**MINERALOGY, GEOCHEMISTRY, AND MAGMATIC PROVENANCE OF MIOCENE TUFFS FROM THE DINARIDES AND ADJACENT BASINS – EVIDENCES FOR MANTLE UPWELLING?**

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In the Dinarides a vast system of intramontane lakes, usually referred to as the Dinarides Lake System (DLS) came into existence in the early Miocene (KRSTIĆ et al., 2001; MANDIC et al., 2012). The DLS affiliated lacustrine environments extended northwards even into adjacent areas of the Pannonian Basin (MANDIC et al., 2019a). Consequently, at its maximum extent, coinciding with the middle Miocene Climatic Optimum, a range of freshwater or brackish to marine depositional conditions established across the area (DE LEEUW et al., 2012; PAVELIĆ & KOVAČIĆ, 2018). The entire region was affected by intensive magmatic activity, which resulted in the deposition of numerous tuff horizons interlayered with lacustrine and marine sediments. This study aims to unravel the mineralogical and geochemical proxies of the tuffs, whose age spans from 18 to 12.5 Ma, in order to report on their nature, provenance and overall diversity in the context of early to middle Miocene evolution of the region that included basin infill, lakes evolution, marine transgression, sea-level lowering, and tectonic uplift.

In total 18 tuff samples were recovered from eight lacustrine and marine basins, stretching from the Styrian Basin in the north-west through the Pannonian Basin (Kalnik Mt., Banovina and Kordun localities) and the Dinarides in the south and south-east (Livno and Gacko localities). Tuffs are commonly intercalated between freshwater marls, limestones and clastic sediments, with the exception of the Ugljevik locality in NE Bosnia and Herzegovina whose tuffaceous layers were deposited in marine conditions established after the Badenian transgression (MANDIC et al., 2019b).

Analyzed pyroclastic material belongs to vitro-crystalloclastic tuffs with a characteristic porphyric texture and homogenous structure. Most of the samples are highly altered, which gave rise to the formation of clay matrix containing preserved contours of volcanic glass. Solely one sample is fairly fresh with abundance of pristine glassy shards, whereas for two samples the abated alteration led to palagonitization. Tuff mineralogy is dominated by illite-smectite clay minerals with quartz, muscovite, biotite, plagioclase, K-feldspar and amphibole being the minor phases. Carbonate is abundant only in fossiliferous Ugljevik samples.

Chemical composition of tuffs is featured by low amounts of K (K2O = 0.34-3.19 wt.%) and Na (Na2O = 0.19-1.29 wt.%), and strong variations in the content of Ti (TiO2 = 0.07-0.97 wt.%) and Si (SiO2 = 20.29-64.66 wt.%). The loss of ignition ranges from 6.51 to 35.84 wt.% (avg. LOI = 17.54 wt.%) indicating high level of alteration. Trace element-based discrimination diagram, Nb/Y vs. Zr/Ti (PEARCE et al., 1996), defines the majority of tuffs as intermediate rocks of trachyte, trachy-andesite and andesite composition while six samples are affiliated to rhyolitic geochemistry. Analyzed rocks display evolved and fractionated geochemical character (Mg# = 8.8-89.5; Cr = 2-118 ppm) with a pronounced enrichment of LREE over HREE [(La/Lu)cn = 3.76-27.89] at ~ 8-100 times chondrite relative concentrations. Negative Eu anomaly (Eu/Eu\* = 0.34-0.78) calls for an early plagioclase accumulation or fractionation at low pressure. Primitive mantle normalized curves (MCDONOUGH & SUN, 1995) outline the omnipresent negative anomalies of Nb-Ta and Ti relative to La [(Nb/La)n = 0.19-1.22; (Ti)n =0.40-5.35], which indicates the subduction related magmatism that underwent a significant fractionation and possibly a continental crust contamination (Th/La = 1.8-22.61, Th/Ta = 2.03-10.89). Calc-alkaline nature of analyzed tuffs is ascertained by the use of Hf-Th-Nb diagram of WOOD (1980) and AFM plot of IRVINE & BARAGAR (1971), which conforms with the findings of ŠEGVIĆ et al. (2014) who analyzed the coeval tuffs from the Sinj Basin locating their source area in the south of the Pannonian Basin.

Preliminary results enabled identification of two distinct magmatic trends present in analyzed tuffs. First is characteristic for the ~17.04 to 14.7 Ma tuffs and is featured by moderately evolved magmatism (~27-50 times chondrite concentrations), which tends to get more primitive with time. Second trend is shown by the Ugljevik tuffs who are less evolved (~6-40 times chondrite concentrations) and are analogue to the previous group being less differentiated over time. This is tentatively explained by multiple and complex magmatic activity during early to middle Miocene (PAVELIĆ, 2001), while the steady increase in mafic character of tuffs over time may corroborate the mantle upwelling origin of Miocene volcanism in Central Europe (KOVÁCS & SZABÓ, 2008).

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