GEOCHEMICAL ASPECTS OF THE MINERALISED EARLY CARBONIFEROUS K1-K3 ORTHOGNEISS IN THE FELBERTAL SCHEELITE DEPOSIT (AUSTRIA)

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The Felbertal scheelite mine, representing a world-class tungsten deposit, is located in the polymetamorphic units of the Habach Complex (Central Tauern Window) about 8 km south of Mittersill. A mineralised felsic metagranitoid (K1-K3 orthogneiss) of Early Carboniferous age has been suggested as the possible source for the tungsten mineralisation. Petrographic and field-based studies reveal two distinct types of K1-K3 orthogneiss, a leucocratic microcline/muscovite-rich and a more melanocratic biotite-rich variety, respectively. Geochemically they can be classified as metaluminous to weakly peraluminous high-K calc-alkaline monzogranites, which are characterised by a significant enrichment in Nb, Ta, U, W, Mo, Bi, Rb, Cs, Be and lower concentrations of LREE, Zr, and Sr compared to barren Variscan Central gneisses of the Tauern Window. The high SiO_2 content combined with low K/Rb ratios of the K1-K3 orthogneiss ranging from 75 to 115 indicate a highly evolved magmatic system. An increase of Si and Ta with simultaneous decrease in Ba, Sr, P, Cs, Ti, and LREE (e.g. Eu) in the leucocratic variety of the K1-K3 metagranitoid compared with the biotite-rich orthogneiss is interpreted as a result of fractional crystallisation. The segregation of allanite in the melanocratic orthogneiss, being the main carrier of the LREE, causes the higher concentrations of LREE and higher LREE/HREE values in this darker variety. The high Ti contents of the melanocratic type are explained by the high biotite modal abundance in the rocks and the depletion of P in the leucocratic orthogneiss is induced by fractional crystallisation of apatite. Fractionation of feldspar mainly controls the variation of Ba, Sr, and Eu. When comparing the ratios of geochemically similar elements (e.g. Zr/Hf, Nb/Ta) a significant difference between the two K1-K3 orthogneiss varieties is obvious. Zr/Hf decreases from 20-23 in the biotite-rich metagranitoid to 13-14 in the leucocratic variety. In addition Nb/Ta decreases from 8-10 to 5-6, respectively. Hence, the leucocratic K1-K3 orthogneiss represents the more evolved granitoid. There is no positive correlation between Ta and elements that would be typically enriched during metasomatic processes (e.g. Be) but it correlates with HREE, Y and Hf. This supports the idea that the decrease of Nb/Ta is due to fractionation of an accessory phase (samarskite-(Y)?). Magmatic crystallisation of the granite protolith is followed by interaction with mineralising fluids released during the late magmatic-hydrothermal stage of granite crystallisation. This subsequent fluid rock interaction is for example indicated by K/Rb ratios <150 (DOSTAL & CHATTERJEE, 1995) and elevated F contents in biotite and titanite (KOZLIK & RAITH, in press). Geochemical data and field-observations therefore suggest a more complex magmatic evolution of the K1-K3 orthogneiss protolith. At least two injections of granitic melts can be distinguished.

DOSTAL, J., CHATTERJEE, A.K. (1995): Chem. Geol., 123, 67-88.
KOZLIK, M., RAITH, J. (in press): Abstract for the 12th SGA Biennial Meeting.