

Re-equilibration textures of extremely high U-Th zircon: Records of post-magmatic alterations

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Zircons with extremely high U and Th contents of 12,000~24,000 and 11,000~40,000 mg/kg, respectively, from a leucocratic quartz porphyry in the Weondong area, South Korea, show all possible secondary internal re-equilibrated textures, supporting the concepts of fluid-controlled re-equilibration. Type-I domain, characterized by the steep depletion of Zr and Si, the enrichment of light to middle REEs, Y, Ca, Fe, and Nb contents, and the discordant and much younger U-Pb zircon ages (26 to 48 Mas), should be a typical texture due to the structural and chemical re-equilibration of self-irradiated zircon by a solid-state diffusion-reaction process (SDP). Type-II domain, characterized by the similar stoichiometric Zr, Si values and U and Th contents to those of primary domain, mineral inclusions (mainly thorite) and micro-pores, and continuously scattered U-Pb ages between 56~70 Mas, shows a typical texture due to the chemical re-equilibration by a coupled dissolution-reprecipitation process (CDRP) during interaction with aqueous fluids or melts. Type-III and -IV domains are the typical overgrowth textures formed by a direct crystallization process (DCP) from a zircon-saturated aqueous fluid. Type-V domain is almost same to type-I, due to the later self-irradiation and re-equilibration of type-IV domain by SDP. Each texture domain represents a re-equilibrated zircon, and the re-equilibrated zircon crystals with the composite internal textures would be formed sequentially, or intermittently through multi-genetic processes by post-magmatic fluids between 70~56 Mas. Unusual zircon crystals provide key information to constrain chemically and chronologically the post-magmatic activities in the study area.