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Research Report, Dr. Gray E. Bebout, Lehigh University, USA
For visit to the ISEI/PML August 8 to August 22, 2001

Part of my recent research has focussed on study of crust-ocean-mantle chemical cycling at convergent margins, and has paid particular attention to the record of the cycling of volatile components in subducting sedimentary and oceanic crustal rocks. My recent work on subduction-zone cycling has turned to work examining records of devolatilization and element mobility in deeply subducted rocks in the European Alps, specifically those in NW Italy and Eastern France. These rocks have experienced complex metamorphic history not only during their deep subduction, but also related to their complex exhumation histories. This superposition of mineral assemblages (with complex textures) related to multiple tectonometamorphic stages necessitates the use of analytical methods affording high degrees of spatial resolution, while maintaining high degrees of analytical precision and accuracy. This PML possesses SIMS (ion microprobe) facilities that allow high spatial resolution analyses of trace element concentration and stable isotope composition and produce data with quality exceeding that of any other laboratory.

On my visit August 8-22, 2001, I undertook detailed ion microprobe analyses of trace element concentrations in UHP metamorphic rocks from the Lago di Cignana locality, Valtournenche (Italy), Monviso (Italy), and exposures of the Schistes Lustres in the Cottian Alps, also in Italy. The work focussed on analyses of porphyroblasts such as garnet and tourmaline, and their mineral inclusions (e.g., mica, clinopyroxene), and matrix phases (e.g., micas, clinopyroxene, zoisite) with the goal of assessing whether or not a sufficient chemical/mineralogical record exists for reconstruction of element mobility during prograde devolatilization of the rocks. The Lago di Cignana and Monviso rocks experienced peak metamorphic pressures exceeding 2.4 GPa (perhaps as high as 2.9 GPa for the LDC rocks), and these rocks can conceivably provide a record of devolatilization and element mobility at depths approaching those beneath volcanic arcs (>80 km). Together, these suites provide the ability to examine fluid-rock history and chemical evolution in both seafloor altered oceanic crust and overlying seafloor sediment, lithologies thought to contribute chemical components to arc lava source regions. The Schistes Lustres contains tectonometamorphic units of largely metasedimentary compositions that have been peak-metamorphosed at conditions of ~1.0 to 1.8 GPa, thus potentially affording assessment of devolatilization in units subducted

to depths intermediate to those of the peak metamorphism of the Lago di Cignana and Monviso rocks and those experienced by the Catalina Schist and Sambagawa Belt suites we have worked on previously (up to ~1.0 GPa represented by these two circum-Pacific suites). While at the ISEI, I also worked briefly with Michael Walter in verifying the presence of coesite in some of the Italian rocks using Michael's laser Raman setup.

One of the primary goals of this visit was to further confer with Eizo Nakamura and other colleagues at the PML (Katsura Kobayashi and Takuya Moriguti) in conceptualizing projects to be undertaken by one or two of my new Ph.D. students. These students, formally Ph.D. students at Lehigh University, would visit the PML for periods of 6-12 months each and would undertake appropriate analytical work aimed at the problems above and under the direction of Eizo Nakamura.