INTEGRATED ANALYSIS OF A SINGLE TURBIDITE FOLD FROM THE UPPER GRANITE GORGE OF GRAND CANYON AND THE ROLE OF DYNAMIC DIGITAL MAPS IN MICROSTRUCTURAL OBSERVATIONS.

MATTHEW CLEVELAND, University of Massachusetts

A single sample of folded Paleoproterozoic turbidite from the Upper Granite Gorge of the Grand Canyon has been studied using a combination of structural, microstructural, petrologic, thermodynamic and geochronologic analysis in order to characterize the P-T-t-D history. High-resolution images, ranging in scale from full-section to single mineral, have been used to track matrix fabrics and inclusions relationships. The sample is dominated by a bedding-parallel composite S1 fabric folded by open to tight upright folds. Porphyroblasts (Grt, Bt) grew early in D2; they contain S1 inclusion trails but are oriented in S2. Electron microprobe compositional maps of garnet, plagioclase, and matrix domains have been used to correlate porphyroblast growth histories and to constrain thermodynamic models. Mn-maps of garnet show dramatic concentric zoning that may be a proxy for growth timing. Monazite occurs as a matrix phase and as inclusions within single garnet grains. Traces across the garnet grains give a maximum pressure of around 7kbar and a maximum temperature of about 600°C. This fold experienced temperatures and pressures well within the Kayanite stability range.

The analysis and re-analysis of metamorphic tectonites such as this require close linkage of optical and compositional images, microstructural measurements and observations, compositional analyses, and petrological models. The maintenance of this linkage is critical if other workers are to utilize existing data to answer new questions. The second part of this study involves the development of a data analysis/storage system with full integration of images, observations, and quantitative data. Dynamic Digital Maps (DDMs) have been developed to integrate geologic maps, field observations, and analytical data. We use full-thin-section images as DDM base maps for fully-linked thin section databases. The DDMs provide an efficient tool for analyzing and integrating data during the primary data collection and analysis. Single thin sections, and the resulting P-T-t-D histories become single data points for regional tectonic analysis. Importantly, the DDMs also allow new workers to analyze the specimen and sample the data in new ways. This type of integration of multi-scale images, observations, and data will be critical if tectonic data are to be archived and reused in the future. The relevant use of DDMs was shown by the need for individual grains to be seen separately and as a part of the fold.