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V45D-0173 - Survey of Adirondack Metamorphic Temperatures Using Quantitative EDS Mapping

Thursday, 16 December 2021
16:00 - 18:00
<i>Convention Center - Poster Hall, D-F</i>

Abstract

Despite renewed interest in the temperatures and pressures of Adirondack metamorphism in recent years, many localities have not been studied in-depth for several decades. We used an SEM with a large-area SDD EDS detector to create long-duration (6–18 hour) calibrated X-ray maps in order to reexamine three types of Adirondack rocks: a migmatite, an amphibolite, and a metagabbro. In addition, data processing using XMapTools enabled us to quickly calculate bulk compositions and temperatures with built-in empirically calibrated thermometers. The migmatite sample, sourced from Treadway Mountain, contains feldspar-rich leucosomes and garnet-biotite rich melanosomes, but kyanite and sillimanite were not observed. Ti-in-biotite thermometry yields a 750°C formation temperature, and metamorphic assemblage modelling in *Perple_X* of local bulk compositions calculated from quantified X-ray maps indicate temperatures comparable to previous literature. Grt-Bt thermometry results in lower temperatures of 650°C, which is consistent with diffusive resetting during slow cooling. The Pine Hill metagabbro displays coronitic textures between olivine and plagioclase, with concentric shells of garnet and OPX; however, several sites also exhibit equant textures of garnet, plagioclase, CPX, and hornblende. A 700°C formation temperature was calculated using both Grt-CPX and Grt-Hbl thermometry. A sample from the Gore Mountain amphibolite, composed of garnet, hornblende, and plagioclase, yields a peak temperature (Grt-Hbl) of 861°C that is consistent with most other recent thermometry. However, it measures approximately 100°C lower than recent temperatures from larger rutile inclusions in garnet, as well as homogenization temperatures of melt inclusions. Our mineral compositions and calculated temperatures match closely with published literature; further WDS analysis will aid in confirming these results. XMapTools allowed us to process data efficiently and with relative ease. The application of thermometers using tens of thousands of mineral pairs allows for a better assessment of sample homogeneity and thus precision. Such an approach shows promise both in research and in teaching.

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- O** Online Only Sessions
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- S** Scientific Workshops
- A** AGU Events
- P** Pod Reservation System
- O** Online Summary Sessions
- S** Suggested Itineraries

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