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Factors controlling whole-rock Ce anomaly in the Lipnice- and Kouty granites, Melechov Massif of the Moldanubian Batholith, Czech Republic

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The primitive Kouty- and Lipnice granites are the first intrusion phase in the Variscan Melechov granite massif. Whole rock analyses of the Kouty type indicate ca. 90 ppm Zr, 50 ppm Ce, and 15 ppm Th, whereas the Lipnice type contains ca. 200 ppm Zr, 140 ppm Ce and 40 ppm Th. Whole rock analyses were taken from a large collection of analyses of each rock type archived at the Czech Geological Survey. The Ce/Ce* ratio (calculated analogically to Eu/Eu* from chondrite-normalized La, Ce, and Pr or Nd), is near 1,1 for both the Lipnice and Kouty granites. In the Kouty type, Ce/Ce* slightly decreases with the differentiation of the parent magma and is negatively correlated with Sn. In the fractionated samples, which were more influenced by fluid activity, Ce/Ce* is more variable but generally lower, and in greisenised rock it is extremely low (0,6). In the Lipnice granite, Ce/Ce* has a strong negative correlation with suitable LREE/Zr ratios and a positive correlation with Rb/Sr. Deviations from these nearly linear relationships are caused by fluid-rock interactions and/or by contamination with a metabasite material. Relations between this Ce-anomaly and other elements as well as its relations to those element ratios, which are used as indicators of magma evolution, are more complicated. This is because of the very similar behaviour of monazite and zircon (the primary carriers of trivalent LREE and tetravalent Ce, respectively), and due to the variable influence of a metapelitic restite. On average Ce/Ce* values calculated according to Nd are comparable with those calculated according to Pr. However, data from the Lipnice granite where Ce anomaly could be calculated from both Pr and Nd in all samples show that the Ce anomaly calculated from La, Ce and Pr has a more distinctive behaviour than that calculated from La, Ce and Nd.

During alteration, e.g. chloritization, albitization etc., of the Lipnice granite, secondary REE-minerals replaced primary monazite in situ. On the other hand, secondary (Th-poor) monazite crystallized from the fluid-transported REE. There is some evidence that during fluid transport, Ce IV was concentrated in the residue due to its lower mobility. In some cases, this fluid probably contributed significantly to the oxidation of Ce III to Ce IV. Ce-oxide and allanite with a highly positive Ce-anomaly have been documented from monazite-replacing minerals. Both phases probably contain the less transported LREE from the original monazite.

In futher studies, microprobe analysis can give further insight into some of the secondary processes which may have fractionated Ce and trivalent LREE. This would allow for the hypothesis that monazite sometimes can contain significant amount of tetravalent Ce to be tested, as well as whether Ce is enriched or depleted relative to other LREEs in altered and secondary monazites to be investigated.

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