

Geological research of caves in Slovakia – a review

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Caves are considered by many geologists as unsuitable for geological research on the score of speleothem occurrence. Nevertheless many caves cut across bedding sequences, uncover significant faults and folds, contain various fossils in cave walls or in sediments and hide many types of minerals. More than 7,100 caves are known in Slovakia in the present. The most of them were created in carbonate rocks, but about 200 non karstic caves occur in granite, gneiss, andesite, basalt, tuff, sandstone, siltstone, quartzite and conglomerate.

Only after World War I, it is possible to talk about targeted geological research in Slovakian caves. Geological research in caves before war was sporadic and accidental (for example description of Demänová Ice Cave by D. Štúr in 1868, find of first tree mold caves by A. Kmeť in 1902 or compilation of cave list in Slovak karst by G. Strömpl in 1912). After World War II successful investigation has been performed by Czech geologist in Domica Cave headed by R. Kettner from 1933 to 1938. Important geologic researches were made in caves of Slovak Karst by J. Seneš (1950, 1954, 1957), V. Homola (1951) and F. Skřivánek (1957, 1966). Systematic geologic research of Slovakian caves has started Slovak Karst Museum and Slovak Caves Administration, which was oriented mainly to lithology, stratigraphy, tectonic, mineralogy and hydrogeology of caves. The most important results are the following.

Stratigraphy and lithology of cave bedrock was researched in Driny Cave with documentation of Lower Cretaceous profile (Michalík et al., 1992). Very interesting was the detection of Miocenian abrasion caves in Malé Karpaty Mts. (Mišík, 1976; Lehotský, 1994; Aubrecht, 2015). In Ochtiná Aragonite Cave the genesis of Devonian reef limestones with the unique variscian fold structures was clarified (Gaál, 2004). Detail micro facial analysis was performed by J. Mello (2004) in Domica Cave and in Liskovská Cave some faults parallel with Subtatic Fault were detected (Psočka et al., 2006). Complex geological investigation and sedimentological studies was realized in Dobšinská-Stratenská cave system (Tulis & Novotný, 1989) as well as in others caves of Slovenský raj Mts. (Novotný & Tulis (2005). In Bystrianska Cave 5 tectonic blocks in Reifling limestones were distinguished (Gaál & Psočka, 2006). Beside numerous geological researches of further caves (e.g., Perlová, Brestovská, Hrušovská, Gombasecká, Čertova, Milada, Malužinská Cave (Vlček & Psočka, 2007; Vlček, 2006, 2007; 2008, 2009; Gaál & Vlček, 2009, Bella et al., 2014) the finding out of Anisian initial reefs with Silicispongiae in Demänová Cave System was significant (Gaál, *in press*).

Stratigraphy and dating of cave sediment was realized in Demänovský Cave System with the continuous Pliocene and Quaternary sequence (Hercman et al., 1998, 2005; Bella et al., 2011, 2012, 2013). Also from Ochtinská Aragonite Cave and Važecká Cave was obtained valuable data with paleomagnetism (Bosák et al., 2002; Pruner et al., 2002; Bella et al., 2016). In Domica Cave and Dobšinská Ice Cave the Pliocene allochthonous sediments were dated by cosmogenic nuclide (Bella et al., 2014, 2015). Valuable data were obtained from Upper Cretaceous paleokarst cave filling in Včeláre quarry (Gaál et al., 2007) and Jurassic cave filling in Dachstein limestones near Bretka (Gaál, 2008).

Tectonic study of Drienovská and other caves of eastern part of Slovak Karst by M. Zacharov (1985, 2008, 2012, 2013) markedly contributed to genesis of this region. In Domica Cave the NW-SE and NE-SW fault system was detected (Gaál & Vlček, 2011). The Zápoľná Cave was created on the base of Choč nappe along some significant tectonic lines (Littva et al., *in press*) however the important fault system was detected in Važecká Cave too (Bella et al., 2016). Tectonic activity and recent limestones block movement are followed by inbuilt dilatometer in several caves in Slovakia (Briestenský & Stember, 2008; Briestenský et al., 2010, 2011). A new term cavitonics was created by Littva et al. (2015) which is encompassed all aspects of active tectonic using caves.

The gravitation slope deformation with crevasse and boulder caves was described in basalt of Cerová vrchovina Mts. (Gaál & Gaál, 1995) and in limestones of Tisovec karst (Gaál, 1997). The origin and typology of boulders caves was described too (Bella & Gaál, 2010).

Paleontological remnants in more than 300 caves were found in Slovakia till now. It belongs to 330 taxons, which testify the high diversion of fossils of flora and fauna in caves of Slovakia (Gaál et al., 2013). Their bigger part (82 %) were found in cave sediments, while smaller part (18 %) in bedrock of cave. Extra propositional researches were realized by V. Ložek (1955, 1958, 1962, 1965 and others) oriented to Quaternary malacofauna of caves in main karst regions of Slovakia. Paleontological remnants – mainly cave bear and cave lion – were studied by Z. Schmidt (1965), Schmidt & Chrapan (1970), P. Holec (1985, 2000, 2007) and M. Sabol (1998, 1999, 2001).

Among many minerals in Slovakian caves we can mention about the some first finding as brushit in Domica Cave (Kašpar, 1934), gypsum in Demänovský Cave System (Pavlarčík, 1986), veseite and apatite in Domica (Cílek, 1999, Cílek et al., 2001), cryogenic crystals in several caves of Low Tatra (Orvošová, 2005; Orvošová & Hurai, 2008; Orvošová et al., 2010), taranakite in Domica (Sejkora et al., 2004) or first explanation of origin of aragonite in Ochtiná Aragonite Cave (Homza et al., 1970).

References will be published on the poster.