MONAZITE FROM A LOW TATRA GARNET LEUCOGRANITE: AGE, ORIGIN AND RELATION TO GARNET

PETRÍK, I.[1], KONEČNÝ, P.[2] & HOVORKA, D.[3]
[1] Geological Institute, Slovak Academy of Sciences, Dúbravská 9, 84005 Bratislava, Slovakia
E-mail: igor.petrik@savba.sk
[2] Geological Survey of the Slovak Republic, Mlynská dolina 1, 81704 Bratislava, Slovakia
[3] Faculty of Sciences, Comenius University, Mlynská dolina G, 842 15 Bratislava, Slovakia

A garnet-bearing leucogranite occurs within the complex of ortho- and paragneisses on southern slopes of the Nízke Tatry Mts. The rock is medium-grained leucogranite with 4% of biotite and up to 4% of garnet. K-feldspar (20%) is perthitic, interstitial, plagioclase (40%, $An_{13\text{-}20}$) forms small phenocrysts. Garnet is euhedral (0.5–3 mm) partly chloritised. Its composition is (centre–rim): $py_{20–7}$, $spess_{5–22}$, $alm_{72–67}$, $andr_{2.5–2}$, $gross_{0.5–3}$. Muscovite was found within feldspars, rarely enclosing fibrolitic sillimanite. Among accessories, monazite is the most prominent forming large subhedral crystals. It is accompanied by apatite and small needle-like zircons, and hosted by quartz, plagioclase or late muscovite.

The rock composition is peraluminous (A/CNK = 1.15) with low Rb/Sr ratio (0.33) and elevated MnO and HREE due to accumulation of garnet. Zr and LREE saturation temperatures give 740 and 809 °C, respectively (WATSON & HARRISON 1983, MONTEL 1993), the higher LREE-derived value being probably due to inherited nature of a large part of monazite.

The big monazite grains commonly show brighter cores and darker rims due to increased Y contents. The darker zones are saturated by Y as documented by small late xenotimes at monazite grain boundaries. Empirical thermometer of PYLE *et al.* (2001) yielded 650 °C for rims and 470 °C in the core probably indicating a restite character of the core, which seems to be inherited from a metamorphic protolith of the granite. The high-Y rims result from exchange reaction with garnet and are, therefore, interpreted as directly related to the granite formation. Garnet is considered a product of incongruent vapour-absent melting of biotite:

Bt + sill + qtz = grt + Kfs + melt

The present biotite may have formed by retrogression of the garnet on cooling segment of the *P-T* path. The assemblage bt – grt – plg – sill – H_2O gives average T = 609 ± 113 °C and P = 4.1 ± 1.9 kbar and 710 ± 139 °C and P = 6.3 ± 2.6 kbar for various garnet rim compositions (THERMOCALC, HOLLAND & POWELL, 1998).

More than 30 grains were dated by microprobe Cameca SX-100 (KONEČNÝ *et al.* 2005) some using detailed profiling: The brighter core containing low Y yielded 352 ± 5 Ma (n = 59) while the rims 334 ± 6 Ma (n = 24). The coincidence of temperatures recorded by monazite Y-rich rims and garnet–biotite suggests that the rims date the last retrogressive event in history of the rock. Retrogression of garnet by biotite and sillimanite by muscovite requires free fluids, which could have acted also as agents between monazite and garnet.

It is concluded that the leucogranite formed 330-340 Ma ago via biotite fluid-absent melting producing peritectic garnet. Fluids evolved during cooling retrogressed parts of garnet to biotite and mobilized Y, which attacked restitic monazite. Dissolved and re-precipitated monazite rims record the lower age limit of this event. The higher limit is given by the age of restitic low Y monazite centres between 350–360 Ma.

References

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