Origin of Archean adakites and NEBA from the Upper Keewatin assemblage, the Lake of the Woods greenstone belt, Western Wabigoon Subprovince, Superior Province

OSAMU UJIKE[1] AND ALAN M. GOODWIN[2]

[1] Department of Earth Sciences, Toyama University, Gofuku 3190, Toyama 930-8555, Japan (ujike@sci.toyama-u.ac.jp)

[2] Department of Geology, Earth Sciences Centre, University of Toronto, Toronto, M5S 3B1 Canada (a.goodwin@utoronto.ca)

Samples and procedure

The Upper Keewatin assemblage (~2720 Ma) of the Lake of the Woods greenstone belt consists of calc-alkaline, tholeiitic to komatiitic and shoshonitic volcanic rocks and turbiditic sedimentary rocks (Ayer and Davis, 1997; Ujike and Goodwin, 2002). Among them we ana-lyzed 21 adakites and 8 Nb-enriched basalts and andesites (NEBA), using XRF and INAA. The criteria of NEBA (ppm Ta >0.4 and $(Ta/Th)_{pm}+(Ta/La)_{pm}$ >0.6) follow Polat and Kerrich (2001), on the assumption that Nb/Ta =17.6.

Analytical Results and Discussion

The adakites, excluding those with Ni <15 ppm, show only a small or no positive Sr anomaly in a primitive mantle-normalized plot and increase in Eu/Eu* and Al_2O_3/Y as Ni decreases and SiO_2 increases, suggesting that (1) their parental magmas formed, leaving residual plagioclase and (2) the magmas decreased in these ratios by interaction with the mantle.

The NEBA are higher in CaO/Al_2O_3 and FeO.t than the contemporaneous shoshonites at MgO =8 %, suggesting that their parental magmas formed by greater degrees of melting than the latter. We interpret this observation to indicate that the parental magmas of the NEBA were derived from diapirs adiabatically ascending from the lower part of the mantle wedge. Despite the fact that the source of NEBA would have selectively scavenged Zr and Ta from the ascending adakite magmas, the adakite samples do not show systematic decrease in either Zr/Zr* or Ta/Ta* with decrease in SiO_2 content, which presumably reflects a limited extent of magmatic interaction with the mantle. Magmas parental to the adakites are suggested to have formed at different depths, probably due to a change in geothermal gradient along the subduction zone.

References

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The solubility of molybdenum determined in synthetic fluid inclusions by LA-ICPMS analysis

THOMAS ULRICH

Geology Department, Australian National University, 0200 Canberra, Australia (thomas.ulrich@anu.edu.au)

The understanding of crustal fluid compositions and the formation of potential ore forming fluids, among many other factors, is based on the solubility of the different elements in these environments.

In this study the solubility of molybdenum (as Mo and MoO_3) is investigated under magmatic-hydrothermal conditions (700°C, 2kbar). The experiments were run either as single capsule or double capsule (experiments that include a fO_2 buffer) configurations in cold-seal pressure vessels. Next to the starting materials a small quartz rod is loaded to trap fluid inclusions. The experimental approach of using synthetic fluid inclusions is to simulate as closely as possible natural processes and to sample the fluid (trapping the inclusions) at high P and T.

To investigate the possible ligands for Mo transport, starting materials consist of Mo powder and KCl-H_2O solutions (5, 10, 55wt% KCl) to explore the effects of Cl concentration on the solubility. In another set of experiments the starting components consisted of MoO3 and H2O to test the effect of hydroxy and molybdate complexes on the solubility.

To test the effect of the oxygen fugacitiy on Mo solubility, different buffers (NNO, MH, ReReO) were used in the experiments. All experiments are pH-buffered by Kfsp-mus-qtz. Additionally, Y and Cs were added in known concentrations as an internal standard to most of the experiments. The experiments were run for 10 days.

Analyses of Mo in solution were carried out by ablating single fluid inclusions with an Excimer ArF laser (193nm wavelength) that is attached to an Agilent 7500s ICPMS. Standardization and quantification of the fluid inclusion analyses is done by using the NIST 612 glass as an external standard and Cs and Y concentrations as internal standards.

Preliminary results show generally high solubilities (hundreds of ppm) for most of the experiments, but are associated with relatively large standard deviations. This might be related to the uncertainty of homogenous fluid trapping during the experiment and/or the homogenous sampling during laser analysis. Both processes will affect the internal standard elements, and thus, the quantitative results of the fluid inclusion analyses. To distinguish more clearly the effects of the different parameters and to consolidate these results more experiments are currently undergone to better control or check for uncertainties.