

Origin of iron-titanium oxide and apatite rocks, Western Transbaikalia

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The origin of the Fe–Ti–V-rich oxide melts is uncertain, but we suggest that these melts formed as immiscible melts within the magma chamber and then settled to the bottom of the chamber, where they accumulated. Nelsonites, which are composed of massive iron oxides and apatite, have been reported in Chile, Mexico and Sweden. It has been documented that they formed directly from immiscible Fe-Ti-P oxide melts. They are usually associated with anorthosites and some alkaline igneous rocks and may be directly comparable with the oxides in Arsenyev massif. These intrusions are related to rift-like structures of various ages and close to alkaline basalts by geochemical characteristics.

Oxide-apatite rocks are concluded to have formed as immiscible liquids, which separated from magmas that underwent strong differentiation. It is postulated that high sodium contents in the silicate magmas play an important role in forming these immiscible liquids [1].

Estimates of crystallization temperature were obtained from coexisting ilmenite-magnetite pairs, using the Fe-Ti oxide geothermometers [2, 3]. Temperature and oxygen fugacity were calculated for ilmenite-magnetite pairs using the ILMAT-1.20 and MELTS programs. ILMAT-1.20 gave temperature estimates for ilmenite-magnetite pairs 640°C for disseminated ores and 669°C for massive ones. However, the MELTS program gave lower estimates for temperature. For example, for magnetite with 6.48 wt. % TiO₂, the ILMAT-1.20 model gives 720°C, compared with 514°C respectively for the MELTS model. At 6.48 wt. % of TiO₂ ILMAT produces log₁₀fO₂ of (-17.25), whereas MELTS yields ΔlogfO₂ of NNO (-2.86).

[1] Philpotts (1967) 'Origin of certain iron–titanium oxide & apatite rocks.' *Economic Geology* **62**, 303–315. [2] Andersen D.J. & Lindsley D.H. (1985) New (and final) models for the Ti-magnetite/ilmenite geothermometer & oxygen barometer. Abstract AGU 1985 Spring Meeting Eos Transactions. American Geophysical Union 66 (18) 416. [3] Ghiorso & Sack (1991) 'Fe-Ti oxide geothermometry, thermodynamic formulation & the estimation of intensive variables in silicic magmas.' *Contributions to Mineralogy & Petrology* **108**, 485–510.

Sources of colloidal and dissolved loads over the hydrological cycle in Siberian rivers

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High latitude permafrost-dominated areas such as Central Siberia present an atypical hydrological cycle punctuated by an important spring flood resulting from snow melting. However, chemical variations in river waters associated to these hydrological variations are rarely taken into account in environmental geochemistry studies. This study aims to work out how the highly contrasted hydrological cycle and the presence of permafrost influence the temporal pattern of chemical element migration. For this purpose, major and trace element concentrations as well as Sr and U isotopic ratios were analyzed in the dissolved load of two Siberian rivers regularly sampled over two hydrological cycles (2005-2007), Nizhniya Tunguska and Kochchumo rivers, following the classical approaches used in the lab (e.g. [1]). Our results highlight that DOC and traditionally insoluble elements such as Al and Fe, but also REE and Th, are mobilized as a major colloidal flux at the spring flood and to a lesser extent during the summer period. The data show the occurrence of two colloid sources, successively involved over time: during the spring flood, the main source of colloids is the uppermost organic soil horizon whereas later in summer colloids come mainly from deeper soil compartments. Similarly, the results point out that the dissolved load of these rivers have to be explained in terms of mixing between deep underground brines that dominate during winter and a summer suprapermafrost flow draining deep soils, with a minor contribution of shallow soil layers during spring flood. It is critical to consider these temporal variations in the intensity and in the nature of dissolved geochemical flux in order to establish reliable chemical budgets and to evaluate weathering rates in boreal regions.

[1] Durand *et al.* (2005) *Chem. Geol.* **220**, 1–19.