

The distinction between high- and low-temperature zircon by differences of REE, Th, U contents.

Mihoko Hoshino[1]; Mitsuyoshi Kimata[2]; Norimasa Nishida[3]; Masahiro Shimizu[4]

[1] Earth Evolution Sci.-Univ. Tsukuba; [2] Institute of Geoscience, University of Tsukuba; [3] RFCST, Univ. of Tsukuba; [4] Earth Evolution Sci., Univ. Tsukuba

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A detailed electron microprobe study was carried out on zircons from granitic rocks, Japan. Zircons from the common granites are relatively poor in minor elements (Y_2O_3 less than 1.49 wt%, ThO_2 less than 0.43 wt%, UO_2 less than 2.04 wt%) (HREE-Th-U-poor type), but those from the granitic pegmatites are much richer in Y (up to 10.98 wt% Y_2O_3 ; 0.221 apfu), Th (up to 6.58 wt% ThO_2 ; 0.052 apfu) and U (up to 14.65 wt% UO_2 ; 0.108 apfu) (HREE-Th-U-rich type). Strong enrichment of HREE, Y, Sc preferentially involved the xenotime-type substitution ($(REE, Y, Sc)^{3+} + P^{5+} = Zr^{4+} + Si^{4+}$). Incorporation of U and Th is primarily governed by a combining the substitutions of both thorite-type and coffinite-type ($U^{4+} + Th^{4+} = 2Zr^{4+}$). Zircons with extraordinary enrichment of several elements (e.g., HREE, U, Th) from granitic rocks, Japan are generally anhydrous, implying those are formed by magmatic process. Enrichment in HREE, Th and U is generally observed at zircon from granitic pegmatite and in the rims of zircon from granite. The HREE, Th and U enrichments in zircon, are caused by hydrothermal activity, suggesting that during the last stage of crystallization of Japanese granitic magma, fluids rich in REE, HFSE, and F- were released. Both chemical compositions of zircons from Japanese granites and paragenesis of stilbite with zircons from those granitic pegmatites indicate that the former are formed in high temperature (more than 700°C), and the latter in low temperature (less than 400°C).