovered the Cave of Peace from here in 1952. This had disturbed the temperature regime in the cave, so in 1953 – 1954 measures were taken to restore the ice fill. The show path was reconstructed through the years 1974 – 1976. The cave has 650 m open for public with elevation difference of –48 m.

Dobšinská Ľadová Cave

Geomorphological unit: Slovak Paradise
Length: 1,483 m
Elevation span: 112 m

Ice gem of the world heritage. The cave belongs among the most important ice caves in the world. Since 2000 it is inscribed on the world heritage list. As compared with known high-mountain ice caves Eisriesenwelt and Dachstein-Rieseneishöhle in Austrian Alps or with the Romanian Scărişoara Cave in Bihor Mts., which has the glaciated part at elevations of 1,100 to 1,120 m n. m., the monumental glaciation of the Dobšinská Ice Cave persist for thousands of years at elevations only 920 to 950 m.

Dobšinská Ľadová Cave is a genetical part of the Stratená Cave System, 24.5 km long. It is formed in the Middle Triassic pale Steinalm and Wetterstein Limestones along the tectonic faults and interbed surfaces. The main part of the cave is represented by a giant cavity descending from the entrance to the depth of 70 m, which was formed by breakdown of rock columns between the passages formed by ponor palaeoflow of Hnilec in several development levels. At present, the most of its volume is filled with glacier, sometimes up to the ceiling, by which it is divided into individual parts. Original oval shapes of river modelling are almost entirely destructed by collapses and frost weathering. The upper non-glaciated parts of the cave are formed prevailingly by horizontal passages and halls with typical oval shapes and ceiling channels. There are also some forms of flowstone fills in the non-glaciated parts of the cave. Conditions for glaciation arose probably in the Middle Quaternary period after the breakdown of ceilings between the Dobšinská Ľadová and Stratenská caves, by which the cave obtained sack-like character with stagnation of cold air that penetrated into the cave through the up-

Dobšinská Ľadová Cave. Photo: L. Vlček

per opening formed by collapse of the ceiling part (present entrance to cave). Freezing the percolating rainfall waters caused glaciation of the underground space. The beginnings of ice formation go back to the Riss ice age (approx. 300- to 140-thousand years ago), or until the end of the Mindel ice age.

Ice fill occurs in the form of floor ice, icefalls, ice stalagmites and columns. Glaciated surface has 9,772 m^2, ice volume reaches 110,100 m^3. The highest thickness of ice is in the Great Hall with 26,5 m. The floor ice is characterized by its stratification. The decrease of ice takes place by melting on the contact with the bedrock. Continuous replacement of the underground glacier supposedly takes around 1,700 up to 2,000 years. The ice is slowly moving from the entrance towards the Ground Floor (2 to 4 cm a year). The cave belongs among the most significant ice caves in the world, which is accentuated by its location outside the Alps high-mountain region (underground ice is at elevation of 920 to 950 m a.s.l.).

Average annual temperature of air in the glaciated parts reaches –0,4 to –1,0 °C (in February –2,7 to –3,9 °C, in August around +0,2 °C). The temperature in the bottom parts of the cave remains under the freezing point all the year round. Relative air humidity in non-glaciated parts is mostly 75 to 90 %, sometimes over 90 %. The cave is of static-dynamic character and different winter and summer regime of air flow circulation. In winter the cold air flows underground and in summer vice versa.

The cave stands for the most important wintering place of the Whiskered Bat (*Myotis mystacinus*) and Brandt's Bat (*Myotis brandtii*) in central Europe. From among 12 species that were found in the cave important is the occurrence of the Pond Bat (*Myotis dasycneme*) and Natterer's Bat (*Myotis nattereri*), which belong among the rarest bat species in Slovakia.

Opening to the cave called "ice hole" was known since long time ago. However, it was only E. Ruffíni accompanied by G. Lang, A. Mega and F. Fehér who descended underground in 1870. The cave was opened for the public as early as 1871. Experiments with electric lighting began in 1881. Regular electric lighting was introduced in 1887, so the cave belongs among the first electrically illuminated caves in the world. Immediately after the discovery the cave took attention of both experts and public and many of that time personalities visited the cave. A concert was

held here in 1890 to the tribute of Karl Ludwig von Habsburg. It was known also by summer skating, which took place for the first time in 1893. The Dripstone Hall and adjusted space were discovered in 1947. During 1953 – 1954 a general repair of the show path and electric lighting was done as well as protection measures after the discovery of non-glaciated parts. Public has access to 475 m with elevation range of –43 m.

Domica Cave

Geomorphological unit: Slovak Karst
Length: 25.8 km (the length of transboundary system; 5,385 m on Slovak side)
Elevation span: 70 m

Enjoy the exciting underground boat ride in the cave! Domica Cave is the most known and longest cave of the Slovak Karst National Park. Except for important geomorphological features, it is interesting by precious archaeological findings, occurrence of flowstone shields and drums, as well as numerous bat species presence. The cave belongs in the world heritage site „The Caves of Slovak and Aggtelek Karst".

The cave is formed in the Middle Triassic pale Wetterstein Limestones along the tectonic faults and limestone layers by corrosive and erosive activities of Styx and Domický Brook and smaller underground tributaries draining waters mainly from the non-karst part of the basin. Horizontal oval passages with ceiling troughs dominate the cave. The passages are in places widened into domes and halls. The passage of Styx gains a character of underground canyon with meanders. Three developmental levels are situated in a relative lowering of 8 to 12 m. The lowest level is filled up with gravels and loam. They also form one genetic unit with the Baradla Cave in Hungary.

Domica Cave. Photo: M. Rengevič

The cave is rich in calcite fills, from which the most typical are shields and drums, cascade pools, onion-like stalactites and pagoda-like stalagmites. Also other sinter forms occur in the cave. Air temperature ranges from 10.2 to 11.4°C and relative humidity from 95 to 98 %.

The bones of cave bear (*Ursus spelaeus*) were dug out from sediments. Sixteen bat species have been found in the Domica Cave and Čertova diera Cave by now. The dominating one is the Mediterranean Horseshoe Bat (*Rhinolophus euryale*), which forms here some 1,200 – 1,400 members' colony, the only one of such a kind in Slovakia. Thick layers of bat excrements – guano can be found in some places. Its chemical reaction with sinter created guano pots. 44 species of collembolans (with the most important endemite *Arrhopalites slovacicus*) were found in this cave together with rare palpigrade *Eukoenenia spelaea*, multipede of genus *Typhloiulus* sp., crustacean *Niphargus tatrensis* and many other species of terrestric and water fauna.

The Domica Cave had offered a short time refuge for the oldest Neolithic inhabitants of the Eastern Slovakia who were creators of the culture with the eastern linear ceramics – and its local branch so called Gemer Linear Ceramics. However, the cave had been mostly settled by the Neo-

lithic humans of the Bükk Mountain Culture. The original entrance was later blocked by debris and the cave became inaccessible.

Archeology

The Old Domica was known since long ago. J. Majko penetrated from its bottom through 15 m deep abyss into large underground spaces in 1926 where plenty of archaeological findings were discovered later. Post holes from dwelling objects and fireplaces were discovered in several places of the cave. More than 200 reconstructed containers from sherds as well as a terrace-dug slope in a fine-grained loam on the Styx bank with imprints of stone axes are evidences of ceramics manufacture in the cave. Irons, awls, arrows, the oldest comb in Europe, ring, decorated cylinder bracelet and fishhook represent the peak of Neolithic processing of bones. Also pendants from shells and animal teeth were preserved. Instruments from stone comprise smoothened axes, wedges and mallet with drilled hole and split stone tools – knives and scrapers. The evidence of fabrics making is the finding of a thick fabric imprint in the loam (the oldest one in Slovakia), clay whorls as well as a fragment of the conic weaving weight unit. The rear parts of the cave served probably as sacred and cult places and charcoal drawings were preserved here. Domica is one of the most important finding places of the Bükk-Mountain Culture in Slovakia.

The lower entrance was built in 1930 and the cave was opened for the public, including electric lighting and damming up the Styx in 1932 for the underground boat trip. At present, public has access to 1,315 m, including the 140 m long underground boat ride.

Only occassional underground water courses flow through the cave. The cave was during intensive rainfall flooded several times in the past. So the agricultural activities were guided to prevent speeding up the runoff waters and soil erosion.

The most western part of the cave system, close to the edge ponor dolines, is formed by the Čertova diera Cave. Its underground spaces descend from the opening down to the Styx riverbed. The easy accessible parts near the entrance of the cave are long known. L. Bartolomeides wrote about the cave in 1801. Presumed connection of the Domica Cave with the Čertova diera Cave was realized by J. Majko in 1929.

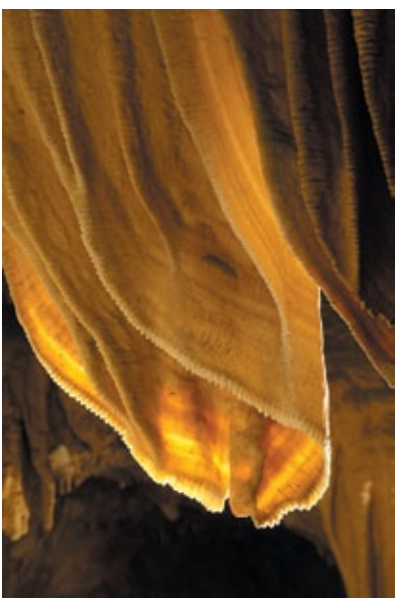
Driny Cave

Geomorphological unit: Malé Karpaty Mts.
Length: 680 m
Elevation span: 40 m

Underground pearl of the Lesser Carpathians Mts. The cave is the only show cave in the western Slovakia and one of the main tourist attractions of the Lesser Carpathians region. As compared with other show caves in Slovakia, where usually larger underground spaces prevail, it represents a system of narrow fissure passages, however with beautiful dripstone decoration.

It is formed in brown-grey Lower Cretaceous chert limestones by corrosion of atmospheric waters penetrating along tectonic faults. It consists of narrow fissure passages, from one to three meters wide and not big hall spaces, formed mostly on intersection of tectonic faults. The discovery chimney descends to 36 m's depth has a character of doline chimney.

A rich sinter fill decorates fissure underground spaces. Flowstone draperies with indented facing are typical for this cave. Flowstone waterfalls and flowstone structures,



Driny Cave. Photo: M. Rengevič

pagoda-like stalagmites and various forms of stalactites occur here. Also small flowstone pools, supplied with water by percolating rainfall water, can be found here. Air temperature in the rear parts of the Driny Cave ranges between 7,1 and 7,8 °C, relative humidity between 92 and 97 %. Air temperature in these spaces reaches from 5,6 to 8,7 °C

Eleven bat species have been found here by now. The most abundant is the Lesser Horseshoe Bat (*Rhinolophus hipposideros*). From among other species the following ones can be found here: Greater Horseshoe Bat (*R. ferrumequinum*), Greater Mouse-Eared Bat (*Myotis myotis*), Barbastelle (*Barbastella barbastellus*), Common Long-Eared Bat (*Plecotus auritus*) and others.

The mysterious hole on the Drinkový Hill was known to local people as early as the 19th century. J. Banič and I. Vajsábel roped down to deeper parts of the doline chimney in 1930. Cavers entered the cave to 36 m's depth from surface in 1932. The lower entrance was thirled in 1933 and interior adaptations started. In 1935, the cave was opened to public with a provisional electric lighting in the length of 175 m, proper electric lighting was installed in 1943. In 1950 the cavers discovered the Hall of the Slovak Speleological Society, which was opened to public in 1959. The length of tourist path is 410 m.

Gombasecká Cave

Geomorphological unit: Slovak Karst
Length: 1,525 m
Elevation span: 15 m

From the canyon of Slaná directly to the underground of the Silická plateau! Gombasecká Cave belongs among the most important caves of the Slovak Karst national park. It is known mostly by occurrence of thin straw stalactites. Within the „Caves of Slovak and Aggtelek Karst" it was inscribed on the world heritage list.

It is formed in the Middle Triassic pale Wetterstein Limestones along the tectonic faults, by corrosive and erosive activities of the Čierny Brook and its intermittent tributary from the well in the Marble Hall. The Gombasecká Cave and Silická Ľadová Cave are a part of the Silica-Gombasek underground hydrological system. Both the caves are separated by so far unknown section of the Čierny Brook. It springs to the surface through the Čierna Resurgence, 11 m above the bottomland of the Slaná River.

The Gombasecká Cave represents a fluviokarst outlet cave. The two floors consist of oval, river modeled as well as fissure passages, which are in places widened by collapses into domes and halls. The upper floor is situated 5 to 10 above the active riverbed of the Čierny Brook, which flows in the lower parts of the cave. The Dry Passage, located on the upper floor, was formed by waters of unknown origin, which intermittently rise through the 10 m deep well in the Marble Hall also at present. The cave is unique by thin straw stalactites, which can reach as much as 3 meters' length. Also other forms of stalactites, stalagmites,

Gombasecká Cave. Photo: M. Rengevič

sinter curtains, coatings and crusts can be found here. Air temperature in the cave ranges between 9.0 and 9.4 °C, and relative humidity between 95 and 97 %.

Remarkable is the finding of a blind multipede of *Typhloiulus* sp. genus with 26 mm body length, which represents the biggest troglobite – genuine cave animal ever found in the Slovakian caves. From among the bats, which occur in the cave only occasionally, we can observe the Smaller Horseshoe Bat (*Rhinolophus hipposideros*) sometimes in spring or autumn season. Fire salamanders (*Salamandra salamandra*) use to dwell in the entrance passage from autumn to spring in the recent years.

Volunteer cavers from Rožňava, organized in the Slovak Speleological Society, discovered the cave in 1951 (V. Rozložník, L. Herényi, Š. Roda, A. Abonyi, A. Rusňák, Š. Ivanec and others). They entered the underground spaces through the Čierna Resurgence with the help of some excavation works. The cave has been opened to the public since 1955. It had been used for speleotherapy for ten years since 1968, as the first cave in Slovakia. The length of accessible part is 285 m.

Harmanecká Cave

Geomorphological unit: Veľká Fatra Mts.
Length: 3,123 m
Elevation span: 75 m

Mysterious underground of the southern Veľká Fatra Mts.! The cave ranks among the most important caves in Slovakia by remarkable origin of cave spaces, mighty breakdown domes, high abundance of moonmilk, as well as by the number of wintering bats.

It is formed in the Middle Triassic grey Gutenstein Limestones along the tectonic faults with locally applied interbed surfaces. Except for voluminous collapse spaces, there are horizontal and inclined passages with irregular oval shapes, however without typical signs of underground river modelling. We can also find distinct collapses and spiral abysses.

The initial cave spaces were formed by corrosion of slowly flowing and almost stagnant water, when they were completely flooded. Mixed corrosion and slow convection flow of water formed irregular sponge-like and oval cupola hollows. After the decline of water-table, which is witnessed by here and there preserved level notches, the cave spaces were flooded only partially. Several distinct collapses of roofs and walls occurred in many places of the cave. Except for collapses, also percolating atmospheric waters contributed to further forming of the underground spaces. Narrow fissure passages and chimneys were formed by their corrosive activity in the cave.

The cave is known by abundant occurrence of white soft sinter – moonmilk. From among the sinter fills, mainly the mighty pagoda stalagmites, wall flowstone waterfalls and draperies catch your attention. There are two pagodas twelve meters high with three meters in diameter in the Great Dome. Air temperature in the cave is between 5.8 and 6.4 °C and relative humidity 94 to 97 %.

Harmanecká Cave. Photo: M. Rengevič

The cave belongs among the most important localities of bats occurrence in Slovakia. Eleven bat species were recorded in the cave by now. Dominating species are the Greater Mouse-Eared Bat (*Myotis myotis*) and Lesser Mouse-Eared Bat (*Myotis blythii*), which occurred here several times in amount of 1,000 to 1,500 individuals. Another abundant bat species in this cave is the Common Pipistrelle (*Pipistrellus pipistrellus*). Frequently, we can find here also the Daubenton's Bat (*Myotis daubentonii*). The most important from the invertebrates are the multipede *Allorhiscosoma sphinx* and crustacean *Bathynella natans*.

The entrance space of the cave called Izbica, which offered shelter in bad weather to woodcutters and forest workers, was known to local people since long ago. The later discovery of the cave in 1932 wasn't a result of a chance but a goal-directed heavy work of 18 years old Michal Bacúrik, who after 14 days dug out a narrow opening and entered the snow white hall later called the Discoverer's Dome. It is interesting that the discoverer was fined for this because he didn't have the permission from the town forest office to enter their forests. The town council in Banská Bystrica closed the cave in 1933 because of flowstone fill protection. Following domes were discovered in 1938. In 1944, during the World War II, the cave served as a shelter for local people. The cave was opened to the public for the first time in 1950. Next discoveries were realized in 1959 and 1987. The length of accessible part is 720 m.

Jaskyňa mŕtvych netopierov (Cave of Dead Bats)

Geomorphological unit: Low Tatras Mts.
Length: 20,195 m
Elevation span: 324 m

The underground of the Slovak national mountain Ďumbier Mt.

The Cave of Dead Bats belongs among the largest and most important high mountain caves in Slovakia and it is the 4th longest and 5th deepest cave here. It is situated in the central part of the Low Tatras in the Ďumbier high mountain karst (1,750 m a.s.l.). The relatively small, deeply folded limestone massif of the Kozie Chrbty 2 km long and 300 m wide, contains a lot of passages inside spread over by now known 14 levels and two parallel branches. The shape of cave plan has a maze character with several big domes. The biggest underground space, Bystrický Dome, is located on the 7th level at the depth of 180 m, having the volume of 52,500 m^3.

Cave of Dead Bats. Photo: M. Sluka

One of the geological specialities is the occurrence of volcanic rocks of Cretaceous age infolded in the limestone strata. They appear in cave passages in several places where they show by red-brown or green colour. The volcanic rock contains lenses of agates of white-pink hue. Another cave speciality are the accumulations of bat bones, which appear almost everywhere and by which the cave received its name. Their age is estimated to 6,000 years. Skeleton remains of martens, bears and goats were found in the entrance parts of the cave.

The average air temperature of the cave is +3,5 °C, however some seasonally glaciated parts have the annual average only +1 °C. Air flow movement reaches 5 m/s because of the open character of the cave.

The high-mountain area of Ďumbier has been more frequently visited since the beginning of the 19th century. However, the first report of a cave discovery is dated to 1925, when J. Chudík and J. Rosiar discovered few small entrances in a limestone ridge Kozie chrbty near Ďumbier. Next discoveries were realized in 1948 – 1949; in 1977 was discovered about 1 km of underground spaces. From discoveries of 1981 the cave was intensively explored and open for public in 1996 as the first Slovak show cave not managed by Slovak Caves Administration and guided in hiking or caving way.

For tourists are open three circular paths in the length of 750 m, 1,000 m or 1,160 m.

Jasovská Cave

Geomorphological unit: Slovak Karst
Length: 2,811 m (cave system with Okno Cave)
Elevation span: 55 m

Discover the mysterious underground of the Jasovská Rock! The cave belongs among the most important caves of the Slovak Karst National Park. It is known by occurrence of rich calcite flowstone fill, remarkable rocky shapes and development of underground spaces, with abundant bat occurrence, several archaeological findings and interesting history. Withing the "Caves of Slovak and Aggtelek Karst" it was inscribed on the world heritage list.

Jasovská Cave. Photo: M. Rengevič

The Jasovská Cave is formed in Middle Triassic grey Gutenstein dolomites and pale Steinalm Limestones. The massif of the Jasov Rock is markedly disrupted by faults and numerous fissures, which condition the prevailing direction of passages and to great extent also the number of passages in the cave. The underground spaces were formed progressively in several development phases from the highest passages to the lowest parts of the cave in relation with the development of the Bodva River valley. Upper and some bottom parts of the cave with high meander passages and halls with ceiling troughs were formed by corrosive and erosive activities of ancient ponor waters of Bodva. The lower parts of cave with domes, halls, wall notches and flat roofs were formed by more or less stagnant water. The lowest parts of the cave with flat roofs were formed by solution of limestone under conditions of slowly moving stagnant water. The lowest parts of the cave including a part of the show path have been used to be flooded in consequence to water-table fluctuations. The lowest level of cave lake is 7 m below the surface of Bodva River level, however, an occassional flooding of the cave lower parts doesn't correlate with Bodva River fluctuations.

Several parts of the cave are decorated with rich flowstone fill. Pagoda-like stalagmites, columns, flowstone waterfalls, shields, drums, straw stalactites and other forms are eye catching. Air temperature ranges between 8.8 and 9.4 °C, and relative humidity between 90 and 98 %.

Bones of cave bear (*Ursus spelaeus*) and cave hyena (*Crocuta spelaea*) were found in the cave as remains of ancient animals. Nowadays, the Jasovská Cave is a very important bat locality. By now, 18 bat species were found in the cave. They stay in the cave mainly in the winter season. The most abundant is the Greater Horseshoe Bat (*Rhinolophus ferrumequinum*) and Lesser Horseshoe Bat (*R. hipposideros*). The cave is one of the most important wintering places of the Greater Horseshoe bats in Slovakia. A tiny palpigrade *Eukoenenia spelaea* represents the rare invertebrates.

The Jasovská Cave was settled in the Neolithic (Bükk-Mountain Culture), Bronze Age, Halstadt Age (Older Iron Age) and Rome Age. Sporadic findings show also to possible short-term Palaeolithic settlement.

It is passed on that the cave (its upper parts) was discovered by a monk from the Premonstrate Order located in Jasov, founded in 12th century. People from village and monastery used the cave as a shelter. Many old inscriptions and drawings on cave walls were preserved. The inscription from 1452 records the victory of Jan Jiskra's (from Brandýs) soldiers. The cave was opened to the public in 1846 by then Canonic Premonstrate Order superior A. Richter. Another spaces were discovered in 1923 and later the upper floor with the inscription from 1452 (J. Zikmund). The cave was reopened for the public in 1924, after some adaptations. It has been electrically lit since 1926. Another parts of cave were open for public in 1931 and 1935. The show path has the length of 550 m.

Krásnohorská Cave

Geomorphological unit: Slovak Karst
Length: 1,550 m
Elevation span: 60 m

Dynamic experience on the underground water flowing below the Slovak Karst! Come inside to walk towards the river up to the dome with the tallest stalagmite in Slovak caves!

Cave located on the northern foothill of the Silická Plateau, on the edge of the Rožňavská Basin. It is known mainly by the mighty dripstone column Kvapeľ rožňavských jaskyniarov reaching the height of 32,6 m, as well as by mysterious underground riverbed. The cave is opened through an artificial adit with opening near the Buzgó spring lying at 316 m.

The cave is formed in the Middle Triassic dark-grey Gutenstein Dolomites and Limestones, with a part lying in light grey Steinalm Limestones. The origin of underground spaces was preconditioned by a distinct tectonic fault along which corrosive and erosive activity of underground stream did its work. The stream appears on the surface in the Buzgó spring, further flowing to Čremošná. The underground hydrological system begins

Krásnohorská Cave. Photo: J. Stankovič

in the dolines near the Žedem well on the Silická Plateau at elevation of 535 m and gradually receives other infiltration waters.

The water course from the spring to the Marikino Lake is 520 m long. The main part of the cave is a canyon passage widened on crosswise faults into mighty domes as much as 45 m high. There are flow through lakes within the underground riverbed in places.

A rich flowstone decoration is in some side branches of the cave, from which the various eccentric helictites are the most interesting. Also soil pyramids were formed here in a remarkable form. Air temperature is 9 °C, relative humidity 98 %.

Four bat species hibernate in the cave mainly the Lesser Horseshoe Bat (*Rhinolophus hipposideros*) and Greater Horseshoe Bat (*R. ferrumequinum*). Terrestric invertebrates living in cave are crustacean isopod *Mesoniscus graniger* and troglophilic multipede *Polydesmus denticulatus*. The spiders are represented by troglophilic harvestman *Ischyropsalis manicata*. Rich populations are formed by rare troglobitic springtail *Arrhopalites aggtelekiensis*, and other springtail of the *Mesaphorura* genus is a new species for science. Stygobitic crustacean *Niphargus tatrensis* is abundant in the underground stream.

The cave was discovered in 1964 by cavers from Rožňava when lowered the water level in karst spring and widened the narrow entrance passage. V. Rozložník began the survey of the spring in 1954. At present, the cave is opened through an adit 120 m long. The first tourist opening to public took place in 2004. The part of the cave open to public is 420 m long.

Malá Stanišovská Cave

Geomorphological unit: Low Tatras Mts.
Length: 872 m
Elevation span: 20 m

The cave is located in the territory of Jánska Dolina Valley. The entrance is on the northwestern slope of Smrekovica in the Low Tatras National Park at elevation of 761 m, and 39 m below the level of Štiavnica Brook. Cave is genetically related with Veľká Stanišovská Cave (840 m) and Nová Stanišovská Cave (2,334 m), which entrance are located in the slopes of the valley.

The cave was formed by erosion and corrosion activities of the underground stream of Štiavnica with the help of atmospheric waters and processes of rock crumbling and collapsing of weathered material along the tectonic faults and interbed surfaces in the Pleistocene and Holocene. The general direction of the cave is N-S. The flowstone fill of the cave is considerably destroyed mainly in the easily accessible parts.

The cave has two developmental levels, the lower one is about 25 m below the flow of Štiavnica. The temperature in cave is from 6,4 °C to 7,0 °C. Air humidity reaches 95 %.

The lower level forms a horizontal passage with

Malá Stanišovská Cave. Photo: L. Vlček

irregular profile with a debris of sharp fragments of the bedrock on the floor. The bedrock is of Middle Triassic Gutenstein Limestones. Some parts of this passage have flowstone cascades and lakes on cave bottom. The upper level is characterized by cave fills in various forms and shapes, with abundant stick stalagmites.

The Stanišovská Cave, together with Malá Stanišovská Cave nearby, represent the most important bat wintering place in the Jánska Valley. Seven species have been found here by now. The most abundant is the Greater Mouse-Eared Bat (*Myotis myotis*). Occurrence of cave isopod *Mesoniscus graniger*, and troglophilic terrestric crustacean from the isopod group (Isopoda) were recorded from the cave entrance. Cave springtails live directly in the cave – like *Pseudosinella paclti*, *Arrhopalites pygmaeus* and multipede *Allorhiscosoma sphinx*. The cave is known also by palaeontological discoveries like cave bear bones and archaeological research confirmed traces of Middle Age settlement.

The Stanišovská Cave belongs among the oldest known caves in Liptov region as well as in Slovakia. The entrance was known from time immemorial. It was the first time surveyed and measured by J. Bucholtz jr. in 1720, however it was described by Matej Bel in 1723 only. Further spaces were discovered in span of 1922 to 1950 by volunteer cavers from Liptovský Mikuláš and surrounding.

Morské Oko Cave

Geomorphological unit: Rimava Basin
Length: 50 m
Elevation span: 38 m

The only one cave open for divers in Slovakia. Exclusive modelled flooded shaft, ideal for experienced open-water divers or speleodivers as only one cave diving locality open for public.

Morské oko Cave is a flooded chasm in the Rimava basin, west from Slovak karst (Southern Slovakia). The underground space of chasm originated by the artesian uplift of karst water from more than 100 m deep karstified Triassic limestone and dolomitic rocks. These carbonates are covered by non-permeable Tertiary siltstones, which caused the tense level of deep water. The recharge area of deep water is situated in the western part of Slovak karst. The chasm developed in Pleistocene after passing of Štítnik River to the west – to recent river bed. In first stage of its developing the fault was entarged by suffosion of uplifting water and in the second stage the chasm was enlarged also by gravitational falling down of siltstone blocks under the water level. Therefore, we can classify the chasm as fault-suffosion-collaps vertical cave.

Many of fossils of sea urchins, shells etc. can be found on the walls inside the cave. The bottom is built by clay or sandy sediments, which come the water trough. Provenance of water was proven by studying the seeds of numerous plants, which have been sampled in the springs at the bottom of cave; they belong to plants which do not occur in the

Entrance lake of the Morské Oko Cave. Photo: Ľ. Gaál

Diving in the Morské Oko Cave. Photo: M. Megela

cave's close surroundings and have origin in more distant area from here.

Exploration of cave is relatively young dated. Diving inside was tried just in 1976, but it was not mentioned as a cave until 1999. From that time, Morské Oko belongs among few of most interesting and most protected caves in Slovakia. Enter to cave was built as a small building with pontoon terrace, where the water table is easily accesible from.

The subterranian life is rich here as well. There live the rare small crustacean inside, which need temperate water for life. Water temperature in site is about 17 °C.

Ochtinská Aragonite Cave

Geomorphological unit: Revúca Hills
Length: 585 m
Elevation span: 30 m

Aragonite gem of the World Heritage. The cave represents a unique natural phenomenon drawing attention by the richness and variety of aragonite fill, as well as an interesting evolution and development of cave spaces.

Iron flowers of aragonite in the Ochtinská Aragonite Cave. Photo: M. Rengevič

It is formed in a lens of Palaeozoic Devonian crystalline limestones situated amidst non-karst rocks – phyllites. The entrance adit opens to cave spaces at 642 m above the sea level. Wedge upwards narrowing passages and halls were formed by corrosive activities of rainfall waters, which percolated along the distinct tectonic faults. Different shape have mainly horizontal passages and halls, which are located between tectonic faults. These originated mostly by corrosive activity of slowly flowing water in consequence of mixing waters of various temperatures and chemical composition, which is obvious by plentiful irregular niches and ceiling cupolas.

Three generations of aragonite were determined in the cave. It is formed from water solutions with high content of Mg-, Fe- a Mn-ions under conditions of stabile microclimate. The oldest are milky translucent kidney-shaped formation and their corroded relics (dated age of 121 – 138 thousand years) with partially recrystalized aragonite, in places metamorphosed to calcite. The second generation of aragonite prevails and occurs mostly in the form of several cm long needles and spiral helictites (dated age of 14 thousand years). These form cluster or dentritic formations (including so called cave flower or anthodite), which are most attractive for visitors. Aragonite of the second generation is still growing, by which it maintains the white colour and clean appearance. The youngest, contemporary generation of aragonite forms tiny fans with diameter of 2 – 4 mm (sometimes even more), sporadically creating miniature helictites with length not overlapping 40 mm.

Air temperature in the cave is between 7.2 and 7.8 °C, relative humidity between 92 and 97 %. Stabilizing of the cave microclimate is caused by ochres that contain 47 – 56 volume percent of water and they are able to absorb and release water vapour.

The cave was discovered by chance by M. Cangár and J. Prošek, the employees of the East-Slovakian Ore Survey in Jelšava, while drilling the geological survey Kapusta Adit in 1954. Cave development works for opening to the public started in 1966 by thirling the access adit 145 m long, which enabled opening the cave to the public in 1972. The length of accessible part is 230 m.

Parenica Cave
Geomorphological unit: Štiavnické vrchy Mts.
Length: 12 m
Elevation span: 5 m

Cave of healing water in the Sklené Teplice Spa.

The healing water with a temperature of 42 °C and high Ca- and Mg-content comes from few thermal springs to the pool inside a cave. High temperature of water as well as the cave interior arrangement connect the effects of bath and sauna together. For healing treatment is used a natural hypotonic mineral water without any chemical additives, having a hydratation effect on skin. The water of pool is completely changed in every day cycles, while new volume of water spill in during the night.

Parenica Cave. Photo: M. Rengevič

Važecká Cave

Geomorphological unit: Low Tatras Mts.
Length: 530 m
Elevation span: 25 m

Underground treasury of the Upper Liptov. The Važecká Cave is one of the most known caves in the northern Slovakia. Though by length it belongs among the short show caves, it is known by occurrence of rich dripstone decoration, remarkable findings of cave bear bones, as well as by rare cave fauna.

Važecká Cave. Photo: M. Rengevič

It is formed in the Middle Triasic dark-grey Gutenstein Limestones by ancient ponor waters of the Biely Váh River side branch. Original river modelled passages are in several places reshaped by collapses, mainly along the interbed limestone surfaces.

Underground spaces are decorated mostly by stalactites, stalagmites and flowstone pools. A large part of the cave is filled with fine-grained sediments from floods of the Biely Váh River and perhaps also from waters of the ponor water flow in half-blind valley in Priepadlá. Air temperatures range between 6.5 and 7.1 °C, relative humidity between 94 and 96 %. Entrance parts are influenced by climatic changes on surface during the year, which are demonstrated by frost weathering of limestones.

The cave represents an important palaeontological finding place of cave bear bones (*Ursus spelaeus*). From among cave invertebrates, the finding of *Eukoenenia spelaea* is remarkable and unique and means the northernmost occurrence of a representative of this order of palpigrades, by what the Važecká Cave ranks among the biospeleological localities of the European importance. Sporadical occurrence of several bat species was recorded in the cave.

The entrance hall was known to local people since long time ago. The continuation of cave spaces was discovered by O. A. Húska and A. Somr in 1922. Thanks to F. Havránek, who rented the cave from the Važec landowners and provisionally opened it to the public as early as 1928. The official assessment permiting opening the cave for public is from 1934. Further spaces were discovered in 1952, 1962 – 1963 and 1988 – 1989. After the reconstruction of show path and installation of electric lighting is the cave in operation since 1954. Public has access to 235 m of path.

Zlá diera Cave

Geomorphological unit: Bachureň Mts.
Length: 314 m
Elevation span: 20 m

Small, but interesting cave under the Bachureň Mts., Eastern Slovakia.

The cave was created in dark limestones and dolomites of Middle and Upper Triassic along the fissures and bedding planes of rocks by penetrating and ponor water. The cave consists of one great dome-space with round shape in groundplan, 35 m in diameter, 11 m high, with small tributary

Zlá diera Cave. Photo: E. Némethy

branches. The most extensive part of side branches represents the Labyrinth. The cave spaces are situated cca 200 m above recent surface flows, but in the past here was mentioned an underground stream. Today only one small pool occurs inside the cave, however, finding of small crustacean *Niphargus* sp. could be an indication of cave stream in the past.

The history of cave reaches to the time of immemorial; local people visited the cave in Middle-Age, what prove the artefacts or local legends. In the literature mentioned about the cave E. T. Krieger in 1841. First plan of cave drew S. Roth in 1884. Cave was used by local people during the Slovak National Uprising at the end of World War II. Opening for visitors by tourist way started in 2005.

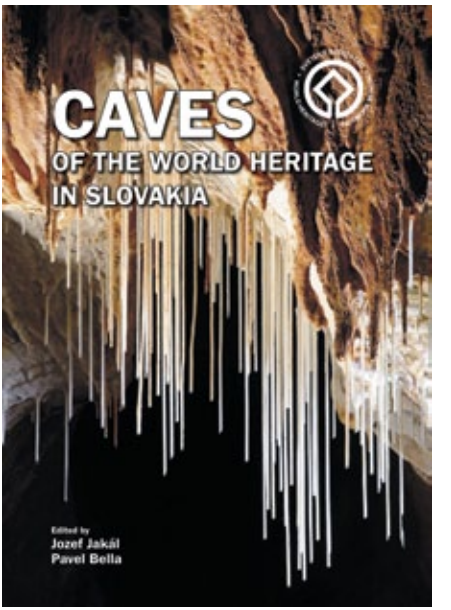
Other 30 caves are open for the tourists, since their location is close to the marked tourist paths and they represent for example a shelter for tourists during the rain or a public educational sites in Slovakia: Svoradova Cave, Šarkania diera, Čertova pec, Elektrárenská Cave, Hučivá diera, Kamenné mlieko, Mažarná Cave, Wesselényiho Cave, Malá Driencanská Cave, Mučínska Cave, Netopieria Cave, Jaskyňa v Skalke, Jaskyňa v Čube, Komín, Šarkanova diera, Babirátka Cave, Brloh, Brložná diera, Čerešňová Cave, Hradná Cave, Košútova Cave, Hájska Cave, Žernovská Cave, Cave pod Jeleňom, Cave nad cestou, Veľká pec, Deravá skala, Malá and Veľká Dolnosokolská caves, Pružinská Dúpna Cave.

All the caves of Slovakia are protected by Law; entrance to them is strictly prohibited. All of them as a part of the natural heritage of the Slovak Republic were by the act of the NC of SR No. 287/1994 On Nature and Landscape Protection enacted natural monuments. The most important ones are declared by the Ministry of the Environment the national nature monuments. The most important sites of national importance are National Natural Monuments. List of the NNM consists of 44 caves: Čachtická Cave, Driny Cave in Western Slovakia, Aksamitka, Belianska Cave, Bobačka Cave, Brestovská Cave, Bystrianska Cave, Demänovské Caves, Dobšinská Ľadová Cave, Harmanecká Cave, Mŕtvych netopierov Cave, Zlomiská Cave, Javorinka Cave, Liskovská Cave, Okno Cave, Perlová Cave, Podbanište Cave, Prepoštská Cave, Stanišovská Cave, Starý hrad Cave, Stratenská Cave, Štefanová Cave, Važecká Cave, Veľká Ľadová Priepasť Abyss, Západná Cave, Jaskyňa v Záskočí Cave in Central Slovakia and Ardovská Cave, Brázda Cave, Diviačia Abyss, Drienovská Cave, Gombasecká Cave, Hrušovská Cave, Jasovská Cave, Krásnohorská Cave, Kunia Abyss, Medvedia Cave, Milada Cave, Obrovská Abyss, Ochtinská Aragonite Cave, Silická Ľadnica Cave, Skalistý Potok Cave, Snežná Diera Cave and Zvonivá Jama Cave in Eastern Slovakia.

Slovakia has gradually included 13 most important wetlands on the List of Internationally Important Wetlands within the commitment of the Ramsar Convention on Wetlands, ratified by the Slovak Republic in 1990. One of them is the Domica, Ramsar Site, which was included on the list in 2001 as the 12th Ramsar site in Slovakia. The second underground wetland included on list of Ramsar in 2006 are the Caves of the Demänová Valley. Both caves are open for the public.

Caves of the World Natural Heritage in Slovakia: a late brief review of engaging book*

Lukáš Vlček



Let's start with some important facts: The caves of the Slovak and Aggtelek Karst were inscribed on the World Natural and Cultural Heritage list of the UNESCO on the basis of a bilaterally nominated Slovak-Hungarian project in 1995, which was approved by the World Heritage Committee in Berlin on December 4 – 9, 1995. This project was extended by the Dobšinská Ľadová Cave in 2000 and approved on the Committee session in Cairns during November 27 – December 2, 2000. The caves of the Slovak Karst now represent the only natural phenomenon inscribed on this list. They present an exceptional example of ongoing geological processes and significant geomorphic features. The representativeness and exceptionality of underground karst forms of the Slovak and Aggtelek Karst resides in the following facts:

i. Genetic and morphological diversity of caves

The area has many kinds of genetic and morphological types of caves in a relative closeness. The most frequent are the river (so called fluviokarst) caves, flown through by water courses at present or in the past, having usually the signs of river modelling and corrosion (e.g. ceiling channels and scallops in Domica and Gombasecká Cave) as well as corrosive spaces formed by chemical solution of limestone by percolation or stagnant karst waters (e.g. abysses Zvonivá jama, Malá and Veľká Žomboj, Malá and Veľká Bikfa, Brázda, Obrovská priepasť), caves with vertical corrosion walls and planated ceilings, corrosion cupolas, inclined side walls (Ochtinská Aragonite Cave). Distinct fault passages (Krásnohorská Cave) or crevasse spaces (Čertova diera, Snežná diera) are not so frequent.

ii. Variability of flowstone fill in caves

There are not many karst areas with so many representative types of dripstone decoration as the Slovak Karst. Soda straws in the Gombasecká Cave reaching as much as 3 m are unique. World known are flowstone shields and drums in the Domica Cave as well as the aragonite crystals in the Ochtinská Aragonite Cave. Except for them, there are many shapes of stalactites (including rarer spheric ones in Domica), stalagmites (pagoda type in Domica, mighty pagodas in Zvonivá jama, stick stalagmites in the Ardovská Cave, palm one in Domica), columns (32 m high dripstone in the Krásnohorská Cave), flowstone curtains (Milada, Domica), coatings, pea forms (Brázda Abyss), flowstone cascades (Domica), lacustrine forms (Diviačia Abyss), moonmilk (Gombasecká Cave, Šingliarka Abyss) and eccentric shapes (Hrušovská Cave). Two caves with permanent ice fill are integrated: Dobšinská Ľadová Cave, with 110,132 m^3 of ice and Silická ľadnica, with elevation of 503 m as the lowest one in the temperate climatic zone. Ice fill occurs also in the Snežná jama Cave.

iii. Exceptional density of representative types of caves in the temperate climatic zone

The karst phenomena are connected with more than 1,000 caves concentrated within the area of about 400 square km. Another 200 square km are on the Hungarian side. Such a density

*The article was written using and thanks to the data from the State Nature Conservancy of the Slovak Republic – Slovak Caves Administration, Liptovský Mikuláš.

connected with high representativeness does not occur on other part of the temperate climatic zone.

iv. Occurrence of rare underground animals and archaeological findings

The numerous karst cavities together with favourable climatic conditions determined also the variety of underground animals, especially invertebrates. Since the environment of troglobitic (or cavernicolous) animals is limited by space, many endemic species known only from this place evolved here. Such is the tiny crustacean (*Niphargus aggtelekiensis*), pseudoscorpion *Neobisium slovacum* or small beetles *Duvalius szilicensis* and *Duvalius bokori*. Ardovská and Domica Cave have invertebras like palpigrade *Eukoenenia spelaea* or multipede *Typhloiulus* sp.

A valuable group of cave animals are bats. Important wintering places include the caves Domica (mainly *Rhinolophus ferrumequinum*, *R. hipposideros*, *R. euryale* and *Myotis emarginatus*), Jasovská Cave, Drienovská Cave, Čertova diera, Dobšinská Ľadová Cave (mainly rare *Myotis mystacinus/brandtii*) and others. The caves offer habitats for more than 500 species of genuine cave animals (troglobites). On February 2, 2001 – the Domica Cave was included into the Ramsar list as internationally important wetland of underground karst waters.

Caves representing the development of several cultures are known from the territory of the Slovak and Aggtelek Karst. Especially valuable are the traces of human activities of the Bükk-Mountain Culture in Domica (with preserved potter workshop, traces after mining the clay, imprint of fabric, findings of pottery, bone needle and many other artefacts and cave drawings), in the Ardovská Cave and in the Silická ľadnica Cave. Especially worthful are preserved cult masks made of human skull of the Kyjatice Culture found in the Majda-Hraškova Cave and Babská diera Cave. Many objects were found in other caves coming from the Iron Age, Halstadt Age or from the Middle Ages. Very valuable is also the historical Hussite inscription on the wall in the Jasovská Cave.

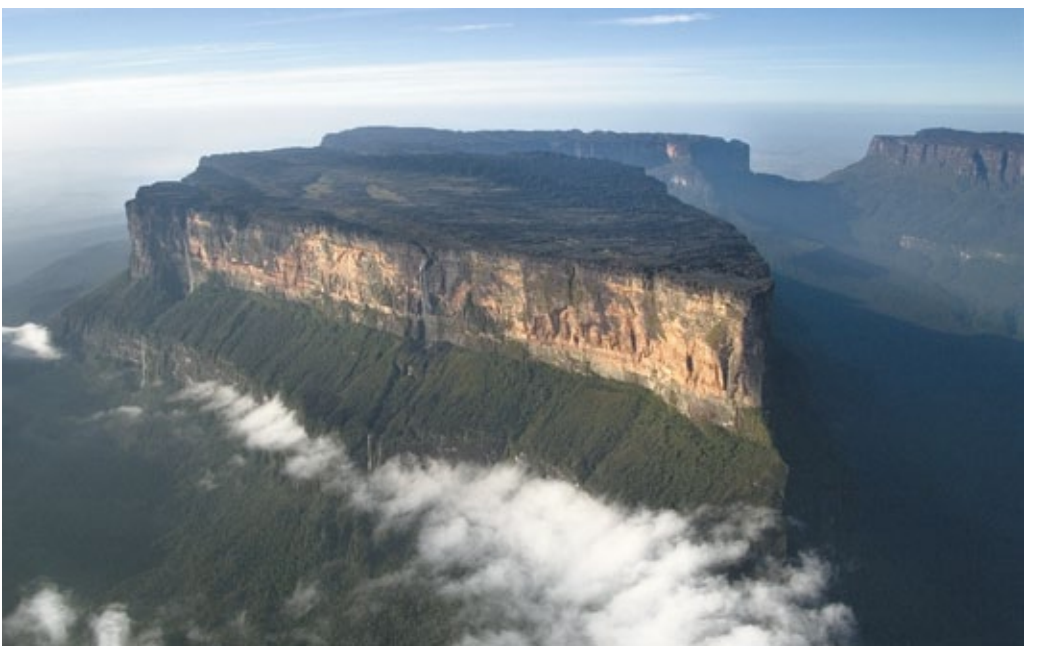
This was only brief review of facts about the caves of the World Heritage in Slovakia. For everyone who would like to know more about this topic, one useful solution available is on hand? Shortly after inscription of caves into the list one interesting book was compiled: Jozef Jakál et al., 2005: Jaskyne svetového dedičstva na Slovensku, 160 pages, edited by the Slovak Caves Administration. The book was consequently translated and with small complements printed also in English version. The book Caves of World Natural Heritage (2009) represents the most representative, complex and concise book about the caves of Slovakia edited in foreign language. By their popular-educational character and almost encyclopedic procesing and accessibility for wide spectrum of readers and simultaneously with preservation of high scientific level of informations inside the text, the book represents an usefull aid for readers with deep interests to the nature, their beauty and treasures. At the same time it brings also knowledge with general information and they are focused not only to the caves of the Slovak Karst area and Dobšinská Ľadová Cave as a parts of World Natural Heritage. The authors led by Dr. Jakál evaluate the whole Slovakia as the land of karst and caves. They refer about the landscape of the Slovak Karst National Park, about karst water, they characterize the caves and cave systems here, their clima, dripstone, aragonite and ice fill. Chapters about speleoarcheology and subterranean biology follow. Chapters about history of cave exploration (predominantly by voluntary cavers, members of the Slovak Speleological Society), about the most important caves and abysses of World Nature Heritage and about the karst and cave protection close the book. The attractivity of book is caused also by more than 300 pictures – schemes and photographies. It could be usefull as learning book for cavers and members of organizations focused on the nature protection as well. The creation of this book represents an important step in Slovak speleology, not only because from the printing of Practical Speleology (in Slovak language only) passed more than two decades, but also because this book introduces Slovak karst, caves and speleology to the wider English reading public and cavers from abroad.

EXPLORATION ABROAD

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

Lukáš Vlček – Branislav Šmída – Zoltán Ágh – Erik Kapucian – Marcel Griflík – Marián Majerčák – Viliam Guľa – Jaroslav Stankovič – Peter Medzihradský – Jozef Ondruška – Peter Masarovič – Pavol Barabáš – Zdenko Hochmuth – Ján Pavlík – Roman Aubrecht – Tomáš Lánczos – Ján Schlőgl – Tomáš Derka
Several speleoclubs of the Slovak Speleological Society – SSS
& Grupo Espeleologico de Sociedad Venezolana de Ciencias Naturales – GESVCN

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.

**Acknowledgements. The scientific research of Slovak cavers was partially supported by APVV grants No. 0251-07 and 0213-10 and VEGA grants No. 1/0246/08 and 1/0268/10.

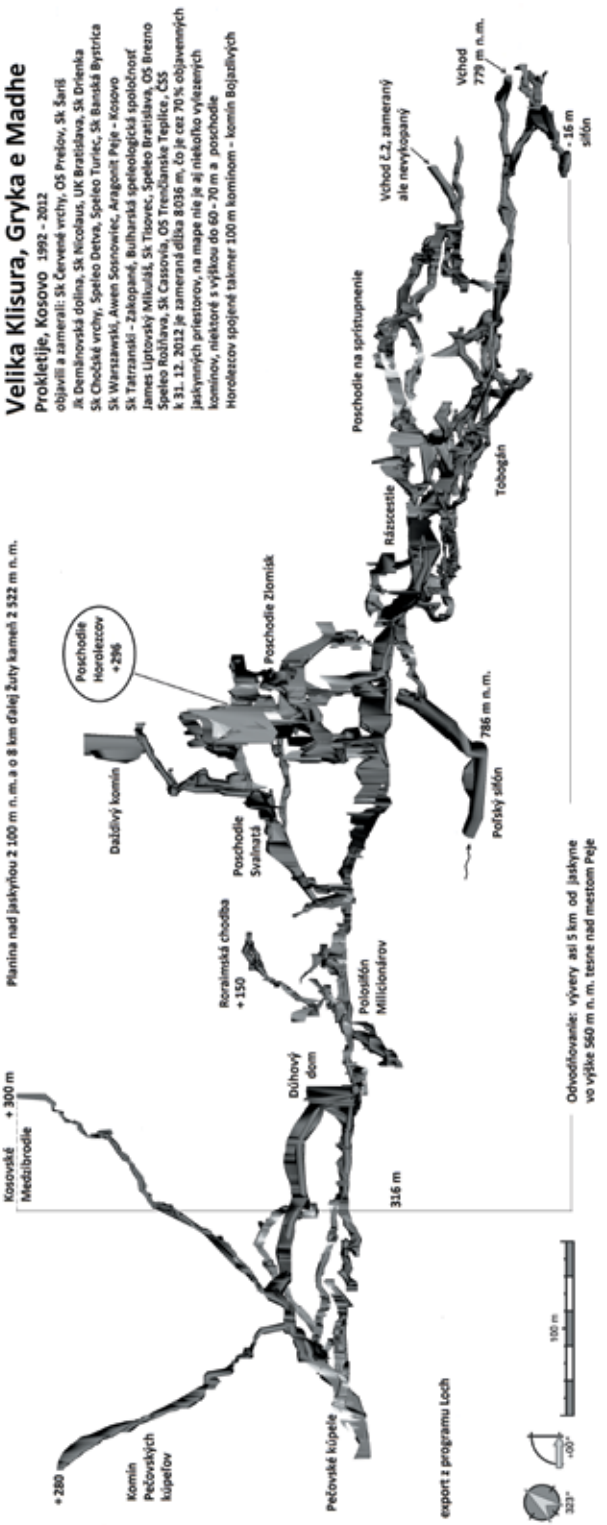
Exploration activities of Speleological Club Červené Vrchy Slovakia at home and in abroad

Ján Šmoll
Speleological Club Červené Vrchy Slovakia

The beginning of activities of speleoclubs's activities took place in 1986 and 1987, when we tried to pass through Wielka Sniezna Cave in polish Tatras Mts. and during the summer we descent to the Ptasia Studnia in Tatras. In 1988 we realized exploration in the Zadný Úplaz Cave in Červené vrchy ridge of Tatras Mts. including 3 days bivouac inside. In 1989 we started working activities in caves of Zadný Úplaz, when the cave falling down was broken and reinforced with wooden beams. Then, in 1990 we discovered Shaft SPS inside and after discovery we decided to establish a new speleoclub within the Slovak Speleological Society. As the leader of club was elected Ján Šmoll. Besides him there were other 28 cavers active in the club, nowadays it has 5 full-members. Not numerous, but enormously active guys :) The activity and discoveries intensity depends on help of friends cavers from other clubs of the SSS too.

Červené vrchy Mts.: marks show the most important cave sites of area. Photo: J. Šmoll

Speleological activities in Slovak mountains started by overpassing the 65 m long and 30 m deep breakdown in Zadný Úplaz Cave with total depth of 164 metres: cave survey, documentation, reinforcing, climbing five chimneys followed; total number of actions: 55. In following we discovered Nová Kresanica Cave, –190 m deep, survey, documentation, overpassing of breakdowns, reinforcing, widening of narrow passages, cave bivouac building and excavation at the end. In Vyšná Kresanica Cave we reached depth of –45 m.



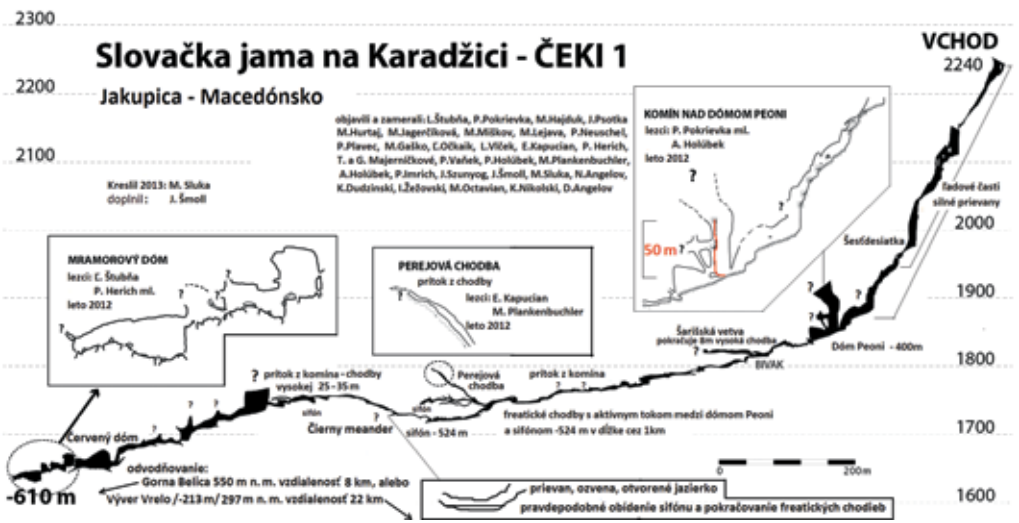
Excavation in Medvedia Cave, KR11, probe under Temniak and Lyžicový doline in Tatras Mts. In 2001 we pumped the sump in Občasná Vyvieračka for four days; seven days lasting pumping action we realized in 2002 and then we discovered Piu Cave in Goričkova massif. In addition excavation works were realised as well in Ľaliové sedlo pass and in –249 m deep Polish cave Studnia v Kazalnicy and other caves of northern part of Tatras Mts., where were directed tens of surface surveys too. We realized more than 250 actions during last 20 years in Červené vrchy Mts., but we were exploring on other localities of Liptov region too. For example, in the Demänovská Valley we explored, documented and climbed chimneys in the Cave of Peace, discovered Nová Jaskyňa pod Baštou Cave, 115 m long; Jaskyňa pod Stodôlkou Cave, 180 m long; Jaskyňa pri kamennej chate Cave, 500 m long; Demänovská Medvedia Cave, 1,550 m long and now interconnected with Demänová Cave System. New discovered passages were in Okno Cave, cca 1,600 metres; in Chrám Slobody Cave, 200 m, and excavations were realized on some places too.

Another localities of interest were explored within Slovak mountains: probes in Salatín massif of Low Tatras Mts., in karst area between Východná and Podbanské villages near Slovak national mountain Kriváň, in Jánska Valley: Jaskyňa Zlomísk Cave and help with works of cavers on Krak's Mt., Low Tatras Mts. We explored caves in Malá and Veľká Fatra Mts.: for example Perlová Cave. Exploration in massifs of Široká Mt., help in Jaskyňa pod Úplazom and Javorinka caves in High Tatras Mts. and in Belianske and Western Tatras Mts. – massifs of Babky and Sivý vrch Mt. We climbed

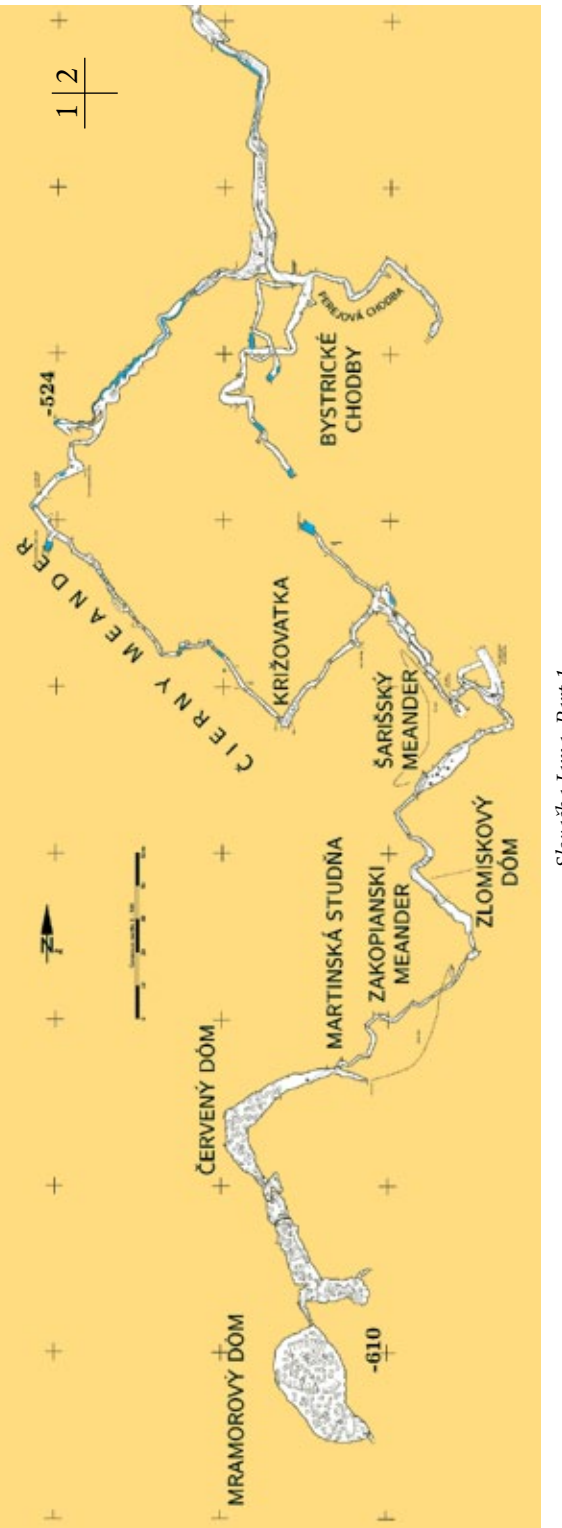
chimneys in Cave of dead Bats and digged in Prosiecka Cave in Chočské vrchy Mts. In 1983 – 2000 few members were active in the Mountain rescue team.

Speleological activities in abroad were organized in cooperation with other clubs of SSS: for example Chočské vrchy, Drienka, Nicolaus, Šariš, Demänovská Dolina, Bratislava, Detva, Comenius University Speleoclub, Tisovec and others. In 1990 was realized our first exploration in Monte Canin area on Italy/Slovenian border and already in 1991 we discovered caves Liptovská No. 1 and 2, later known as CEKI 2. In 1992 we discovered entrance to the Velika Klisura Cave (Gryka e Madhe) in Kosovo and explored for the first time the Jakupica Mts. We walked trough Polar Ural Mts. in Russia. In 1993 we passed Wielka Sniezna Cave, Poland and some caves of salt-karst of Ukraine; in 1994 we documented Daján Derchén Aguj Cave in northern Mongolia and in 1995 we returned to Kosovo again. There was discovered a great cave, which exploration took time of few years: 1996, 1997, 2002 and later. In 2003, during exploration

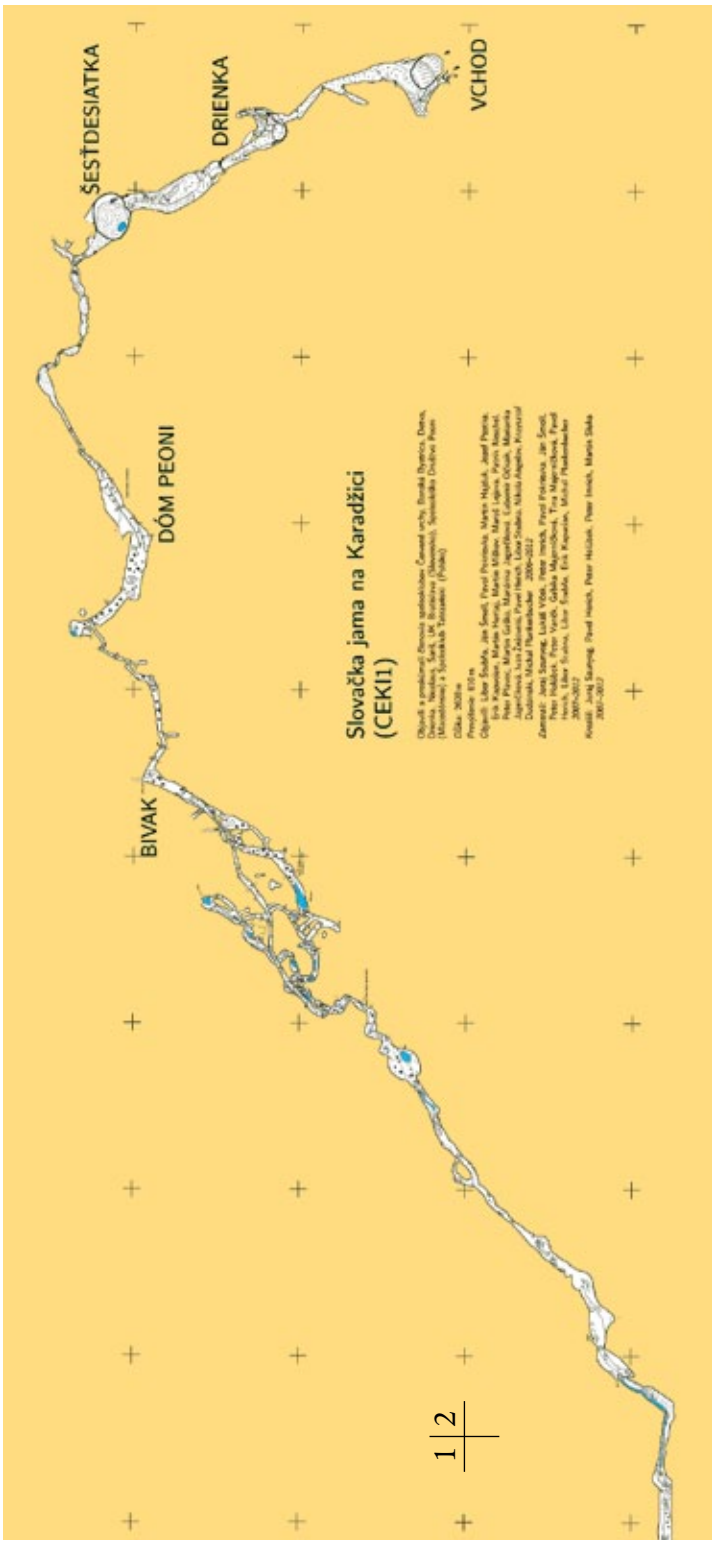
Velika Klisura Cave. Photo: M. Audy



on the plateau above the Velika Klisura Canyon and homonymous cave, we discovered 70 m deep Snow Shaft, 1.1 km vertical distant from this site. In 2004 has began new survey of cave and new start of exploration of Jakupica Mts. above Skopje, Macedonia. 2005 was a year of discovery of Solunska Jama, –277 m in Jakupica and other big abysses there. In 2006 was explored the karstic mountain of Idhembelit, Albania; some caves were discovered also in ponor zone of Skadar Lake: the most important is Zaver Cave, which sinks the main mass of ponor waters from Skadar Lake, flow out in 280 m deep karstic Ochrid Lake in Macedonia above the more than 2200 m a.s.l. high Galičica Mts. In Jakupica we focused on Karadžica massif with Abyss No.11, later known as Slovačka jama. In this year we descended into depth of 200 m. In 2007 caves Shpanik and Small Shpanik in Valbona Valley in so-called Albanian Alps (Prokletje) were discovered and explored; and we returned to the Slovačka jama in Macedonia too. 2008 was the year rich on discoveries: small caves in Shpanik catchment area, Albania; Velika Klisura and Sušica Canyon exploration; Slovačka jama was deepened to –524 m with extensive continuation. This discovery shows the huge caving potential in Jakupica Mts., as one of the most important karstic areas of Balkans. In 2009 we were back in Kosovo: in Velika Klisura we thought about opening the cave for tourists. Until today, here were climbed up more than 1.4 km of chimneys to the hight of +320 meters. The chimney of Medzibrodie is still continuing, it has air draft and water supply and potential till the plateau surface 1 to 1.2 km vertically. The Radavc Cave in the resurgence zone of Beli Drin river was explored and surveyed – this more than 1 km long cave belongs to the system of one of the biggest resurgences in Balkans. After 2011 the Slovačka jama in Karadžica plateau, Macedonia reached –610 metres and it is



Slovačka Jama, Part 1



Slovačka Jama, Part 2

the deepest cave of Macedonia. The potential of further discoveries here is really great: it gives tens of kilometres of underground passages till the resurgences in Matka dam and Gorna Belica, where speleodivers worked simultaneously.

In Balkans we caved in Velebit Mts. too. Already in 1993 we explored Lednica S.U.K. To the depth of –432 m. Not only Balkans, but also other continents of Earth were interesting for us: for example expedition to the Toca da Boa Vista Cave was realized in 1997, where we were helpful by discovery and survey of 11 km of passages of cave, which reached the length of 91 km and it represents the longest cave of southern hemisphere. During 1996 – 2007 we learned about the European karstic landscapes using tens of bicycle trips pointed to Bulgaria, Romania, Albania, Monte Negro, Kosovo and Macedonia.

Besides the speleological activities we pursue to climbing and ski-touring in high-mountains all-around the world: mountain ranges in Romania, Norway, Italy, Austria, Switzerland, but also mountains of Ural, Pamir, Ťan-šan or Caucassus.

Cave diving in Mexico

Karol Kýška and Dan Hutňan
Speleodiver

The members of Slovak Speleological Society annually participate on expeditions into underwater caves at peninsula Yucatan in Mexico. This expeditions are followed through co-operation with the cave divers from the Czech Speleology Society.

Czech and Slovak cavers have been exploring at Yucatan from the year 2003, till now (December 2012) they found and surveyed 89 km caves, underwater caves and fewer dry caves.

Exploration is running in the area of village Chemuil. One of the most reached successes is the conjunction of systems K´oox ball and Tux ku paxa. The system K´oox ball with its length 73,400 m is charted between underwater caves at No. 4th (source QRSS). And it is on 1st place as underwater cave, which has a map.

This important discovery has been managed by the team of Dan Hutňan and Míra Manhart in autumn 2011. However this discovery pre-

Speleodivers exploring the K'oox Baal Cave System. Photo: R. Husák

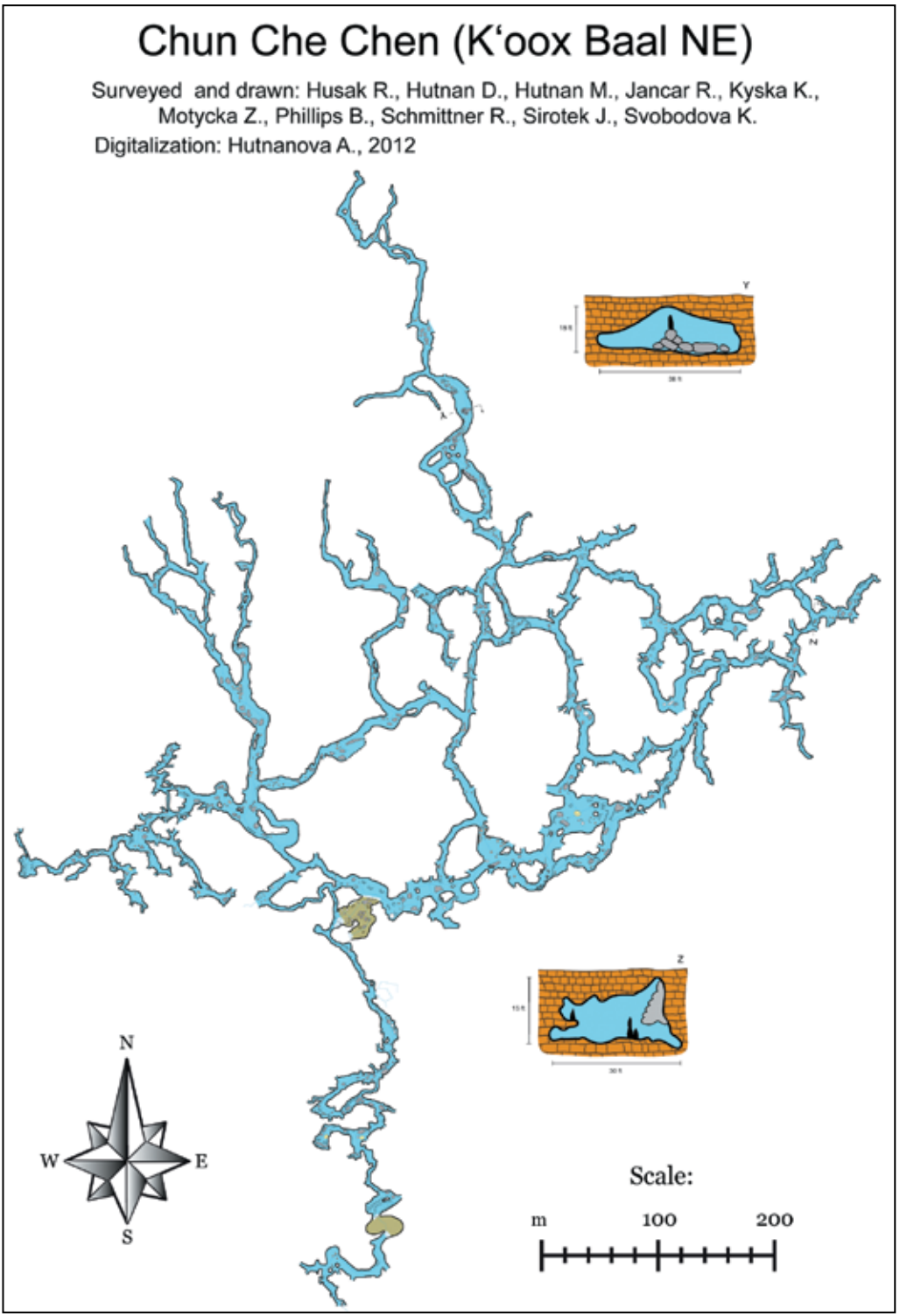
ceded many years´ standing exploration under the water and inside the jungle.

The members of Slovak Speleological Society belong to the leaders of exploration at Yucatan with these results.

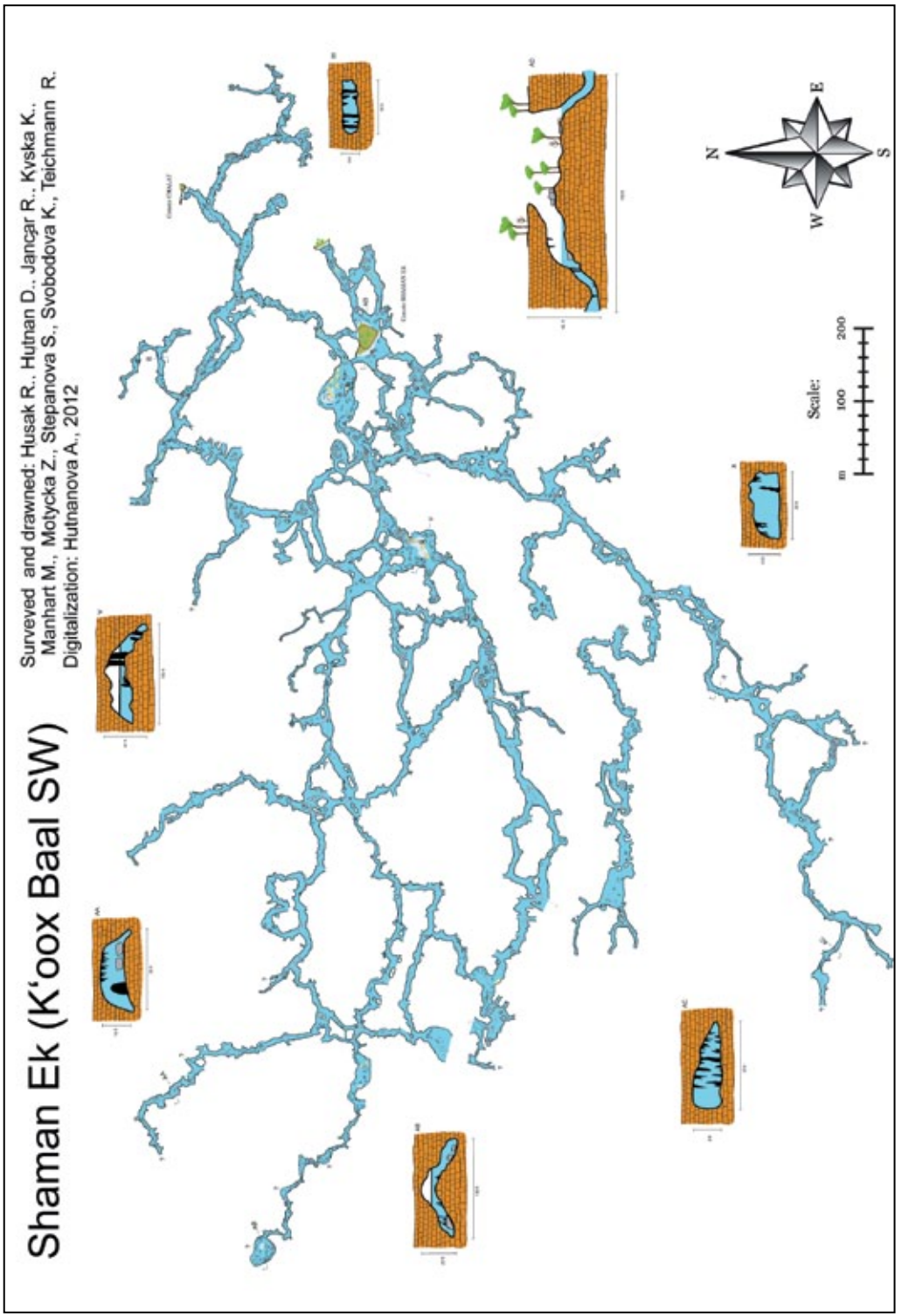
The members are: as cave divers Dan Hutňan, Michal Megela and Karol Kýška and as dry caver Zdenko Hochmuth.

Cenot Chun Che Chen.
Photo: R. Husák

Sistema K'oox Baal



K'oox Baal, part Chun Che Chen



K'oox Baal, part Shaman Ek

Sardegna 2012: Way under the valley

Dan Hutňan and Karol Kýška
Speleodiver

The weather in Cala Gonone is ideal. The sea is like oil. Four days ago when I brought a boat to Sardinia it looked horribly. Waves would certainly not allow us even to enter the cave portal where we were going to stay. The weather forecast for the whole week is very favourable. In the port we meet our local friends Mario and Fabio. Mario apologizes that he can´t help us to transport the gear with his boat. Two days ago his friend died in a motorcycle accident and they are going to say goodbye to him. Nevertheless he shows us which of the boats anchored in the sea we are to take and where we can find the key. We thank him but refuse. This year we will manage it with our own boat. We will carry our gear in three turns.

Transport in Ramo Sud – Grande Frana. Photo: K. Kýška

We set up the camp as usually in the Blond Lady´s Hall. Immediately we start to transport a part of the material to the end of the Southern Branch of Bue Marino, which is the goal of this year expedition and we are going to try to follow the last year success. We gradually transport the material for six divers to the three and a half kilometres distant Terminale siphon. Altogether over 1,000 metres of swimming in lakes, overcoming of sand dunes, lapies pools and boulders. On 6 October each of us goes this route twice. Tomorrow is the day D. In the morning still one transport team has to carry the heavy underwater scooters.

On 7 October at noon the first exploration pair is prepared to go behind the 630 metres long and 30 metres deep Terminale siphon. My and Karol´s task is to arrange the guide line so that it would be visible. As ever also this year a part of it will be under new deposits of sediments. We are able to pull it out from sand and mud rather quickly at full speed of the scooter. Some tens of minutes after the first pair also two other "trains" of divers get across the siphon. Mahony takes Martin clinging on him and Radek Teichman has Ondra holding the strap between his legs. Three scooters significantly speeded up the transfer through the siphon but mainly saved a lot of air necessary for another diving behind the siphon.

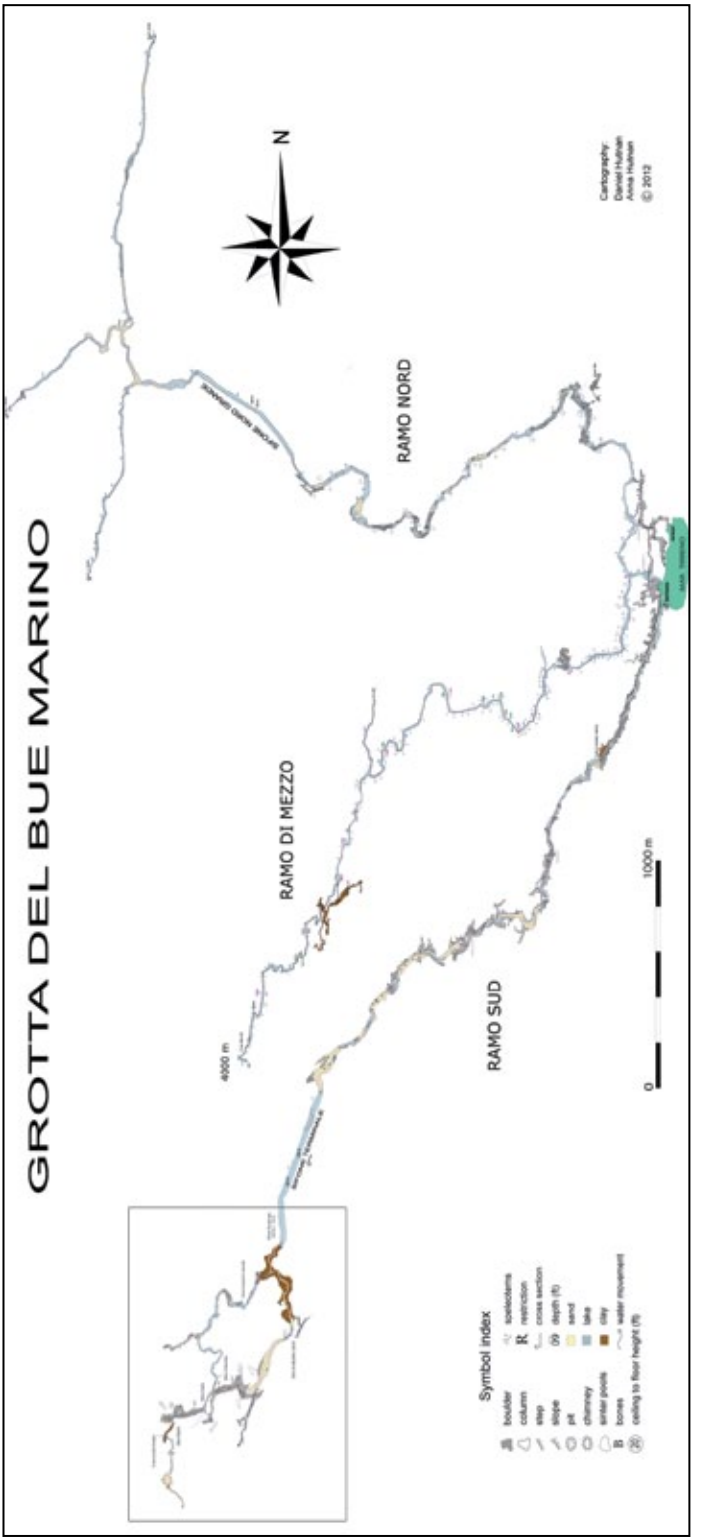
Three pairs – three goals. Radek and Ondra will try their luck in two small pools in a branch before the Smelly Eel siphon. It was discovered during the mapping last year. Radek swims 25 metres through a small southern siphon behind the Smelly Eel and emerges in the well-known area. The northern one will be more interesting. After submerging here he eventually proceeded thirty metres. The space is small and there is no place to fasten the guide line. Sludge released during the progress catches the divers very quickly. It has no sense to continue in zero visibility. Radek turns back. We will have to return to this place some other time.

Mahony´s and Martin´s task is to carry two diving cylinders to the very end of Ramo Sud and submerge in the siphon S4 we named the French Two. It is at the edge of the Codula di Luna valley. According to the old records about the Le Guen´s submerge from 1982 the Frenchman swam here 20 metres far and into the depth of eight metres. We suppose that the diver was stopped by an impassable caving-in, which can be therefore reasonably expected. However we have to check it. The path to the end of the Southern branch leads around the Betrayal siphon. There is a complicated maze of turns drawn in the map only as a memory sketch. Mahony and Martin have already been here once but even after one hour of going the wrong way with cylinders on their backs they can´t find the correct shortcut around the Betrayal siphon into the final parts of Ramo Sud. They believe that the passage they are looking for changed after rainstorms and is closed. They turn back.

Karol and me were the first to get behind the Terminale siphon and we immediately set off to the next route. Unlike the remaining divers who used 2 × 7 l cylinder and one twelve-litre stage bottle for crossing the long Terminale siphon each of us drags an additional seven-litre bottle. We will have to dive a lot until we get to our today´s target. At first we have to carry the twins on the back and the seven-litre bottles hanging on our sides to the 300 metres distant Hasenmayer´s Question Mark siphon. Mud, sand, stone blocks of the size of a truck. One false step would in the best case end in a broken leg. We are dripping with sweat. The entrance lake of the siphon with its fourteen-degree water is our salvation. We get through the three shallow 50 – 100 metre long siphons without any problems. The dry sections between them are worse. Each of them begins and ends by a steep sandy slope. It´s not so bad going down. However when climbing up we tread in one place until the foot holds. After five hundred metres we are in the hall where years ago we noticed an evident branch. At last we get rid of the additional bottles which were to serve for saving air in the backpack cylinders for new discoveries. There are still 60 metres through the dry section before us and we are near the siphon where until now no human flipper stepped. Nothing small. Ten metres of width, two to five metres of height. It is clearly the main drainage collector! The passage is wonderfully washed out, with sand and gravel on the bottom. After thirty metres the siphon ends and a dry passage follows above which ten metres high two enormous windows open into the upper floor. Another lake with a siphon appears before us. We swim again some tens of metres under water and then on the surface. There is a giant caving-in of stone blocks waiting on the side. We can climb it up to about ten metres. We can see several places through which it could be possible to crawl, however not in a wet suit. The edges of the rocks are razor sharp. This is a work for an equipped dry caver. It is important to make a map of the new discovery. On the way back Karol tries to climb into one of the windows between the siphons. However without a rope it won´t be possible.

All three pairs meet in the dry parts near the Terminale siphon and after some preparations they set out on the journey back through the giant flooded tunnel, in some places 30 metres wide. Thanks to using scooters we saved a lot of air. After swimming through we leave the full unused cylinders for three divers, one scooter and some small things near the siphon. We carry the remaining gear three and a half kilometres to the exit from the cave again. The group waiting for us in the base camp will have to go and fetch the things once more.

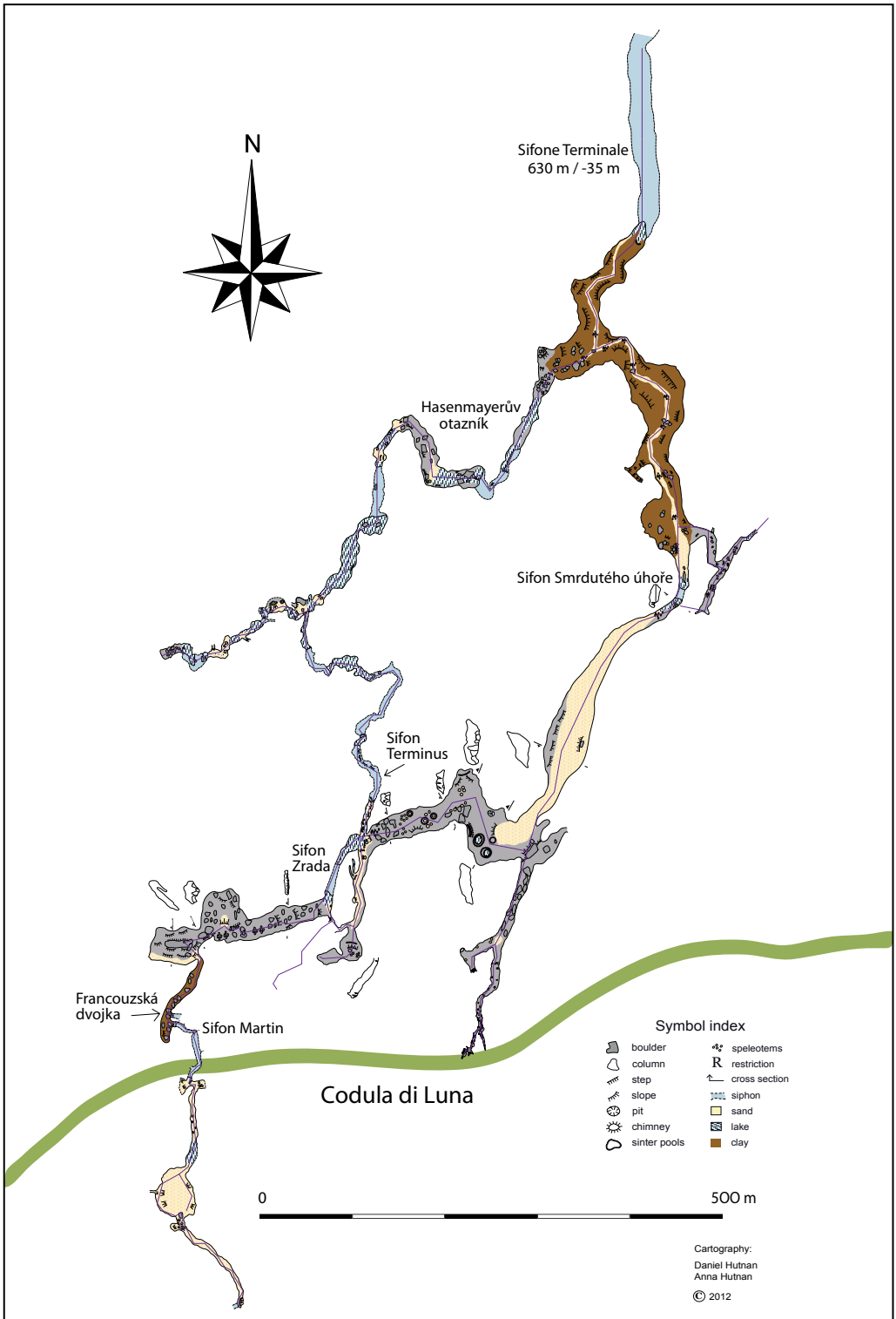
Afterwards we have two days for regeneration. We combine the diving in the Cala Luna cave with picking up mussels for a festive dinner. Bel Torrente is also a beautiful flooded cave and Radek shoots here Mahony´s troubles with the missing six kilograms of weights. He replaces them by the found stones which he gradually loses. We also manage to go and look at the seven-hundredth metre of Ramo Nord. We make a telephone call to Roberto Loru who leads the explorations in the Sue Molente cave to discuss the possibility to get the avalanche beacon Pieps to one of the turns in the Southern Branch of Bue Marino behind the Terminale siphon. Already in 2007 and 2010 we had a radio navigation system at this place. The distance from the cave to the surface in the side part of Codula di Luna found at that time was 23 metres. Meanwhile Roberto and his people found a small abyss which they deepened to 19 metres. It is important to verify



if they are digging in the correct direction. Though a dry entrance into the Southern Branch behind the Terminale siphon would not solve the problem with getting across the valley underground but it would enable a more detailed dry exploration of the cave in its remote parts. On Wednesday 10 October we plan to go behind the Terminale siphon again.

Karol who was supposed to be one of the three explorers going behind the siphon wakes up with pains in his back. At seven o´clock in the morning the transport team consisting of Michal, Tomáš and Barbora goes out with a scooter, stage bottles and freshly charged lights. Then at ten o´clock the exploration group including me, Mahony and Martin instead of Karol. Besides carrying the avalanche beacon to the agreed place in the cave we want to try again to find its end behind the French Two siphon at the very end of Ramo Sud.

We get through the Terminale siphon in 15 minutes. Afterwards also through the short Smelly Eel siphon. Mahony and Martin start the avalanche beacon in the turn by one hour sooner than agreed with Roberto. Meanwhile he goes down to the Codula di Luna valley to determine the direction but particularly the distance between the underground passage and the bottom of the found small abyss. After we have started Pieps we move on to the Betrayal siphon. I have been here already sev-


N
Sifone Terminale
630 m / -35 m
Hasenmayerův
otazník
Sifon Smrdutého úhoře
Sifon
Terminus
Sifon
Zrada
Francouzská
dvojka
Sifon Martin
Codula di Luna
Symbol index
boulder
column
step
slope
pit
chimney
sinter pools
speleotems
restriction
cross section
siphon
sand
lake
clay
0
500 m
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Anna Hutnan
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eral times here and I quickly spot the crack missed by the boys three days ago during their penetration. We bypass the Betrayal siphon on the dry path and then from it we start to measure the polygon up to the end of the cave. The mapping twenty years ago was made without an inclinometer and it is certainly necessary here. Crawling on all fours we get through the caving-in rising steeply up near the ceiling. Then a psycho-squeeze follows between boulders holding just "by word of honour" and then we find ourselves in the hall into which Jochen Hasenmayer got 34 years ago.

While Mahony and me finish the measuring of the polygon in the big hall, Martin with a twin on his back crawled to the final passage of Ramo Sud and arrived to the French Two siphon. Ten metres from the French siphon we find an unknown pool among the boulders. Though the access is worse the siphon looks well. We name it Martin´s siphon. After some preparations I submerge into it and goggle at wonderfully washed out spaces where it is possible to swim comfortably even with a twin on your back. After eighty metres the siphon ends in a pool 10 × 5 metres. I continue 330 metres through spacious dry passages and end in a narrower sinter passage with another siphon. It is time to survey the spaces. I suspect that we succeeded to achieve the first penetration under the Codula di Luna valley in history. The measured azimuths clearly prove it. The whole discovery is 400 metres long and leads to the South – perpendicularly to the valley. However I will be hundred percent sure only after entering all the measured values in the computer. After an hour and a half I emerge from the Martin´s siphon near the "frozen" friends. On our way back to the Terminale siphon we pack the avalanche beacon. As we found later Roberto measured the distance from the bottom of the abyss to the cave as eight metres. The transmitting Pieps was lying on the bottom of a three metres high hall, so the actual distance to be overcome from the surface is really small.

Codula di Luna. Photo: R. Husák

Our passage through the long Terminale siphon is hampered by Mahony´s scooter which is at its last gasp. It doesn´t matter though, air reserve is sufficient even if both scooters had had it. In another drive through the siphon we help ourselves by pulling each other. There are still the three and a half kilometres of dry transport to the camp ahead of us. On the way we meet other members of the expedition who went to fetch the remaining material. The whole operation took us ten and a half hours.

On Thursday from seven o´clock in the morning we are packing and in three drives we get the material from the cave to the port. After the transporters are loaded we have a meeting arranged with Leo Fancelle in Dorgali. We inform him about getting across Codula. Leo is thrilled. He calls to Roberto Lora and excitedly repeats: „Settanta chilometri, settanta chilometri!" Seventy kilometres. It is the expected length of the system which will be here if the connection of the Su Palu – Su Spiria, Carcaragone, Su Molente, Cala Luna and Bue Marino caves is successful. We have just made one of the basic steps to the birth of this longest system in Italy by the penetration under Codula...

Exploration of Drăcoaia Cave in Romania

Vladimír Papáč
Speleoclub Drienka

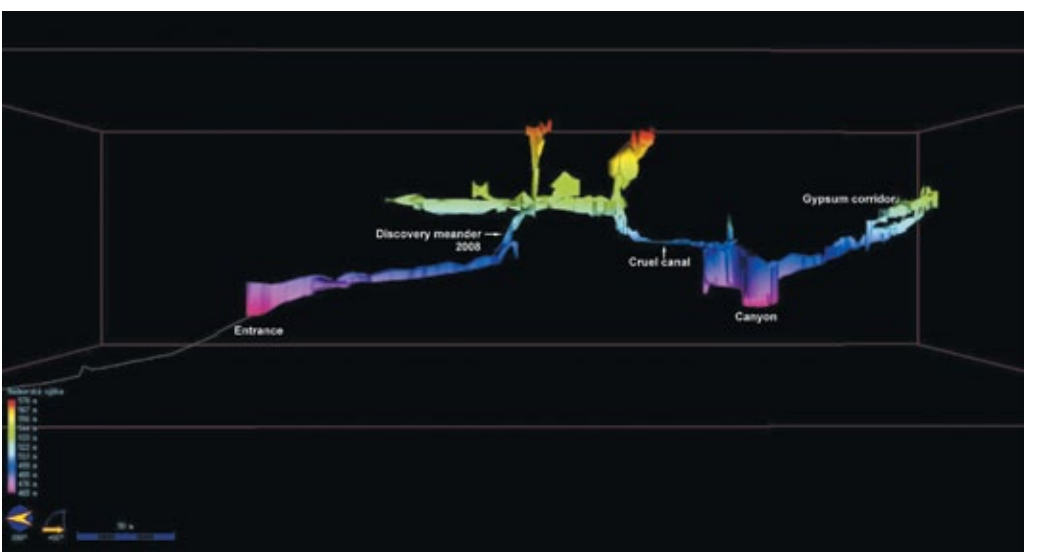
Sighiştel Valley (Apuseni Mountains) represents karst area with greatest density of caves in the country (Fig. 1). The area of about 15 km^2 contains 186 caves (following Cadastrul Pesterilor din Romania). Majority of caves are of fluvial origin and constitute fragments of cave systems. So far, cavers and researchers have discovered many interesting facts about the caves of the valley. For example, caves Magura and Drăcoaia are type locality of cave fauna (e.g. Gruia, 1971; Papáč & Kováč, in press) and Coliboaia Cave is an important archaeological site, in which have been recently found prehistoric carbon drawings of rhinoceros, bears and possible other animals (Ghemiş et al., 2011). In terms of other speleological survey is important hydrological research on karst valleys draining. Overlying Permian sedimentary rocks provide accumulation and runoff of rainwater to the karst area. There are several karst springs in the valley, but Blidaru spring near Drăcoaia Cave is the most significant. Hydrological tracer experiments carried out by Orăşeanu et al. (1991) proved hydrological connection of several ponors with Blidaru spring. Longest proved hydrological connection is between Avenul Dosu Muncelului (1,100 m a.s.l.) and Blidaru spring (435 m a.s.l.) – 665 m of denivelation and almost 4 km of air distance.

Fig. 1. Sighistel. Photo: V. Papáč

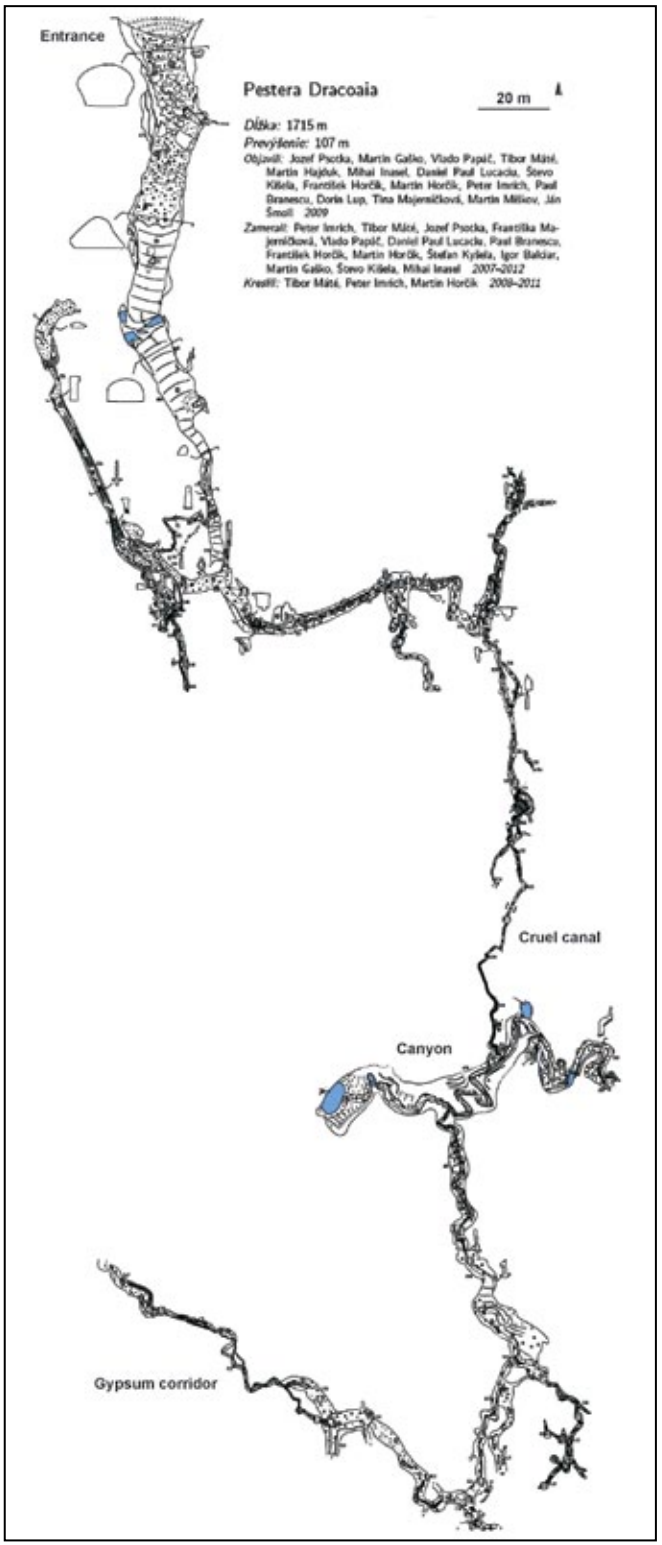
Fig. 2. Entrance. Photo: V. Papáč

Impressive entrance (Fig. 2) of Drăcoaia Cave (Devil´s cave) is well-known among the local people since long ago. In literature the cave was first mentioned by A. Schmidl (1863) in his book on the Bihor Mountains. Originally known cave forms a huge ascending corridor with a length of 200 m, finished with sinter overflows. It appeared that this was the end of the cave for long period. At the end of the cave under the sinter barrier we recognized in 2002 small fist-sized hole with intensive, roaring air draught. Cavers were aware of it but it was obvious that no one tried to dig there. Good quality of limestones, proper tectonic predisposition and fact that farthermost swallow hole is situated + 665 m of denivelation and almost 4 km of air distance from closely Blidaru spring give us a great chance to penetrate into the more extensive cave system. After days of digging in watered gravel we passed through

Fig. 3. Canyon. Photo: V. Papáč



Drăcoaia Cave side view. Prepared by P. Imrich



the strait and entered into the five meter tributary chimney with impassable narrow channel (Horčík & Papáč, 2002). In 2007 we continued to work there with driller and finally in September 2008 discovered more than 550 m of new corridors (Papáč & Psotka, 2008, 2009). Narrow ascending meander led us into horizontal corridors, with more options for exploration (parts *Echo*, two big chimneys, *Channel passage*). After exhausting all possibilities we hesitated for a while where to continue the exploration, but already in October 2009 was located lost air draught in a narrow meander at the bottom of *Column shaft*. We were convinced that short outflow meander filled with sand and gravel must continue. Digging here was more difficult, water still flooded the workplace and it was tiring to transport material and ourselves. During the digging, we had to use hand pump with 5 m long exit tube, which we pushed ahead. Water could drain because beyond a bend meander began to decline more. We overcame flooded place but we still had to get over severe narrowings. This 80 m long *Cruel canal* is the most difficult place in the cave, but finally in August 2010 leads to discovery of 600 m of new passages. Cave continued with huge active corridor called *Canyon* (Fig. 3). This 30 m high and 3 – 5 m wide passage is ended by siphon on both sides and ceiling parts are still being examined. In August 2011, as a result of climbing at the end of the significant tributary (Fig. 4), was discovered *Gypsum corridor* and

other parts with a total length of more than 300 m. After mapping was even recognized that *Gypsum corridor* heads beyond outflow siphon of *Canyon* and air drought was found there. In May 2012, we began to dig here and up to now forwarded 9 m. Currently, this place is the most perspective along with some untouched chimneys. At the end of 2012 Drăcoaia Cave reached the length 1715 m and vertical range 107 m. More than 200 metres still remain unmapped. In the period 2008 – 2012 was thus discovered in the Drăcoaia Cave almost 2 km of new corridors and it belongs to one of the longest caves in the Sighiştel Valley.

Expeditions participants: Martin Gaško, Vladimír Papáč, Jozef Psotka, Tibor Máté, Martin Miškov, František Horčík, Martin Horčík (Speleo Drienka), Peter Imrich, Františka Majerníčková, Martin Hajduk (Speleo Šariš), Igor Balciar (OSS Rimavská Sobota), Štefan Kyšela.

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Fig. 4. Gabi Hall. Photo: T. Máté


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