Zircon U–Pb dating of lower crustal rocks from the Góry Sowie Massif (Central Sudetes, SW Poland): new insights on the sedimentary origin and the tectono-thermal evolution

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Devonian HP-UHP lithotectonic associations represent pivotal element of Paleozoic evolution of European Variscan belt across the continent from Portugal to Poland. The Góry Sowie Massif (GSM), located in the Central Sudetes, represents one of the best preserved outcrops of lower crustal rocks that experienced protracted Devonian tectono-metamorphic history at the easternmost extremity of the belt. The area is surrounded by Devonian ophiolite remnants (c. 400 Ma; Kryza & Pin 2010) and by Devonian and Silurian to Carboniferous sedimentary basins in the northern and southern part, respectively. The GSM is mainly composed of paragneisses and subordinate orthogneisses, metabasites and granulite. The dominantly sedimentary association and the overall geotectonic setting contrast with other kilometer-scale granulite complexes in the Bohemian Massif that are dominated by felsic granulites and Late Cambrian orthogneisses that experienced 340 Ma HP metamorphism. Weak Carboniferous overprint makes the GSM a key locality to better understand Devonian stages of formation of HP granulites and provenance of the whole pre-Devonian lithological association. New U–Pb analyses were carried out on zircons from four migmatitic paragneisses, three felsic biotite-poor granulites and two biotite-rich granulites in the northern part of the GSM, in order to constrain source provenance and tectono-thermal history of the area.

The paragneisses are dominated by stromatic migmatite, comprising medium-grained leucosomes alternating with melanosomes. The main mineral association is biotite, plagioclase, K-feldspar, quartz, garnet and locally sillimanite and/or kyanite. Accessory minerals include zircon, apatite, monazite, rutile, opaque and minor tourmaline. Zircons from the paragneisses are mostly prismatic to sub-rounded grains with oscillatory cores (Th/U > 0.1) overgrown by dark homogenous metamorphic rims (Th/U < 0.1). The cores record a main age population between 492–545 Ma (40–50% of concordant analyses) and few Neoarchean to Proterozoic clusters, whereas the metamorphic rims yield younger ages (25–40%) between 381–396 Ma. Felsic granulites occur as hundred m-scale bodies associated with metric lenses of amphibolites, mafic and ultramafic rocks in the northern part of the massif. The felsic granulite is mainly composed by plagioclase, quartz, garnet, kyanite and with biotite and K-feldspar. In biotite-poor granulites there is minor biotite, whereas the biotite-rich granulite is characterized by abundant biotite, and sillimanite replacing kyanite. Zircon, monazite, apatite, rutile and opaque minerals are present as accessory phases. Zircons from biotite-poor granulites are mostly sub-rounded and "soccer-ball" grains, while zircons from biotite-rich granulites are mainly idiomorphic prisms. Under CL, zircons show similar patterns of those from paragneisses: cores surrounded by rims. Zircons from biotite-poor granulites show a main Devonian peak (25–40%) with ages between ca. 391–402 Ma obtained on rims and entire "soccer-ball" grains. Cores record abundant Cambro-Ordovician population and few Neoproterozoic ages. In contrast, zircons from biotite-rich granulites provide a main peak (25–34%) at ca. 499–531 Ma with a small younger cluster at ca. 396–425 Ma and minor older population at Neoarchean to Proterozoic. The well preserved Cambro–Ordovician population in the biotite-rich granulites correlates with less preserved population of the biotite-poor granulite, suggesting more pronounced metamorphic (re)crystallization of zircon in biotite-poor granulite.

The new data reveal that source provenance of the paragneisses as well as granulitic rocks was dominated by Cambro-Ordovician sources. The Cambrian sedimentary and possibly also felsic and mafic volcanic rock association was subsequently metamorphosed by Middle Devonian HP tectono-thermal event coeval with the emplacement of the Devonian ophiolitic rocks surrounding the area. Therefore, the Devonian HP event is possibly related to large scale oceanic/continental subduction.

REFERENCES

Kryza R. & Pin C., 2010. The Central-Sudetic ophiolites (SW Poland): Perogenetic issues, geochronology and paleotectonic implications. *Gondwana Research*, 17, 292–305.