Zircon 'micro-vein' in gneissic peralkaline granite

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U-Pb ages and U, Th, and REE compositions of a zircon 'micro-vein' and host sample zircon from gneissic peralkaline granite were determined by SHRIMP at Hiroshima Univ. The vein- and host sample zircons, referred to as type I and type II zircons, respectively, are characterized by low average atomic number-contrast (AZ-contrast) rim and high AZ-contrast centre domains in backscattered electron images.

The occurrence of ubiquitous fluorite micro-inclusions in the type I zircon and less commonly type II zircon indicate that fluorite was already a stable phase during crystallization of zircon from evolved magma rich in HFSEs. Earlier formation of fluorite may have buffered activity of F in the melt, which consequently lead to saturation and sudden precipitation of a large number of zircon crystals. The Th/U ratios (~0.5-1.5) in the high AZ-contrast domains of both zircon types and the synneusis structures they form as well support crystallization from a melt. Furthermore, the type I zircon (centre = 779 ± 69 Ma; rim = 780 ± 35 Ma) and type II zircon (centre = 778 ± 49 Ma; rim = 780 ± 31 Ma) yielded indistinguishable U-Pb ages, which are within analytical uncertainties identical to the 776 ± 12 Ma zircon U-Pb emplacement age of the peralkaline granite determined independently from a different sample material. Hence, the types I and II zircons were crystallized during the emplacement of the granite and soon after infiltrated by late magmatic-hydrothermal fluids that leached parts and less commonly whole of the zircon grains resulting in loss of significant amounts of U, Th, and the REEs. The leached and recrystallized domains contain micro-fractures, possibly caused by volume change during cation exchange reactions or later by differential volume expansion of trace element rich and poor domains (Lee and Tromp, 1995). However, the zircons were young and non-metamict at the time of interaction with fluids which resulted in the low AZ-contrast recrystallized domains by a dissolution-reprecipitation mechanism (e.g., Putnis, 2002).

The 776 ± 12 Ma emplacement age of the peralkaline granite brings into light the occurrence of older anorogenic granitoid magmatism in the western Ethiopian Precambrian terranes and this would contribute to further constrain the tectono-magmatic evolution of the region.

Reference

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$^{87}Sr/^{86}Sr$ - ratio of sphene and apatite in Cu-Mo porphyry deposits as indicators of material sources and dynamics of the ore-forming processes

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Accessory apatite and sphene contain >300 ppm Sr and <5 ppm Rb and therefore are useful for an estimation $^{87}Sr/^{86}Sr$ in the minerogenic melting and/or solution. This minerals possess high concentrations of REE and fluid F and Cl. Efficiency of apatite coupled with sphene and isotope-geochemical indicators ($^{87}Sr/^{86}Sr$+REE+Cl+F) has been investigated by the example of Shakhtama deposit (Siberia, East Transbaikalia) [1]. The following magmatism succession was established for the deposit by $^{40}Ar/^{39}Ar$ method: host gabbride –193-192 Ma and granodiorite –168-166 Ma, ore-bearing porphyry – 160-151 Ma, post-ore dikes- 145-140 Ma. $^{87}Sr/^{86}Sr$ in the apatite from different rocks of the Shakhtama deposit is 0.7071÷0.7078 and correspond to intermediate mantle-crust value. $(^{87}Sr/^{86}Sr)_0$ measured by different mineral and bulk isochrones get into the same interval.

Sphene is characterized by another regularities. Its nodules (even in one handle rock sample) have different colors - from light-yellow to grey-brown, and moreover this two varieties often occurred together. Same interval of $^{87}Sr/^{86}Sr$ is characterized by 0.7074÷0.7113.

Grey-brown sphene possess decreased values of $^{87}Sr/^{86}Sr$, comparable with $^{87}Sr/^{86}Sr$ in apatites. Light-colored sphenes have higher $^{87}Sr/^{86}Sr$ – 0.708-0.7113. This fact could be interpreted as following: the subsequent magmatism pulses are accompanied by thermo-fluid influence on older in age rocks. The radiogenic ^{87}Sr, enters into a lattice light-colored sphenes is evolved as a result of decay of the dark-colored minerals.

Acknowledgements

The work was supported by RFBR (grants 03-05-64533 and 04-05-64238).

Reference

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