



## The 3.5 Ga granulites of the Bug polymetamorphic complex, Ukraine (U-Pb SHRIMP-II zircon data)

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The Bug polymetamorphic complex composes the south-west of the Ukrainian Shield. It experienced multistage deformation and metamorphism of 3.6 to 1.95 Ga. The age of protolith of the gneiss enderbite is up to 3.7-3.6 Ga (Claesson et al., 2006; Lobach-Zhuchenko et al., 2010, 2013; Bibikova et al, 2013).

The 3.5 old granulitic zircon (sample UR132) was found in a light grey massive medium grained with weak foliation granulite from the Odessa quarry located at the right riverside of the Bug (N 48° 13' 55.2"; E 29° 59' 75"). The rock is mafic in composition ( $\text{SiO}_2 = 51.50 \text{ wt\%}$ ,  $\#mg=0.43$ ,  $(\text{La}/\text{Yb})_n = 7.5$ ), and shows enrichment in Sr (333 ppm), Zr (244 ppm), and Nb (12 ppm) compared to MORB. This contains antiperthitic plagioclase (An30-35), hypersthene (En0.46 Fs0.53 Wo0.01), diopside (En0.33 Fs0.20Wo0.47), quartz, ilmenite, magnetite, apatite, and zircon.

Three types of zircon are recognized. (1) Large ( $\sim 300 \mu\text{m}$ ) isometric and oval grains displaying bright colour and sector zoning in CL. Some crystals have fir-tree texture. Isometric shape together with fir-tree zoning is typical for zircons growing under conditions of granulite-facies metamorphism (Hoskin and Schaltegger, 2003). These zircons are low in U and Th, have high Th/U ratios (0.61-1.1), and display decreasing of element contents from the centre to margin (ppm): U – 68 to 44, Th – 58 to 19, total REE – 723 to 406, Y – 1049 to 553, and Li – 1.23 to 0.91 at the constant (Lu/La)<sub>n</sub> ratios (4200-4600). Zircon's crystallization temperature calculated from the Ti content is 705 °C and is consistent with those calculated on the base of the mineral composition. (2) Small sized (60-100  $\mu\text{m}$ ) zircons. Most of these occur within plagioclase and truncate antiperthite lamellae. They show euhedral zoned cores and bright rims in CL. (3) Zircons principally distinguished from those of groups 1 and 2. These are dark in CL, some grains are severely structurally damaged and contain numerous inclusions (Qzt, Pl, Kfsp, rare Opx and Cpx).

Zircon U-Pb isotopic analysis was carried out using SHRIMP II ion microprobe technique at the Isotopic Centre of VSEGEI, St.-Petersburg. Six transparent grains of the (1) group form a discordia line with Concordia intercepts at 3499 $\pm$ 33 Ma (and 2638 $\pm$ 240 Ma (MSWD=2.3). According to internal textures and chemical composition of zircons their formation is associated with granulite metamorphism. The 207 Pb/ 206 Pb data for 11 grains from (3) group are highly variable in age from 3330 $\pm$ 5 to 2356 $\pm$ 7 Ma indicating isotopic disturbance. They do not form an isochrone, thus reliable determination of their age is not yet possible.

Thus, the oldest granulitic event at 3499  $\pm$  33 Ma has been identified and justified for rocks of the Bug polymetamorphic granulite complex. Recognition of this oldest granulite metamorphism proved possible due to preserved isotopic and geochemical features of zircon.

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