2004 Denver Annual Meeting (November 7–10, 2004)

Paper No. 50-13

Presentation Time: 1:30 PM-5:30 PM

A GEOCHEMICAL INVESTIGATION OF TEMPERATURE CHANGE AND FLUID FLOW DURING HIGH PRESSURE METAMORPHISM IN SYROS, GREECE

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In order to understand metamorphic history of Syros, Greece, a petrologic and geochemical analysis of marbles and calc-silicates was undertaken. Temperature estimates made using calcite-graphite carbon isotope thermometry and calcite-dolomite cation exchange thermometry were compared to temperatures obtained from petrologic geothermobarometry. In addition, carbon and oxygen isotope analyses of carbonates were used to investigate fluid flow in marbles.

Three distinct rock units on Syros all appear to have experienced a high pressure-low temperature blueschist to eclogite grade event at ~ 55 Ma and a greenschist overprint at ~ 25 Ma. Equilibrium mineral assemblages in marbles include epidote-group minerals that indicate that peak temperatures were between 510° and 600° C, while garnet-bearing assemblages indicate that retrograde metamorphic temperatures were above 530° C. Temperatures estimated using calcite-graphite thermometry averaged 335° C ± 67° C, while estimates made using calcite-dolomite geothermometry yielded temperatures of 407° C ± 111° C.

Of these, silicate mineral assemblages most likely provide accurate estimates of peak and retrograde temperatures. Estimates made using calcite-graphite thermometry reflect prograde conditions, resulting in lower temperatures because graphite crystals in marble did not fully equilibrate with surrounding calcite. In contrast, calcite-dolomite temperatures likely represent retrograde conditions as re-equilibration between phases can occur quickly even at lower temperatures.

Fluid flow during metamorphism appears to be limited. Positive correlations between carbon and oxygen isotope ratios of carbonates at hand-sample scale are consistent with variable loss of small amounts of fluids during prograde decarbonation reactions. In turn, isotope heterogeneity between hand-samples over an outcrop scale and limited isotopic exchange across silicate-marble contacts indicates that fluid movement was localized and was not pervasive in marble units or between marble and surrounding metapelite units. By investigating metamorphism on Syros using these different methods, it is possible to provide a more complete metamorphic history of the island.

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General Information for this Meeting

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