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## Variscan monazite ages and peak metamorphic P-T conditions recorded in gneiss/migmatite from the Pannonian Basin Basement (Mt. Papuk, Croatia)

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The Mt. Papuk area in Croatia is a natural laboratory for studying magmatic and metamorphic processes on exposed igneous and metamorphic rocks that were created during several major orogenic events – pre-Variscan, Variscan and Alpine. Among them, the Variscan orogeny was recognized as the most widespread and the best documented one already in the last century. In recent years research on pre-Variscan and Alpine events led to detailed information on timing and P-T evolution, whereas the Variscan orogeny in the vast area between Bohemian Massif and Mediterranean terranes was just sporadically investigated. The huge gap in Variscan P-T-t data started to be an obstacle for regional paleogeographic reconstructions that can be overcome by studies of the Mt. Papuk area bearing new key informations.

To determine the timing of Variscan event(s), dating with the electron microprobe on monazite and xenotime and the LA-ICP-MS on apatite and zircon was conducted. So far, we extracted a set of geochronological data from four selected type-localities (Šandrovac, Jankovac, Čarugin Kamen, Koturić) with medium- to high-grade gneiss including migmatite in the western part of the Mt. Papuk area using monazite. In addition, a metamorphic P-T-t path was constrained.

The rock specimens show a schistose fabric and a well-preserved mid- to coarse-grained granoblastic texture. Some of them show traces of partial melting. The schistosity is defined by the preferred orientation of elongated feldspar grains, mica (biotite and muscovite)-rich domains and quartz ribbons. K-feldspar and plagioclase are the dominant phases followed by quartz, biotite, white mica and, in some rocks, almandine-rich garnet (65-70% mol.% alm) and staurolite. Zircon, apatite, monazite, rhabdophane, allanite, ilmenite, rutile and titanite are accessory minerals.

Monazite grains are irregular in shape and locally elongated varying in size from ~15-50  $\mu\text{m}$ . They are irregularly distributed within the matrix assemblage enclosed in micas, feldspar, garnet and quartz. Monazite shows a high  $\text{Ce}_2\text{O}_3$  content (around 28 wt. %).  $\text{La}_2\text{O}_3$ ,  $\text{Nd}_2\text{O}_3$  and  $\text{ThO}_2$  contents slightly vary around 13 wt. %, 12 wt. %, and 3.4-5.3 wt. %, respectively. In general, the composition of monazite does not differ significantly among localities with the exception of yttrium. The content of  $\text{Y}_2\text{O}_3$  is highest (up to 4 wt. %) in monazite from rock samples that show traces of partial

melting, revealing a high-T event, and around 2 wt. % in monazite from gneiss.

The weighted average age of  $374.1 \pm 5.8$  Ma ( $1\sigma$ , 95% confidence level, MSWD=0.68, probability of fit=0.993, n=96) fits well with the measurements for each type-locality:  $384.5 \pm 9.0$  Ma (n=15),  $373.3 \pm 7.6$  Ma (n=28),  $379.0 \pm 10.0$  Ma (n=31) and  $364.0 \pm 24.0$  Ma (n=22), respectively. However, probability density histograms reveal discernable groups at 390, 373 and 330 Ma age maxima and point to more than one event during the metamorphic evolution of the Variscan crust. The derived P-T-t path implies a rapid exhumation from a depth of ca. 30 km with a nearly isothermal hairpin-like ("narrow") clockwise path reaching max. P-T values of 9-9.5 kbar and 610°C with occurrence of melt during exhumation at ~5 kbar and 640°C.