Geophysical Research Abstracts, Vol. 8, 01747, 2006
SRef-ID: 1607-7962/gra/EGU06-A-01747

Magmatic *versus* metasomatic origins for tantalum mineralisation at the Tanco Deposit, Manitoba, Canada

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Tantalum is a key element in the current electronics industry and its demand has steadily increased with the advent of laptop computers and cellular phones. For this reason, there is a strong will to understand tantalum mineralizations, particularly in their most common host rocks, $i.e.$ rare-element granitic pegmatites. Although rare-element granitic pegmatites have been the object of many studies that investigate their internal structure, mineralogy and petrogenesis, the processes that control tantalum mineralization remain poorly understood. In particular, the role of fluids in tantalum ore precipitation is largely unknown, and very few studies have provided insights on the relative contributions of magmatic *versus* metasomatic processes to tantalum mineralization. One of the major problems arises from the difficulty in distinguishing primary magmatic from secondary, hydrothermal textures in such complex rocks.

In the Tanco pegmatite, Manitoba, Canada, tantalum mineralization shows a complexity that reflects the complex petrogenesis of its host pegmatite. Tantalum occurs in the form of at least eight distinct oxide families in various associations. Tantalum is particularly abundant in central zones of the pegmatite, which consist of mica-quartz alteration after microcline. Thus, this pegmatite provides a unique opportunity to investigate Ta mineralization in both primary magmatic zones and late replacement zones. Our study investigates the relative contributions of magmatic *versus* metasomatic processes in two different styles of tantalum mineralization in the Tanco pegmatite. It focuses on two complementary areas, one where tantalum is hosted by aplite and associated with early magmatic zones, and the other where tantalum is associated with mica alteration in late central zones. This later area occurs in the Tanco Lower pegmatite, a separate body beneath the main Tanco deposit.

The various tantalum oxides were investigated in detail texturally and chemically (2000 electron microprobe analysis, 100 backscattered images, 12 element maps). Chemical variations in the columbite quadrilateral were constrained for columbite- and wodginite-group minerals, both at the crystal scale and at the pegmatite scale (i.e from earlier to later zones). In the Tanco Lower pegmatite, the particularly complex textures in Ta oxides suggest a possible role of metasomatic fluids in the crystallization of some Ta phases. These textures are considered in conjunction with the available experimental data to evaluate whether the mineralization is a result of primary magmatic or late hydrothermal processes. We conclude that tantalum mineralization is essentially magmatic in origin, although late pegmatitic fluids may have an indirect role in Ta oxide crystallization.