



SIMS SHRIMP-II U-Pb zircon data for an Archaean igneous complex (3.5-2.9 Ga) and its Palaeoproterozoic reworking in the Orehov-Pavlograd compressional zone, Ukrainian Shield

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The Orehov-Pavlograd zone (OPZ) is located between the Mesoarchaean-Neoarchaean Middle Dnieper Province and the Mesoarchaean-Palaeoproterozoic Azov Province in the eastern Ukrainian Shield. This represents a Palaeoproterozoic large-scale N-S trending shear zone composed of Archaean and Palaeoproterozoic high-grade metamorphic rocks. An Archaean igneous complex consists of metatonalites, granitic veins, mafic dykes and hornblende granulites.

U-Pb isotope analyses have been performed in the Centre of Isotopic Research, VSEGEI, St.-Petersburg using a SIMS SHRIMP-II instrument. A SIMS instrument (a Cameca IMS-4f ion microprobe at the Yaroslavl' Branch of the Institute of Physics and Technology RAS) has also been used to analyze the content of trace and RE elements in zircons. Weakly deformed tonalitic lenses occur within strongly deformed and migmatized metatonalites. Oscillatory-zoned cores of zircons from such a lens have yielded a Concordia age of 3500 ± 13 Ma. Some zircons contain strongly metamict inclusions which consist of one or several conjoined zircon grains. Oscillatory zoned zircons from a Bt-Grt gneiss after tonalite gave a Concordia age of 3503 ± 12 Ma [1], one grain contains a fragment of zircon with a Concordia age of 3638 ± 57 Ma. An upper intercept age of 3401 ± 8 Ma (MSWD=0.40) has been calculated for oscillatory-zoned cores of zircons from a granitic vein within the tonalitic lens. A least changed fragment of a mafic dyke has preserved zircons with a Concordia age of 2881 ± 18 Ma. All of these rocks underwent several deformational and metamorphic events. The oldest event has been recorded by ~ 3.3 Ga zircons that form both individual grains and metamorphic rims and occur in the tonalite and the granitic vein. 2.8 Ga zircons have been found in the tonalite, granite, mafic rock and Bt-Grt gneiss. Zircons from a hornblende granulite have a Concordia age of 2084 ± 14 Ma. Palaeoproterozoic reworking has been revealed close to a contact between the Archaean igneous complex (infrastructure) and a Palaeoproterozoic supracomplex. It resulted in high-grade metamorphism, reaching granulite-facies, and in change of the tonalites into Bt-Grt gneisses: all of these rocks display a similar major, trace and rare element composition and values of Nd model age (DM) (~ 3.6 Ga) [2].

Igneous and metamorphic processes are recorded by REE patterns in zircons. The 3.5 Ga oscillatory-zoned magmatic cores have the low La content, positive Ce and negative Eu anomalies whereas metamorphic grains and overgrowths are characterized by the high La content, the absence of Ce and Eu anomalies and a tendency to flat REE pattern. The REE content in garnets and biotites indicates the redistribution of these elements between major minerals and zircon during metamorphism.

So, we distinguish the following events in a geological history of the OPZ: (1) 3.5 Ga, crystallization of igneous protoliths of tonalites and Bt-Grt gneisses; (2) 3.4 Ga, granitic veins; (3) 3.3 Ga, metamorphic overgrowths around zircons from tonalites and granites; (4) 2.86 Ga, emplacement of mafic dykes and coeval metamorphic overprint in Bt-Grt gneisses and amphibolites; (5) ~ 2 Ga tectono-metamorphic event responsible for main geological features of the OPZ.

1. S.B.Lobach-Zhuchenko, E.V.Bibikova, V.V.Balagansky, S.A.Sergeev, G.V.Artemenko, N.A.Arestova, N.P.Shcherbak, 2010. Doklady AN, 433 (2): 212-218.
2. S.B.Lobach-Zhuchenko, Yu.S.Egorova, A.V.Yurchenko, V.V.Balagansky, G.V.Artemenko, V.P.Chekulaev, N.A.Arestova, 2009. Mineralogical Journal (Kiev), 31 (1): 3-10.