The new crystal caves in Hungary at Beremend and Nagyharsány

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Two crystal caves, extremely rich in formations, became known in the southernmost part of Hungary in the last decades.

On November 12, 1984, during an explosion, a 1 m cave mouth opened in the upper level 116 of the Beremend limestone quarry, on the NE front, at the foot of the wall, which led into a hall full of debris. It is a great result, that this cave did not share the fortune of its about two dozens fellows, which were demolished on the spot. The discovery was reported to the Ministry of Environmental Protection and Nature Conservation, which immediately delegated a research team under the guidance of Katalin Takács-Bolner. They explored only the first hall of the cave and realised that there is a passage leading further. Still in this year, on December 6, there was a second field survey. In this occasion, more helping hands were invited – supposing it may be carry out demolition work. Thus, among others, I myself also took part in this survey on behalf of the Rózsadomb (Rose Hill) "Kinizsi" Speleological Society together with Péter Adamkó, when we discovered the back parts. At the beginning of 1985, the team of József Kárpát explored also the other branch of the cave, which ends in an active lake filled by 18^{o}C water.

Shortly after the discovery of the cave, its scientific elaboration also began. The mineralogical research was led by László Bognár, and the fossils collected by the team of Katalin Takács-Bolner were determined by Dénes Jánossy and György Topál.

Today, the length of the cave exceeds 700 m, and its vertical extension has reached 53 m. By the end of the ‘90-ies, the final entrance had been completed. The original entrance hall has been partly filled up due to safety reasons. The visitors can get from the entrance into the hall under the fill in a wide iron tube. From the bottom of the rocky wall, a long concrete tube leads to the present-day, final entrance under the area of the subsequent collapse. In the environs of the entrance, explosion and mining have been stopped.

The Nagyharsány crystal cave was discovered “officially” in April 1994. According to unverifiable gossips, however, the discovery took place already a decade before, but this fact was kept quiet and the entrance was filled up.

This version is supported by the facts, that not far away from the present-day entrance, light filters in the cave for a relatively significant length at the foot of the quarry wall, and in this section well-sorted debris of undoubtedly anthropogeneous origin poured in. The crushed rock material of 1–2 cm size could not have absolutely got into the cave in a natural way.

After its discovery in 1994, the cave was surveyed also by the team of Katalin Takács-Bolner. In addition, on behalf of the Speleological Department Kinga Székely and at the same time Sándor Kraus, Gábor Salamon and Zsolt Végh examined the cave. As a result, the map of the cave was compiled, which is unpublished up to this day. According to this map, the length of the cave exceeds 550 m, and its vertical extension is 60 m. The end point does not reach the karst water level, but there is no possibility to get lower down in the narrow passage due to the fantastic richness of the formations.

No official presentation of the cave has been published. In order to protect it, its existence has been almost kept secret. The only lecture about the cave was delivered by Katalin Takács-Bolner at a conference in Jósvafő, in 1995. Though sampling has taken place, the analyses have not been carried out yet. This is the reason why we have received permission from Ildikó Lendvay and Ildikó Havas in the name of the Danube–Drava National Park to survey the caves under the guidance of Tibor Parragh several times and examine the formations collected during limited sampling.

The work was carried out in the frame of a diploma project – under my supervision – by Tamás Vigassy. As he has obtained a foreign scholarship, it is my task now to give a summary of his work

Development of the cave has begun, the entrance section has been made accessible by rust-proof steel sidewalk and ladders under the guidance of Pál Berczik. In order to protect the formations, no permission is given to descend into the cave until the construction works will not be finished.

From geomorphological point of view, there is a noticeable similarity between the positions of the two caves, situated little more than 5 km from each other.

The Nagyharsány crystal cave is situated under the highly karstified, extensive surface of Mt. Szársomlyó, which is considered a significant gathering ground. The bottom of its eastern part, formed between two steep bedding planes, can be found 10–15 m higher than the thermal water level of the Beremend crystal cave.

Above the Beremend crystal cave, surface water can ooze in only from a limited area due to the small extension of the Beremend block.

On the basis of the map of Alföldy and others from 1977, no separate karst water flow directions and systems must be taken into consideration between the Nagyharsány and Beremend slivers. Karst water levels of the two blocks is nearly the same according to the well data, as well.

As to its features, the Beremend crystal cave is a typical thermal karst cave. Its passage structure is characterised by several storeys and labyrinths. There is not at all fluviatile sediment in it. The passages of the cave have no connection with the topography of the surface, and it is characterised by extremely rich mineral precipitations, which can be related to the presence of warm water. And finally, still there is in the cave the lake, which is warmer than its environment…

The case of the Nagyharsány crystal cave is already not so unambiguous. The different character and height above sea level of the passages indicate clearly two cave levels. The upper level is represented by an extensive hall system on the western side, covered by large flowstones and stalagmites. The lower level is represented by a much smaller, narrow, steeply sloping passage system on the eastern side, richly ornamented by mineral precipitations, related to the warm water, and stalactites.

To sum up these observations, it can be established, that the Beremend crystal cave is dominated by thermal water character, following the tectonic preformation, while in the case of the Nagyharsány crystal cave, the passage system of tectonic origin was later formed by thermal water processes.

Though the forming processes were similar in the case of both caves, the host rock of $CaCO_3$ of 99.5% pureness and the Nagyharsány Limestone, formed in the Cretaceous, are the same – there are some differences in the mineral assemblages. The minerals were examined macroscopically, in thin section by cathode luminescence microscope, derivatograph and spectrograph as well as by means of X-ray powder diffraction and stable isotopes.

Besides the carbonate minerals, quartz, sericite/illite, chlorite, smectite, ankerite and anorthite could be detected at the western end point of the Nagyharsány crystal cave. This mineral assemblage is not the insoluble residue of the Nagyharsány Limestone. The great amount of bone material, found in the environs of the sample, refers also to transport from outside. This bone assemblage was determined by László Kordos as of Pleistocene–Holocene age on the basis of the collection of Piroska Pazonyi. Here – presumably due to E–W-ward strike-slip faults – an opening may have formed in the ceiling of the hall (roots hang down even today).

In the Eastern Branch, on a surface little more than 1–2 m^2, gypsum material of a snow-white 1–2 mm thick crust could be detected.

Quartz appears also in several samples from the Beremend crystal cave as pollutant. In the bauxite-like sample, collected at the entrance, gibbsite, goethite and kaolinite occur.

In both caves, precipitations of calcite material are predominant in great diversity. On the basis of the optic emission investigations, the carbonates in the samples are of high pureness and poor in trace elements.

In the Beremend crystal cave, dripstone occurs only at the lake in a smaller quantity and it is covered by peastone. On the contrary, the Nagyharsány crystal cave is very rich in dripstones. It is interesting, that in the hall system of the western side mainly large sized, sometimes human waist thick stalagmites and huge, locally 10 m long flowstones occur, while the sloping, narrow passage system of the eastern side is characterised by only maximum 10 cm thick stalactites. The reason for the difference may be the fact, that on the western side a very thin, altogether 10 m thick heading with steep layers can be found. On its planed surface, the soil mantle is insignificant and the vegetation is scattered, which does not provide continuous dripping. Seasonally variable respiration of the hanging roots probably increases the CO_2 concentration. Besides the young, one metre long, extremely thin stalactites, it is also remarkable, that the stalagmites were frequently broken to several pieces.

The peastone is snow-white in the Beremend crystal cave. It covers richly the walls and ceilings almost everywhere, and the rocks can be observed only at a few places. Distribution boundary of the common peastone is terminated frequently by a sharp line. In the inner parts of the cave, angular peastone, bounded by rhombohedral faces with an edge length less than 0.5 cm, also appears. During the exploration, even a nice specimen of coral peastone was observed, but it disappeared from the cave in a short time.

Peastones of the Nagyharsány crystal cave are not so white. They have a brownish colour, and resemble the common peastone of the caves in the Buda Mts. However, it is remarkable, that the peastone precipitations alternate with dripstone layers, mainly in the Western Branch. At least, three generations of dripstones can be distinguished! Examined in thin sections, the peastone precipitations are concentrically zoned. They do not luminesce.

The glass ball peastone is relatively widespread in the cave. It is a yellowish brown, globular formation, translucent like glass, which is saturated with $CaCO_3$, and gets precipitated from cold water solutions, flowing down, due to mechanical effects.

In the central, collapse zone of the Western Branch, in a dripstone environment, the dripstone peastone, consisting of unusually big, 2.5 cm diameter grains appears.

The absolute number one speciality of the Nagyharsány crystal cave is the peastone column, which occurs at several places in the Eastern Branch. It is an about 20–30 cm high, 4–8 cm diameter formation of dripstone habitus. It has a net structure, radial build-up and hole in the middle. The inner grains are usually smaller. Probably, the developed peastone agglomeration was at least partly redissolved by aggressive dripping waters.

Multigeneration calcite crusts occur barely in the Beremend crystal cave, and mainly in a redissolved state. In the Nagyharsány crystal cave, first of all in the Western Branch, however, they are one of the most frequent precipitation types. Some specimens may reach 10–20 cm thickness. Usually, their surface is strongly corroded.

The vein calcites are characteristic of both caves, probably they are older than the cave system. At many places, the spherical niches were corroded into this formation. At the spot of the corrosions, the surfaces break up fibrously, like needles. Some veins may be 1–1.5 m thick, and their colours range in bands from snow-white to red.

Agglomerations of aragonite crystalline needles occur in both caves. However, while in the Nagyharsány crystal cave they can be found only at a few places, in the Beremend crystal cave they are common. The locally whitish, glass-like crystalline needles, which are nearly 1 cm long, stick out from the almost 1 cm diameter peastone grains most frequently, resembling a pincushion. In the Washing Powder (Mosóporos) Branch, redissolution of the needles, which hang down and stand in dripping water, can be also observed. Here, according to X-ray powder diffraction investigations, aragonite is a component also of the powder, covering the bottom of the passage.

Dolomite and ferriferous dolomite occur in the powder-like samples of both caves.

Magnesite and ferriferous magnesite were detected in the Washing Powder Branch of the Beremend crystal cave.

Huntite could be detected first in Hungary in the Beremend crystal cave. The massive whitish material on the surface of the peastones is nearly pure huntite. The same could be detected the first time also in the Nagyharsány crystal cave, under similar conditions of occurrence.

The formations were subject to stable isotope investigations several times. The $D^{13}C$ and $D^{18}O$ investigations partly have not been finished yet, partly their evaluation needs to be the topic of a separate lecture.