An Analysis of Apatite Chemistry in Garnet Porphyroblasts and in the Matrix of Metamorphic Rocks

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Introduction
There is a relatively small amount of data available relating to apatite chemistry in metamorphic rocks. In this paper I will attempt to analyze apatite in garnet porphyroblasts and in the matrix of metamorphic rocks to determine if petrographic location has any effect on the chemistry of the apatite. The analysis will focus mostly on apatite's halogen end members fluoride and chloride. In order to accurately assess any measured difference the relative timing of garnet growth must also be determined.

Background
The samples for this study were collected for another University of Maryland undergraduate research project in Coos Canyon, Maine. The rocks exposed at Coos Canyon are part of the Perry Mountain Formation. The Perry Mountain Formation is part of the Silurian clastic wedge, which was deposited on top of a very thick Late Ordovician clastic sequence in the Merrimack Synclinorium (Osberg et al. 1968; Bock et al. 2004) The rocks found here are bedded quartzo-feldspathic schist containing garnet (up to 0.5 cm diameter) porphyroblasts sharply interbedded with light gray plagioclase-quartz amphibolite and granular to vitreous light-gray quartzite (Burton et al. 2000).

Methods
Sent out 6 samples to be made into thin section
Extensive petrographic analysis of new sections to find apatite
Analyzed sections using Electron Probe Microanalyzer to determine apatite chemistry
Elements apatite was analyzed for include F, Cl, P, Fe, Na, Ca, Mg, Mn, Sr, La, Si, Ce
Compiled and organized data for use in analysis

Accuracy and Precision
In any scientific study before you can attempt to draw any conclusions it is important to assess the accuracy and precision of the data that has been collected. Accuracy is a measure of how close the measured results that were obtained are to the actual values which are determined with the use of standards. In this study samples were used to calibrate the probe. From these standards error can be measured. If the error in a measurement was found to be above an acceptable level the data was discarded. Doing this ensures that the data is accurate. As a measure of accuracy, for each probe session, I measured the composition of Durango Apatite. Durango Apatite has the accepted value of 3.53 weight % F and 0.41 weight % Cl. The Durango Apatite was analyzed 25 times by the probe and yielded 3.58 weight % F and 0.44 weight % Cl.

Conclusions
Apatite chemistry does not vary as a function of petrographic location
Apatite grains that are inclusions in garnet porphyroblasts are not shown to have different chemistry than grains located in the matrix
It is unknown whether this is true for apatite in other metamorphic rocks
Apatite of the Perry Mountain Formation is dominated by the F Ap component

References
Bock, B., et al., 2004, Scale and timing of Rare Earth Element redistribution in the Taconian foreland of New England: Sedimentology, v. 51, pp. 885-897