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Archaean and Palaeoproterozoic metamorphic events in the Orekhov-Pavlograd compressional zone, Ukrainian Shield

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The Orekhov-Pavlograd zone (OPZ) is located between the Mesoarchaean-Neoarchaean Middle Dnieper Province and the Mesoarchaean-Palaeoproterozoic Azov Province in the eastern Ukrainian Shield. The OPZ consists of Archaean and Palaeoproterozoic high-grade metamorphic rocks. According U-Pb isotope analyses Archaean methaigneous rocks have age of 3.5-3.3 Ga, and latest AR events dated form both individual grains and metamorphic rims in the tonalite and the granitic vein occurred at about 2.88 Ga ego. Paleoproterozoic zircons from a hornblende granulite have a concordia age of 2.08 Ga [1].

P-T conditions of the 3.5–3.3 Ga processes calculated from the Ti content in zircon are of 730–760°C.

Metamorphic event dated as 2.88 Ga is more preserved and detected in some amphibolites after mafic dykes. According to different methods of hornblende-plagioclase geothermometry along with Al- and Ti-geobarometry of hornblende, the amphibolites have formed at temperature of 735–749 °C and pressure of 5.2 to 7.8 kbar.

P-T conditions of Paleoproterozoic metamorphic processes have been calculated for a Paleoproterozoic high-Al paragneiss and mafic rocks.

On the base of the computer software THERIAK-DOMINO [2], near-isothermal decompression from ca. 8.5 to 6.0 kbar at 650 °C and then to 5.8 kbar at 740 °C has been determined for small irregular garnet grains (grs 4–7% and XMg 0.36–0.37) associated with the same biotite and plagioclase. P-T conditions obtained by means of the P-T pseudosection calculation are identical within errors to those defined by the Grt + Bt + Pl + Ozt geothermometer by [3] and the geobarometer by [4], T = 675 °C and P = 5.6 kbar.

Temperature and pressure calculated for assemblage Grt-Pl-Opx-Amph-Ilm-Ru (mafic rock) by using the TWEEQU method shows: 1) high values of pressure and temperature (ca. 7 kbar and 800 °C) are linked with the first metamorphic event with Opx-Cpx assemblage, 2) moderate values (ca. 5 kbar and ca. 600 °C) are referred to the second metamorphic event when amphibole was crystallized instead of orthopyroxene. The latest metamorphic reworking took place at P = 3.3–4 kbar and T = ca. 600 °C.

The resulting Paleoproterozoic P-T-t path suggests a clockwise P-T evolution of the OPZ area.

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