NEW APPROACH OF PALEOCLIMATIC RECORD INVESTIGATION, STUDY OF BAUXITE-FILLED PALEOKARST. MODEL LOCATION: ČOLTOVO QUARRY, SLOVAK KARST

Petronela Filipčíková[1], Roman Aubrecht[2,3], Peter Bačík[4]

[1, 2, 4]Comenius University, Faculty of Natural Sciences, Mlynská dolina, Ilkovičova 6, Bratislava
[1]Department of Geochemistry, [2]Department of Geology and Paleontology, [4]Department of Mineralogy and Petrology
[3]Earth Science Institute, Slovak Academy of Sciences, Dúbravská cesta 9, Bratislava

INTRODUCTION

Paleoclimatic reconstruction is widespread and progressive field of study, which uses many different natural materials as proxies to reconstruct former climatic conditions.

Bauxite ores, or smaller accumulations situated on karst terrains are well known from many different countries, for example Croatia (Peh a Kovacievič Galovič, 2014), southern Italy (Mongeli, 2002) and Slovakia as well (Gaál, 2008). Recent research with focus on climate reconstruction is based on using proxies to explain former natural conditions. Data obtained analyzing bauxitic material deposited in paleokarstic cavities, where the walls are covered with sinter crust, reveals us information about former temperature, age and humidity as well. Our model location is quarry situated in the Čoltovo village belonging to area of Slovak Karst, southern Slovakia.

METHODS

We collected samples of "lateritic material" trapped in paleokarst cavities in straight contact with buried sinter crusts. We collected those sinter crusts. To prove the character of „lateritic material" we conducted the powder X-Ray Diffraction analysis, which indicated that the material is represented purely by diaspore, which is Al oxide hydroxide mineral (α-AlO(OH)). Therefore we can assume the material most likely represents a remnant bauxitic lateritic weathering crust.

In the case of investigating lateritic material such as bauxite, the most focus is on study of spheric ooidal structures dispersed in fine-grained matrix and the determination of content and type of minerals (mainly bohemite, diaspore, hematite) in those ooids, which can elucidate wet/dry conditions during their formation (diaspore layers indicates dry; hematite layers wet conditions). Paleoenvironmental reconstruction is based on description of growth of ooids using fractal geometry (Mongeli, 2002). The age of bauxitic material is commonly determined in the terms of sequence stratigraphy using overlying layers of determined age (in our case are probably absent). Also zircone dating, as the most precise and recent method, can be applied (Mongeli et al., 2016).

We can also identify age of paleokarst features using very recent, accurate and sophisticated dating methods.

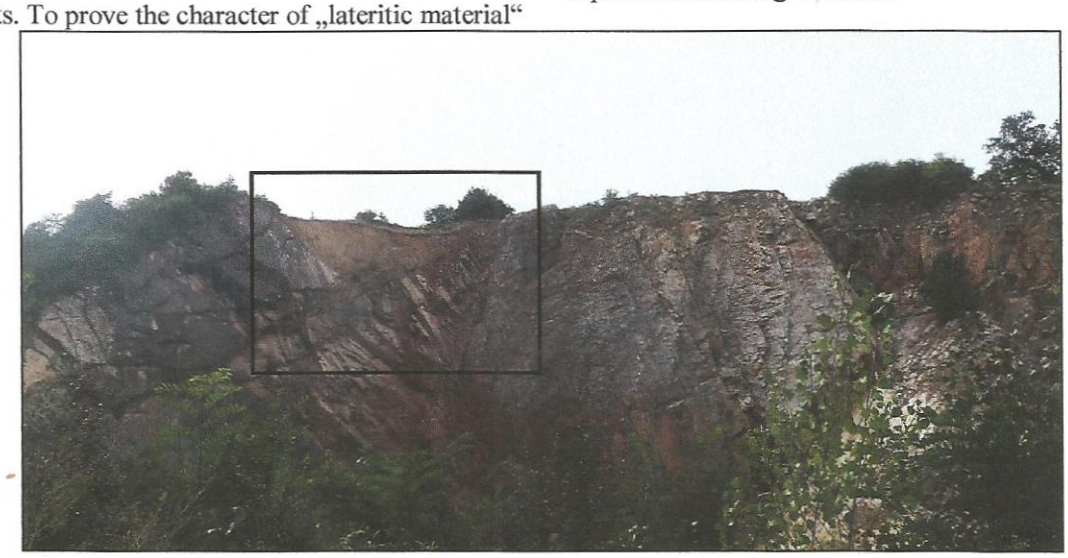

Fig. 1 Čoltovo quarry, the southern most outcrop, sampling site 1 and 2, detail - outcorp of transversal section trough sinkhole, filled with sandy material (top)bauxite

The lower most age boundary will be defined by U/Pb dating method applied on the samples of old, recrystalized fossil sinter crust. This data will provide us time frame for another analyses. Subsequently, the sinter crusts will be analyzed using ICP-MS to get information about $^{13}C/^{12}C$ and $^{18}O/^{16}O$ stable isotope ratios needed to elucidate former temperature variations.

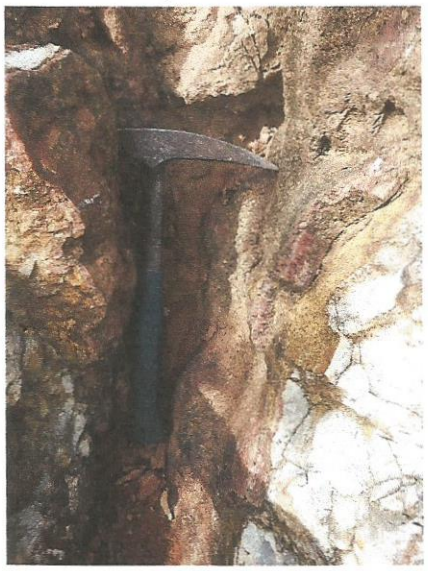

Fig. 2 Cavity with sinter crust and bauxite filling

DISCUSSION

Slovakian bauxites were described relatively long time ago (Borza and Pospíšil 1959, Číčel, 1958, Ivan, 1970), they are situated in Mojtín, Domaniža, Pružina, Markušovce and also in Čoltovo village. Early Slovakian studies were concentrated on ore geology, description of deposits and there was large discussion about the difference between terrarossa and bauxite material. Nowadays, those problems are solved, researchers came to conclusion that terrarossa is bauxite´s progenitor (Drun et al., 2007 in Peh a Kovacievič Galovič, 2014) and the investigation of this material get another direction. Slovakian paleokarst locations were described mostly by Činčura (1998), Gaál (2008), and unpublished rigorous thesis by Lehotský (2009), where age was determined based on stratigrafics and content of fossils in sedimentary fillings of buried karst cavities.

CONCLUSION

This approach to climate reconstruction is relatively new, it uses very progressive analytical methods, and the main focus is recently on data processing using specific software. Except age and temperature we can also detect the rate of precipitation, distinguish wet/dry conditions (and probably also their duration) of formation of bauxite deposits.

After we obtain results, we will be able to reconstruct climatic conditions pretty deep to the Earth´s history. The oldest information will be gained from sinter crust covering the triassic limestone „paleocave" then we assume some gap in time needed to fill this paleokarst cavity with bauxitic-lateritic material. If everything goes well, we will also find the upper boundary, in the form of sedimentary layer of known age, which directly overlain our sampling site.

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