

## Geosciences and Environmental Science Colloquium Series

11:00 AM, Monday, February 6, Bolin 115

Dr. Jay Thomas, Associate Professor, Syracuse University

*"Out of (chemical) equilibrium and into metamorphic depths: mineral inclusions in garnets and elastic thermobarometers reveal true crystallization depths"*

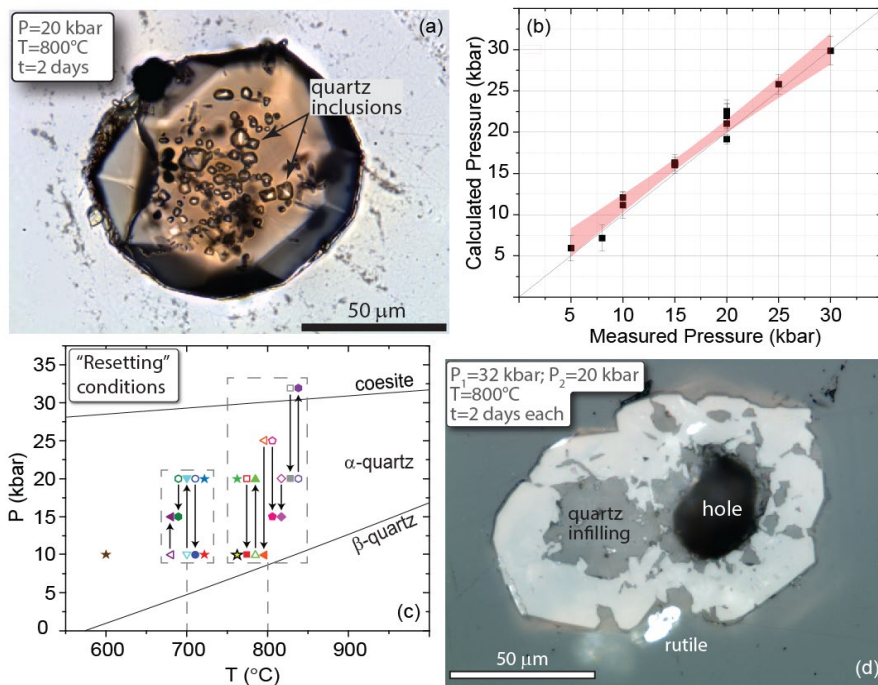


Figure 1. (a) Transmitted light micrograph of experimentally grown garnet with quartz inclusions. (b) Measured experimental pressures compared to average calculated entrapment pressure. The red-shaded region shows the 95% confidence band, and the black diagonal line is a 1:1 correlation. (c) Plot showing changes to experimental conditions in runs used to evaluate stress relaxation and inclusion "resetting". Experiments were run at each condition for at least two days. Arrows point to the final run conditions. (d) Garnet crystals from a stress-relaxation experiment. Coesite crystals trapped at  $P_1$  exploded when pressure changed to  $P_2$  in the quartz stability field leaving holes that sometimes filled with quartz.

### Summary

The presentation will summarize experimental research to develop the quartz-in-garnet elastic thermobarometer used for estimating the pressure (depth) and temperature at which garnet-bearing rocks crystallize. For more than 150 years scientists recognized that mineral inclusions can have remnant pressures potentially relatable to the pressure (depth) and temperature at which they crystallized (Sorby and Butler 1868). In summary, when a mineral grows around an inclusion, the cavity in the host mineral perfectly accommodated the volume of its inclusion, and the pressure applied to both the inclusion and host were equivalent. Subsequent changes in pressure ( $P$ ) and temperature ( $T$ ) during exhumation can cause the host and inclusion volumes to change by different amounts to produce inclusions with remnant pressures. I will describe advances over the last decade to determine entrapment conditions of quartz inclusions in garnet. The presentation will also show how we combine the quartz-in-garnet elastic thermobarometer with other thermobarometers to estimate the  $P$ - $T$  crystallization conditions of rocks. Finally, I will describe ongoing experiments to evaluate how stress relaxation caused by changes to  $P$ - $T$  conditions can "reset" remnant pressures in quartz inclusions during exhumation.