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Metasomatic replacement of inherited metamorphic monazite in a biotite-garnet granite from the Nízke Tatry Mountains, Western Carpathians, Slovakia: Chemical dating and evidence for disequilibrium melting

IGOR PETRÍK[1,*] AND PATRIK KONEČNÝ[2]

[1]Geological Institute, Slovak Academy of Sciences, Dúbravská 9, 84005 Bratislava, Slovakia
[2]Geological Survey of the Slovak Republic, Mlynská dolina 1, 81704 Bratislava, Slovakia

ABSTRACT

Granitoid monazite is a potential candidate for restitic origin because of its very low dissolution rates. A biotite-garnet granite (Nízke Tatry Mountains, Slovakia) contains monazite characterized by older, BSE-bright domains irregularly replaced by BSE-dark domains. They are interpreted as the result of late-magmatic replacement by a dissolution-reprecipitation mechanism. Garnet is mostly magmatic, with peritectic cores, and the granite is thought to have formed by biotite fluid-absent melting. Xenotime-monazite and garnet-biotite thermometry yield 600–650 °C at 400 MPa, for Y-rich monazite, suggesting that equilibration took place in the presence of fluid. Chemical and textural relations enable the distinction of four types of monazite, which have been dated. Type I monazite, forming grain interiors, is Th-rich and overgrown by a lower-Th type II variety. Type III monazite has the lowest U and also overgrows the type I, whereas type IV monazite has the highest U (and Y) contents. U/Pb-Th/Pb isochrons reveal that, whereas monazite types I and III are older (355 ± 7 Ma), the age corresponding to the Variscan metamorphic peak, types II and IV are ca. 10 million years younger (346 ± 3 Ma, type IV). Monazite types I-III are considered to be inherited from a metamorphic protolith, whereas type IV is interpreted to be the age of the latest magmatism. Application of LREE and Zr diffusion coefficients to monazite and zircon indicates that the accessory restite assemblage observed is consistent with a short magma residence time (<500 years) during which monazite remained mostly intact, whereas zircon was partly dissolved.

Keywords: Monazite, chemical dating, garnet, biotite granite, restite, disequilibrium, Western Carpathians, Slovakia