

Building a dynamic image-based database: Integrating thin section images and data using Dynamic Digital Maps

Williams, M.L., Cleveland, M., Condit C.D., Department of Geosciences, University of Massachusetts, Amherst, MA 01003, mlw@geo.umass.edu.

The analysis and re-analysis of metamorphic tectonites and many other geological materials require close linkage of optical and compositional images, microstructural observations and measurements, compositional analyses, and petrological models. The maintenance of this linkage, especially between images and data, is critical if other workers are to utilize existing data to answer new questions. We present an image-based data analysis/archival 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 dynamic thin section databases. Images, at a variety of types and scales, are directly linked to data sets ranging from mineral analyses, whole-rock analyses, geochronologic information, and texture/fabric data. In addition, the DDMs are linked to tools for analysis of raw data and for modeling and integrating results. The linked tool set is a critical value-added component such that the DDMs are not only an archiving tool but also a powerful tool for analyzing and integrating data during the primary data collection and analysis stage of a project. Essentially, single thin sections, and the resulting Pressure-Temperature-time-deformation (P-T-t-D) histories, become dynamic multifaceted nodes in a regional tectonic database. Further, because the DDMs access raw analytical data (microprobe traverses, geochronological analyses, etc.), new workers can reanalyze a specimen and resample data in new ways. This type of integration of multi-scale images, observations, and raw data will be critical if tectonic data are to be archived and reused in the future. Using "DDM templates", DDMs are easy to create and modify without extensive GIS background. As an example, a DDM thin section database has been generated from a single sample of folded Paleoproterozoic turbidite from the Upper Granite Gorge of the Grand Canyon. The DDM integrates structural, microstructural, petrologic, thermodynamic and geochronologic information all critical for characterizing the P-T-t-D history. High-resolution images including optical images, microprobe compositional maps, QuickTime movies, electron images, and interpretive sketches, ranging in scale from full-section to single mineral, have been used to document texture, fabric, and compositional relationships. The integration of images, interpretations, and raw compositional data allow workers to analyze and archive data and interpretations from new or on-going studies while also allowing future workers to utilize existing data for constraining entirely new research questions and hypotheses.