A distinct tectono-metamorphic evolution at the southern edge of Tisia Mega-Unit revealed by monazite and xenotime age dating

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The Slavonian Mountains (Pannonian Basin, Croatia) are the area of particular significance within Tisia Mega-Unit. This large unit, with complex internal structure, encompasses three huge southward dipping Alpine nappe systems that expose characteristic lithologies of south-eastern part of Pannonian Basin basement. Complexes of the central nappe system (i.e. Bihor) outcrop along the 5.5 km long, NNW–SSE trending Kutjevačka Rijeka transect. This transect is one of the most prominent geological cross-sections that reflects a complex history of the metamorphic and igneous evolution, giving insight into crustal evolutionary processes and their relationship to deformation and metamorphism.

Our previous age dating of monazite from the representative rock complexes along Kutjevačka Rijeka transect, combined with geothermobarometric data, revealed complex structure and metamorphic history that includes a pre-Variscan (Ordovician to Silurian; 444±19 and 428±25 Ma) and a Variscan (356±23 Ma) medium-grade metamorphism [1, 2]. The primary focus of this study is on surprisingly large extent of very low- to low-grade Alpine metamorphism recorded in the parametamorphic rocks (chloritoid and chlorite schists) along the transect. The Th–U–Pb age dating on xenotime grains within the chloritoid schist gave an average age of 120±36 Ma, peak metamorphic conditions reaching 3.5–4 kbar and 340–380 °C. The age of 219±81 Ma obtained on Yb-rich xenotime (inherited?) core domain(s), implies a possible existence of older low-grade metamorphic phase(s) [3]. Two distinct penetrative low-grade metamorphic foliations recorded in the chlorite schists are accompanied by existence of two populations of small (~3.5 μm) low-Th monazites, giving an average age 99±15 Ma. Histogram of obtained ages shows two peaks at 120 and 80 Ma while age modelling recognized two peaks at 113±20 and 82±23 Ma. Those ages argue against "stratigraphic doubts" that contradict Alpine metamorphism in the area.

[1] Balen *et al*. (2006) *Miner Petrol* **87**, 143–162. [2] Horváth *et al*. (2010) *Lithos* **117**, 269–282. [3] Balen *et al*. (2013) *Int J Earth Sci*, in press.

Contribution of fungi and bacteria to the Mg biogeochemical cycle in podzolic soils

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Silicate mineral weathering is a key process in soil formation through leaching of essential elements (Mg, Fe, Al), which sustain plant growth and determine the chemistry of soil solutions and exchange complex. Biological role on silicate mineral weathering remain to date a scientific challenge due to the strong relation between plant growth, silicate mineral weathering and CO_2 cycle. However, some constrains, such as microflora associated to plants, are unresolved allowing to quantify biological impact on silicate mineral alteration in the soil and on major cation biogeochemical cycle. Soil microorganisms (fungi and bacteria) play a major role in the availability of nutrients in soils. They participate in weathering of primary materials through the production of low-molecular masses organic acids (LMMOAs). The objective of this study is to quantify the impact of microorganisms (bacteria and fungi) during granite bioweathering and to better understand and quantify the contribution of microflora to Mg biogeochemical cycle.

For this, we lead several experiments of geological material (granite) bioweathering to investigate the impact of fungi and bacteria on the release of Mg from granite during 42 days. The microbial communities were directly isolated in November 2011 from different horizon (O, E, B) of a podzolic soil under 3 different tree species (Scots Pines, Spruce, Birch) in Norunda (Sweden). To characterize mechanisms of dissolution, we monitored low-molecular organic molecules produced by microorganisms, microbial biomass, pH, Mg released and Mg isotope ratio variations.

Result indicates that pH decreases significantly from 6.5 to 4-5 during the first week of the experiments and then roughly stabilizes over time. In contrast, in all experiments, the fraction of released Mg is strong until 30 % at the end of the experiments. There is a positive correlation between the Mg leached from phlogopite and the carbon produced (LMMOAs and biomass) by microbial communities. Whatever the tree species, the microbial communities isolated from the upper part of the organic horizons of the soil are less efficient to weather the granite and don´t produce great quantities of LMMOAs. Preliminary isotope analyses indicate that $\delta^{26}Mg$ in the leaching solutions collected at the end of the experiments are close to the initial value of the granite. Only leaching experiments performed with microbial communities isolated from the upper part of the organic horizons induce a high enrichment in the light isotope (~ -1.0‰) in the solution, suggesting a biotic effect that will be investigated.

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