## Testing the utility of trace element geochemistry of apatite as a petrogenetic indicator

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Apatite, formula $CaPO_4$ (F, Cl, OH), is the most common of the phosphate minerals. It is a common accessory mineral in




Atlantic Geology, 2007, Volume 43, Number 1

many igneous and metamorphic rocks. In addition, the structure of apatite allows for a wide range of substitutions, notably of measurable quantities of REEs, U, Y, Sr, Mg, Na, and Mn. Its common occurrence and potential for high variability of trace element chemistry make apatite a good candidate for use as a sensitive petrogenetic indicator.

In order to assess the usefulness of trace elements in apatite as an indicator of petrogenesis, a study of trace element geochemistry of apatite grains from spatially related but lithologically or stratigraphically distinct rocks will be undertaken. The study will consist of three main points: 1) assess the intra-sample variation in trace element chemistry exhibited by samples of apatite standards from Sludyanka, Durango, Kola and others; 2) from felsic tuff horizons from the Dolomites of Northern Italy, assess the variation in trace element chemistry of apatites within each horizon, then assess the variation between separate horizons; determine whether trace element chemistry of apatite can be used to correlate these tuffs between locales; and 3) from the Lyon Mountain gneiss from the Adirondacks, determine if there is a relationship between trace element chemistry of apatite and location within specific zones of alteration or mineralization.

This study will employ CL, BSE, EPMA and LA ICPMS analyses. From the samples to be studied, apatite grains will be picked and mounted in epoxy. A CL map of the mount will be made. BSE photographs of all grains to be analyzed will be taken. The EPMA will be used to measure F, Cl, Mn, P, Ca, Fe, Mg, and Sr. Then the LA ICPMS will be used to measure trace element chemistry. The Ca concentrations derived from the EPMA will be used as an internal standard, to normalize the LA ICPMS counts to concentrations.

Two datasets will be incorporated into this project. Earlier apatite analyses performed by John M. Hanchar in 2002, using the methodology described above, will form the dataset for interpretation of the Italian felsic tuff horizons, and part of the dataset for investigation of variation in the recognized apatite standards. A second dataset will be collected during the Fall of 2007, from apatites from the Lyon Mountain gneiss as well as the Sludyanka standard.

Interpretation of the data will involve constructing plots and performing statistical analysis. X-Y variation diagrams and REE chondrite-normalized plots will be constructed. Type plots discussed in academic literature will be constructed and assessed. Statistical analysis will be employed to quantify the variation observed in trace element concentrations, and to determine if the degree of variation is statistically meaningful.

The final aims of the project are to determine if trace element chemistry of apatite can be used as an indicator of petrogenesis, and if so, what are the best trace element comparisons for distinguishing different suites of apatite. If the results are positive, it could be a powerful tool in the determination of petrogenesis, with applications in stratigraphic correlation and modeling of ore-forming processes.