

Cordilleran Section - 116th Annual Meeting - 2020

Paper No. 3-2

Presentation Time: 8:30 AM

GEOCHRONOLOGY IN THE BOWELS OF MAGMATIC ARCS: A TALE OF TWO MINERALS, FIORDLAND NEW ZEALAND

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Precise and meaningful ages are essential for understanding thermal and mass fluxes within magmatic arcs and between arc crust and adjacent mantle. Isotopic dates are readily determined; however, direct ties between ages, magmatism, and metamorphism may not be apparent. SHRIMP-RG and CA-TIMS zircon, and ID-TIMS garnet ages outline the possibilities and limitations in rocks from the lower crust of the Fiordland magmatic arc where metamorphic temperatures were $>850^{\circ}\text{C}$ at ~ 14 kbar.

We present data for 3 migmatitic orthogneiss samples containing melt veins, garnet selvages, and garnet reaction zones (GRZ): 09NZ22-Crooked Arm, 15NZ25-Bligh, & 13NZ34b-Acheron. In 09NZ22, U-Pb zircon ages from the host and GRZ range from c. 121 to c. 116 Ma and do not define distinct populations based on age, morphology, or CL. Ten CA-TIMS zircon ages ranging from 118.3 ± 13 to 115.7 ± 18 Ma record episodic magmatism. The larger range of SHRIMP-RG ages record magma emplacement, metamorphic dissolution-reprecipitation, and local Pb loss. Garnet Sm-Nd ages range from 113.1 ± 2.3 to 103.6 ± 2.3 Ma and display systematic correlation with grain size. Ages for c. 1 cm garnet record growth during metamorphism, while the 0.1-0.3 cm grains with younger ages reflect intracrystalline diffusion and Sm-Nd closure. In 15NZ25, LA-ICPMS U-Pb zircon ages from the matrix and inclusions in large garnet porphyroblasts are 121.4 ± 1.5 Ma (N=11) and 114.7 ± 1.1 Ma (N=25/26), respectively. We interpret older zircon to record magma emplacement and younger zircon to record metamorphism. Sm-Nd ages for >1 cm garnet record growth during metamorphism at 112.3 ± 2.0 (core-mantle, N=4) followed by overgrowth and/or diffusion at 106.9 ± 3.1 Ma (rim, N=2). In 13NZ34, Sm-Nd ages for 1 cm garnet record growth from 115.9 ± 1.1 Ma (core, N=5) to 111.3 ± 1.8 Ma (rim, N=4), while c. 0.2 cm grains record closure of Sm-Nd to diffusion at 103.9 ± 1.8 Ma (N=7).

The 3 migmatitic orthogneiss samples illustrate that: 1) large age uncertainties for SHRIMP-RG U-Pb zircon give estimates for magma emplacement but cannot resolve protracted magmatic processes, 2) CA-TIMS U-Pb zircon dates document timescales of protracted magmatism, 3) Sm-Nd ages for ca. 1 cm garnet grains reflect garnet growth at peak temperature, and 4) Sm-Nd ages for 0.1 to 0.3 cm garnet grains reflect cooling through c. 750°C .

Session No. 3

[T16. Metamorphic Processes in Cordilleran Arc Systems](#)

Tuesday, 12 May 2020: 8:00 AM-12:00 PM

Madera Room (The Westin Pasadena)

Geological Society of America *Abstracts with Programs*. Vol. 52, No. 4
doi: 10.1130/abs/2020CD-347006

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