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Multi-stage Metamorphism of Metapelites from Western Lithuania, Eastern European Craton: Geodynamic Implications for a ca. 1.8–1.5 Ga time span

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The Western Lithuanian granulite domain (WLG) in the Eastern European Craton has experienced four high-grade Proterozoic events at ca. 1.81-1.79 Ga, ca. 1.73-1.68 Ga, ca. 1.62-1.58 Ga, and ca. 1.52-1.50 Ga [1]. Metasedimentary granulite samples (Lk1D, Pc3/6, Bl150) were selected to revise the age data using detailed monazite CHIME dating (by EPMA at Faculty of Geology, University of Warsaw). A phase equilibria modelling was performed using bulk-rock compositions, petrographic observations, and SEM–EDS mineral chemistry to improve P-T estimates.

Phase equilibria modelling indicates the peak metamorphic (P-T) conditions of 850 °C at 7.5-8.5 kbar (Lk1D), 750-780 °C at 6.5-7.5 kbar (Pc3/6), and 700 °C at 6 kbar (Bl150). Lk1D records a metamorphic event of ca. 1.77 Ga (mean 1772±9, n=130, MSWD=0.054) with a ca. 1.60 Ga overprint. In sample Bl150, a detrital monazite of ca. 1.84 Ga is overgrown and surrounded by ca. 1.70-1.72 Ga monazite. Pc3/6 preserves remnants of a ca. 1.79 Ga event. The most prominent ca. 1.59 Ga (mean 1590±9, n=123, MSWD=0.42) metamorphism is followed by deformation and reheating of ca. 1.57 and 1.56 Ga. There are indications of ca. 1.52 Ga reworking.

Only a few indications of the regional 1.8-1.79 Ga metamorphism have been observed (Pc3/6). Some rocks were reworked at ca. 1.77 Ga, while most rocks have experienced metamorphic events of 1.70-1.72 Ga, 1.60-1.56 Ga and 1.52 Ga; the three last events overlapping with the results of previous investigations.

The neighbouring Transscandinavian Igneous Belt (TIB 2) in south-central Sweden likely caused the heat flow responsible for the 1.60-1.72 Ga metamorphism. The younger than 1.60 Ga events may be related to an anorogenic granitic magmatism e.g. the Riga intrusion of rapakivi-granitic rocks, that penetrates the northernmost part of the WLG [2] and to the mafic magmatism in central Sweden [3]. The youngest ca. 1.52 Ga reworking might be caused by the Gothian or Dano-Polonian orogenies.

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