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253-9: RESOLVING THE AGES AND NATURE OF INTRUSION, METAMORPHISM AND PARTIAL MELTING IN MIGMATITE: AN EXAMPLE FROM FIORDLAND, NZ

Tuesday, 24 October 2017
09:00 AM - 06:30 PM
Washington State Convention Center - Halls 4EF

Zircon and garnet geochronometers (U-Pb, Sm-Nd, & Lu-Hf) are used for understanding outcrop- and orogenic- scale processes in lower crustal rocks. These isotopic systems often yield a range of ages that may reflect igneous and metamorphic processes. Therefore, ages can be difficult to interpret without additional data. Migmatite from the Malaspina Pluton provides an excellent example because zircon and garnet are found in a wide variety of textures. Textural occurrences and trace element mineral compositions provide critical constraints for age interpretation and the origin of leucosomes.

Garnet and zircon occur in cross-cutting leucosomes, vein selvages, adjacent garnet reaction zones (GRZ), and host orthogneiss. These leucosomes have been interpreted as in-situ or externally derived melts. Zircon dates cannot be grouped into populations based on spatial occurrence or on CL type; however, there are distinct age and compositional groups. Zircon from host and GRZ have chondrite-normalized REE patterns with enriched Ce, small negative Eu anomalies, and HREE enrichments with positive slopes. Trace element compositions of zircon define 2 populations with high HREE & Hf (host) and low HREE & Hf (GRZ). In addition, zircon from host and GRZ show distinct Th versus U trends, indicating that older GRZ zircon are not derived from the host rock. Single crystal Pb/U zircon ages are 118.3±0.1 to 115.7±0.1 Ma (CA-TIMS) and Pb/U zircon spot ages are ca. 121 to 110 Ma with some young cores (SHRIMP-RG). Sm-Nd garnet ages from ca. 1 cm grains in vein selvages and porphyroblasts not associated with leucosome veins are 112.8±2.2 and 110.8±2.0 Ma, respectively. Selvage garnet also yield a Lu-Hf age of 114.8±3.5 Ma. Chondrite-normalized REE patterns for selvage garnet have HREE enrichment with near-horizontal slope. The zircon and garnet REE data are compatible with little or no co-equilibrium.

We conclude that: 1) the oldest zircon ages (> 119 Ma) are inherited, 2) the pluton intruded at ca. 118 Ma, 3) high-grade metamorphism and partial melting occurred between 115 & 112 Ma based on garnet & younger zircon ages, 4) the youngest zircon core dates of ca. 110 Ma are compatible with some Pb loss, 5) Sm and Nd diffusion in garnet cannot be ruled out, and 6) the two distinct compositions of zircon are compatible with injection of externally derived melts.

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