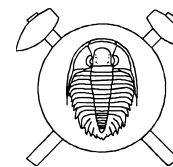


Distribution and stability of monazite and xenotime from the West-Carpathian granitic rocks

I. BROSKA¹ – C. T. WILLIAMS²

¹ Geological Institute of the Slovak Academy of the Sciences, igor.broska@savba.sk

² Natural History Museum London, UK, ctw@nhm.ac.uk



The paragenesis of accessory minerals in granitic rocks depends mainly on water or volatiles contents, and very strongly on aluminosity and alkalinity of the primary melt. Among the range of accessory minerals present, typomorphic REE-bearing accessory minerals, such as monazite or allanite, can help to discriminate (by their presence or absence, or physico-chemical character), between the Palaeozoic orogenic I- and S- type granite suites of the Western Carpathians.

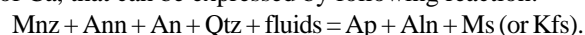
Distribution: The distribution of monazite and allanite, important for distinguishing between I- and S-type granites, has been studied in the West-Carpathian granites. Observed differences in relative abundance of these two minerals can be explained by their different solubilities in peraluminous melt, where the solubility of allanite is higher than monazite (Broska et al. 1999) and so allanite dominates in the I-type granites. In comparison with the I-type granitic rock, total Al in allanite increases with whole rock peraluminosity, usually being above 2.0 Al apfu, in allanites from S-type granites.

Monazite, locally occurring with xenotime, characterizes Palaeozoic S-type granites, only late differentiates of the I-type granitic rocks contain these minerals. Compositionally, monazite, as solid solution of the monazite *s.s.*, brabantite and huttonite components, show some dependency on the primary melt composition, or physico-chemical conditions. The brabantite component increases with peraluminosity and peralkalinity, and the huttonite increases with temperature.

Stability: The stability of monazite is restricted to the fluid regime. Alteration of monazite by subsolidus magmatic fluids can occur at relatively low temperatures. Monazite breaks down from the crystal rims inwards and is replaced by REE-rich apatite. Generally, the newly-formed apatite forms only as very narrow rims on monazite grains, but sometimes the replacement can be extensive. The excess

REE from the alteration of monazite forms as allanite as separated crystals within the rock. Additionally, huttonite can crystallise, this being accompanied by an increase in mobility of actinide elements, U and Th (Broska *et al.*, 2000, Hecht – Cuney, 2000).

Other types of alteration can be seen in higher metamorphic regimes. In amphibolite facies metamorphism, monazite breaks down to allanite, often with an intermediate zone of apatite (Finger *et al.*, 1998, Broska – Siman, 1998). This assemblage is associated with the reaction between biotite, anorthite and monazite-(Ce) with high activity of Ca, that can be expressed by following reaction:



The apatite in such transition zones within monazite-allanite-epidote coronas or grains usually contains very low contents of the REE.

Xenotime is also unstable during metamorphic overprinting in amphibolite facies. Xenotime alteration, similar to that of monazite, results in REE-rich epidote growing as a corona around the xenotime grains. The composition of this epidote is close to allanite-(Y). Such alteration of xenotime has been observed in some orthogneisses (Janák *et al.*, 1999).

The stability of the REE-bearing accessory minerals has not been fully investigated, although their distribution is crucial for the understanding of REE mobility in granites.

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