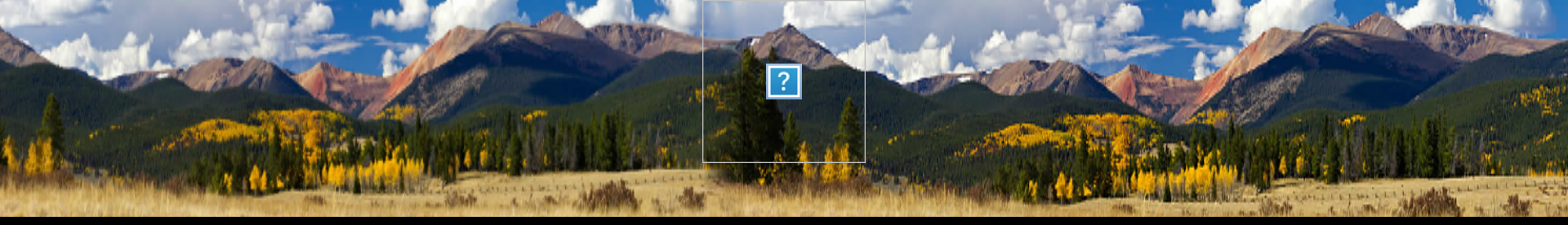

Booth No. 27 CREATING A STRATOVOLCANO: PETROGENESIS OF THE CONE-BUILDING LAVAS OF SOUTH SISTER VOLCANO, OR

Friday, May 17, 2019
09:00 AM - 03:30 PM
Oregon Convention Center - Exhibit Hall B

South Sister Volcano formed during a cone building episode that began ~33kya in which ~8.5 km^3 intermediate magmas erupted from its central vent and flanks over ~10ky. To understand the conditions that give rise the formation of abundant intermediate melts, we conducted a detailed petrologic study on nine intermediate melts (56-65.3 wt% SiO_2) from units that make up >60% of the erupted volume during South Sister's cone building episode. Samples range in crystallinity (≤15%), but all contain six phases (plag + cpx + opx + ilm+ mag + ap); no hydrous phases were observed. We measured compositions of oxides using the Cameca SX-100 electron probe at University of California, Davis, and incorporated them into a geo-thermometer to obtain pre-eruptive temperatures. Pre-eruptive temperatures for the intermediate magmas range from 908±8°C to 942 ±29°C. We used MELTs to determine the conditions (pressure and H_2O contents) at which intermediate liquids are produced through crystallization of a parental liquid (an MgO-rich basalt from South Sister's periphery; BBR-1) at the oxide-derived pre-eruptive temperatures. We considered a model run successful when it produced (1) an intermediate melt composition in a melt fraction that would facilitate efficient extraction at the calculated pre-eruptive temperatures, and (2) a phase assemblage that would match the trace element concentrations of the andesites. In MELTs, we equilibrated the basalt over a range of temperatures (1200-900°C), pressures (200-900 MPa), and with starting H_2O contents of 2, 4, and 8 wt%. Model runs initiated with 4 and 8 wt% H_2O failed to produce melt/solid fractions that would favor melt extraction at the eruptive temperatures. Model runs initiated with 2 wt% H_2O produced intermediate magmas in eruptible melt/solid fractions at all pressures. We found that intermediate melts, with REE concentrations that match the natural andesites, occur in an eruptible fraction at 500 MPa, in equilibrium with an assemblage of cpx + opx + gt + ap. These phases are consistent with the natural samples, with a notable absence of garnet. Our collective results suggest that, during the time of the cone building event, the South Sister intermediate melts formed deep (~500 MPa; ~16 km) and crystallized in the shallow crust.

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