A-type granites of Prydz Bay, Antarctica: Products of melting of a two-component granulite crust?

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Cambrian (519-494 Ma) A-type granites, cropping out over ~130 km along the Prydz Bay coast are structurally, texturally and mineralogically diverse. Intrusions in the SW carry hornblende, chevkinite-perrierite, allanite and titanite; those in the NE carry garnet and monazite. Fluorite is widespread; oxides include magnetite, hercynite, ilmenite and, locally, högbomite and hematite. The granites (SiO_2 59.8-77.7%, ASI 0.95-1.19) are high in Fe, alkalis and K_2O/Na_2O (1.1-5.2), Ga/Al, HFSE and REE, with remarkably high Zr (322-1625 ppm), LREE (Ce 107-2101 ppm) and Th (up to 878 ppm Th; Th/U = 28-142). REE fractionation is strong (La_N/Yb_N 36-454), being more pronounced in the NE. Sr-Nd-Hf isotope ratios ($^{87}Sr/^{86}Sr$ 0.708- 0.726, ε_{Nd} –8 to –13, ε_{Hf} –4 to –14) and Nd-Hf model ages are consistent with magma sources in equivalents of the exposed Neoproterozoic ortho- and paragneisses. High $^{207}Pb/^{204}Pb_t$ (15.71-15.77) and low $^{206}Pb/^{204}Pb_t$ (17.7-18.16) indicate Pb isotope evolution in a high-μ reservoir since ~2.5 Ga, followed by a low-μ stage for several 100 Ma prior to granite formation. A ~1 Ga granulite-facies event recorded in Prydz Bay gneisses could explain the drop in U/Pb. Co-variation of REE-Y and Sr-Nd isotopes in the granites suggests at least two crustal components in the magma source. Component 1 (ε_{Nd} ~ –13, $^{87}Sr/^{86}Sr$ >0.72) produced melts with strong HREE fractionation and Y depletion (major residual garnet), represented by 3 of the 4 NE intrusions. Component 2 (ε_{Nd} –7 to –10, $^{87}Sr/^{86}Sr$ 0.708-0.714) produced melts with lower Gd_N/Yb_N (less residual garnet), represented by the SW intrusions. Both components contain the high-207/low-206 isotope signature inferred to be linked to the regional ~ 1 Ga granulite-facies gneisses. Since these source rocks are residual, dehydrated gneisses, it is inferred that temperatures well above the wet solidus were required for melting at ~0.5 Ga, a condition we suggest was inherited from the pre-collision thermal structure of the lithosphere in Prydz Bay.

'Kimberlitic' zircons from Paleproterozoic Kimozero kimberlites (Karelia): Mineralogy, geochemistry and U-Pb geochronology

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The origin of xenocrystic zircons from the Paleoproterozoic Kimozero kimberlite is in discussion. The kimberlite is located in the Eastern part of the Karelian craton among the Middle Paleoproterozoic (2.1-2.0 Ga) Zaonezhskaya supracrustal sequence of the Onega trough.

Most zircons separated from the kimberlitic breccias are large (up to 1000 μm) isometric, soccer-ball shape crystals and correspond to the description of kimberlitic zircons [1]. There are two general types of inner structure of the zircons: homogenous and oscillatory zoned.

Oscillatory zoned zircons represented as cores in zircon grains. They have U-Pb isotopic age around 2.4 Ga. Their geochemical characteristics suggesting they are relicts of magmatic zircons formed from depleted, possibly, basaltic source.

The two genetic groups of homogenous zircons from Kimozero kimberlites were revealed. The zircons of Ist group are extremely depleted by all trace elements such as REE, U, Th, P, Ti, Li and have the age of 1986±4 Ma. Their geochemical characteristics are comparable with kimberlitic zircon megacrysts described for various kimberlites all over the world. Thus, the zircons are thought to be engaged from a mantle Kimozero kimberlite source. The obtained age for the Kimozero kimberlitic zircons is very close to the age of the alkaline-ultrabasic carbonatite magmatism in the North-Western part of the Karelian craton 1999 ± 5 Ma [2]. The zircons of IInd group are also depleted by U, Th, REE, but they are enriched in Hf, P, Li, Ti and have an older U-Pb age of 2406±6 Ma. Geochemical features of the zircons of IInd group are typical for lower crustal xenoliths [3]. Their crystallization was probably related with granulite metamorphism occurring 2.4-2.5 Ga ago as part of large-scale intense thermal reworking of lower crust by rising plume under the eastern part of the Baltic shield.

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