Genesis of the Gemeric granites in the light of isotope geochemistry: Separated facts from myth

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The basement of the Gemeric Superunit is composed of Early Palaeozoic (Cambrian to Late Carboniferous) rocks, mostly low-grade flyschoid metasediments and metavolcanics, with remnants of an ophiolite complex metamorphosed under high-grade conditions. This volcano-sedimentary sequence was intruded by small granite apophyses derived from a huge underlying post--orogenic granite body 50 km long and 15 km wide, known from geophysics in the Upper Permian. Granitic rocks of the Gemeric unit are commonly referred as Gemeric granites. Several petrographic types of granite are distinguished. A coarse-grained and/or porphyritic biotite granite variety occurs in the deeper part, whereas the medium-grained muscovite-biotite granite and fine-grained two-mica granite, often greisenized, are found in the upper part of body. Geochemically, the Gemeric granites are unique in comparison to the other Western Carpathians Hercynian granitic rocks. Their overall characteristics place them among specialized tin-bearing granites. They have elevated SiO_2 values (73–78 wt.%), a strongly peraluminous character (Shand's index – A/CNK = 1.2–1.6), high concentrations of F, B, Rb, Li, Cs, Sn, Mo, Be and low concentrations of Sr, Ba, Zr and V (Uher and Broska, 1996; Petrík and Kohút, 1997; Broska and Uher, 2001, and citations therein).

The genesis and source of the Gemeric granites were discussed many times (e.g. Cambel and Petrík, 1982; Kráľ, 1994; Petrík and Kohút, 1997; Kohút et al., 1999, 2001; Gaab et al., 2005; Jiang et al., 2008; Magna et al., 2010). Cambel and Petrík (1982) postulated their S-type affinity and origin from mature crustal material. According to Kráľ (1994) the Gemeric granites were generated from one source with high Rb/Sr and wide I_{Sr} ratios 0.707–0.732; representing disturbed Rb-Sr system, which was reopened during the Alpine time (250–145 Ma). Petrík and Kohút (1997) supposed dehydration melting of a quartz- and muscovite-rich precursor from matured, recycled sedimentary supracrustal rocks, such as quartz--muscovite pelitic schist as a source of Gemeric granites. Negative $\varepsilon_{Nd(i)} = -4.6$ and elevated stable isotopes values $\delta^{18}O_{(VSMOW)} = 10.0 \sim 10.4$ ‰, $\delta^{34}S_{(CDT)} = 4.48$ ‰, indicate a mature continental metasedimentary feldspar and muscovite-rich protolith according Kohút et al. (1999, 2001; Kohút and Recio, 2002). Lead isotopic data from Gaab et al. (2005) e.g. high $^{206}Pb/^{204}Pb$ ratios (above 18.6) and similarly high $^{207}Pb/^{204}Pb$ ratios (above 15.7) suggest for melting of metasedimentary protolith, being typical for collision granites. However, fluids played a major role in the development of the Gemeric apophyses according Gaab et al. (l. c.) as WR–Pb–Pb data suggest for reopening of system between 250–231 Ma. Tourmaline $\delta^{11}B_{(TO-1)}$ values varying between –10.3 and –14.2 ‰ are partly overlying with those from their host rocks (–11.4 ~ 17.1 ‰). These tourmalines likely formed from crustal magmatic–hydrothermal fluids related to the Hnilec granites and/or from the late stage metamorphic–hydrothermal fluids (Jiang et al., 2008). The modest variability with restricted range of $\delta^{7}Li_{(L-SVEC)} = -0.4 \sim +1.2$ values common in pelites, points to a metapelitic parentage (Magna et al., 2010) for the Gemeric granites. Presented data suggest for their evolved crustal origin in general.

However, check of primary Sr isotopic data reveals, that not all I_{Sr} are extremely radiogenic. Similarly, new Nd isotopic results with $\varepsilon_{Nd(i)} = -0.3 \sim -4.0$ and $T^{Nd}_{DM} = 1.30 \sim 1.01$ Ga indicate that these data are analogous to common I/S-type granitoid of the Tatric Unit. Hafnium isotopes (Kohút, 2011) measured close to zircon SHRIMP spots denoted as $\varepsilon_{Hf(t)}$ form distinct intervals with following values: –5.35 ~ –0.75 (–2.47 ± 1.6; mean ± standard deviation). Hafnium model ages (T^{Hf}_{DM}) of the studied zircons provided following age spectra: 1 258 ~ 1 004 Ma (1 098 ± 87 Ma). These characteristics are comparable to identical ones from common I/S-type granitic rocks from the Tatric and Veporic superunits of the Western Carpathians. Taking in account the results from all isotopic systems (Sr, Nd, Pb, Hf, O, S, Be, Li) it is suggested that the Gemeric granites were melted from crustal sources of reworked Pan-African basement remnants, that experienced sea--floor weathering, were permeated by volcanic (boron) emanations and finally were modified by ore bearing fluids.

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