Boron isotope constraints upon fluid-rock interactions associated with emplacement of the 1.8–1.1 Ma Geysers plutonic complex

MAE MARCAIDA*, MATTHEW COBLE, MARTY GROVE

Stanford University, Dept. of Geological Sciences, USA (*correspondence: marcaida@stanford.edu)

In the Geysers-Clear Lake region of northern California, emplacement of the 1.8–1.1 Ma Geysers plutonic complex (GPC) [1] produced an extensive hydrothermal system and biotite-hornfels aureole within late Mesozoic low-grade, subduction-related rocks of the Franciscan Complex. The hydrothermal system has evolved over time to the present-day vapor-dominated system that is the largest producing geothermal field on Earth. The GPC and its associated contact aureole are penetrated by many deep boreholes that have revealed the internal structure and emplacement history of the intrusive complex. Hydrothermal tourmaline occurs in veins within the GPC and its hornfelsed wallrocks. We are investigating the role of fluid circulation between the low-grade Franciscan metasedimentary rocks and the GPC that may have significantly contributed to the extensive tourmaline-related mineralization.

Tourmaline grains recovered from air-drilled cuttings from two wells (SB32 and SB34) that intersect the GPC at depths below the aureole display both resorption and overgrowth textures. Ion microprobe measurements of $\delta^{11}B$ values of these grains range from –14 to +16‰, with most results between –5 to +5‰. The large variation in measured B isotopes revealed by our preliminary results likely indicates mixing of heterogeneous fluids derived from the magmatic intrusion (source of ^{11}B-depleted boron) and Franciscan metasedimentary rocks (source of ^{11}B-enriched boron). The presence of compositionally distinct fluid reservoirs in the Geysers system is supported by fluid inclusion studies [2]. Additional B isotopic and trace element measurements of tourmaline from depth-constrained cored rocks of the GPC and its hornfelsed aureole are underway to further constrain system-wide fluid transport. Analysis of tourmaline in these sectioned cores will allow a detailed consideration of isotopic and chemical zoning in tourmaline that is informed by a full spatial and textural context.

[1] Schmitt et al. (2003) *Geochimica et Cosmochimica Acta* **67**, 3443–3458

[2] Moore and Gunderson (1995) *Geochimica et Cosmochimica Acta* **59**, 3887–3907