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Metamorphism and magmatism in the western East European Craton: implications for 1.84 to 1.45 Ga evolution in Lithuania

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The western East European Craton (EEC) was formed by the accretion of distinct terrains at c. 1.8 Ga. Some boundaries between particular terrains and their continuation across the Baltic Sea from Lithuania to Sweden have to be justified.

Recently obtained numerous U-Pb zircon ages from the Siupariai 3 (Sp3), Palukne 1 (Pl1) charnockites, Rukai 1 (Rk1), Geluva 99 (Gl99) granitoids, Bliudziai 150 (Bl150), Lauksargiai (Lk2, 5) and Pociai 3(Pc3) granulites determined using a Cameca ims1270 instrument of the Nordic high-resolution ion-microprobe facility (NORDSIM), as well as monazites of the Sp3, Pl1, Vydmantai 1 (Vd1) charnockites, Lk2, 5, Bl150 granulites dated by Cameca SX-100 electron microprobe (EPMA dating) at University of Warsaw allowed to reconstruct terrain boundaries from north to south in western Lithuania and a sequence of crust-forming events.

In the north, the slightly deformed, coarse-grained Sp3, Pl1 and Vd1 (Claesson et al., 2001) charnockitoids crystallized in the time span of c. 1.84-1.81 Ga. The magmatic zircons contain a few c. 2.4-2.0 Ga inherited cores. The rocks were deformed and thermally reworked immediately after their crystallization as indicated by c. 1.79-1.74 Ga zircons and c. 1.85-1.76 Ga high-Y monazites, but the major metamorphism they underwent not earlier than c. 1.70 Ga. Thick zircon rims and rounded sector-zoned metamorphic zircons of c. 1.70 Ga likely grew together with peak garnet at 800o C, 7 kbar (Sp3) or 760o C and 6.5 kbar (Pl1). Numerous 1.62-1.56 Ga monazites recorded decompression to 2 kbar and cooling to 500o C in Sp3, mostly cooling to 450o C (at 4 kbar) in Pl1, and isothermal decompression from 650o C at 7 kbar to 500o C at 3 kbar in Vd1.

In the south, the Bl150, Lk2, 5 and Pc 3 metasedimentary granulites containing a wide age range (3.0 to 1.85 Ga) of detrital zircons were deposited not earlier than 1.89 Ga. An incipient metamorphism started with the growth of relatively high-Y monazite (Y>3%) at 1.84-1.83 Ga, however a peak of 850o C at 9-10 kbar was likely achieved c. 1.80 Ga ago as indicated by metamorphic zircon (Lk2), and confirmed with 1.81-1.79 Ga monazite. Two isobaric cooling steps after the peak may be attributed to the two episodes of monazite growth at 1.72-1.70 and 1.63-1.62 Ga (Bl150) or at 1.70-1.64 Ga (Lk2, 5). The Rusne 1 tonalites intruded the metasedimentary granulites at c. 1.81 Ga (Claesson et al., 2001).

To sum up, the 1.84-1.81 charnockitic magmatism in northwestern Lithuania can be correlated with TIB 0 magmatism in south-central Sweden and may be attributed to an active continental margin as well. This indicates a terrane boundary in west Lithuania earlier not recognized. The c. 1.81 Ga granitic magmatism and c. 1.81 -1.76 Ga metamorphism are related to major accretion of the western EEC when a volcanic island arc, which is identified in NE Poland, southern and central Lithuania in the present south (Wiszniewska et al., 2005), possibly collided with the continental margin in the north. The 1.70-1.60 Ga metamorphic events can reflect a distal influence of the 1.7-1.6 Ga Gothian orogeny in SW Fennoscandia (e.g. Ahall and Connelly, 2008).

The 1.55-1.45 Ga AMCG magmatism, c. 1.56 Ga metamorphism and deformation of charnockites can be manifestations of the Danopolonian orogeny, particularly prominent around the South Baltic Sea.

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References

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