Supplement Methods

Rock samples must be finely powdered before acid digestion. Each batch of samples must include five to six standard reference materials (SRMs; rock standards), chosen to bracket the major elemental composition of the rocks. The standards used included BHVO-2 (USGS; Hawaiian basalt), BCR-2 (USGS; Columbia River basalt), DNC-1 (USGS; North Carolina diabase/basalt), GSP-2 (USGS; Colorado Silver Plume granodiorite), SCo-1 (USGS; Cody shale), and AGV-2 (USGS; Oregon Guano Valley andesite). Approximately 0.05000 g ± 0.0050g of powdered samples was weighed out for each SRM and unknown sample into an acid-cleaned and labeled Teflon Savillex beaker. Once all samples were weighed out, the bulk digestion process took five days, using double distilled, ultra-clean (DD) acids and ultra-pure water (MQ H_2O) in all steps. Powders were digested by HNO_3:HF acid attack following the methods of Anderson et al., (2021), Lytle et al., (2012), and Kelley et al., (2003).

The five-day digestion process was as follows. After all samples and SRMs are weighed out, 1 mL of DD Nitric Acid (HNO_3) and 2 mL of DD Hydrofluoric Acid (HF) were added to each beaker and subsequently heated in the DigiPREP digestion block at 105°C for at least 24 hours. After allowing the beakers to cool for 1-2 hours, they were then uncapped and returned to the digestion block to dry down the samples at 100°C for 3 hours. Once the samples were dry, without moving the beakers, 3 mL of DD Hydrochloric Acid (HCl) was added to each beaker to help ensure total dissolution. Beakers were then recapped and heated at 105°C for 8 hours. After allowing to cool for 1-2 hours, the beakers were uncapped and returned to the digestion block to dry down the samples at 100°C for 3 hours. Next, once the samples were dry again, 3 mL of DD HNO_3 and 3 mL of MQ H_2O was added to the samples without moving the beakers. The beakers were then capped and returned to the digestion block to heat at 105°C for 8 hours. The samples were now

ready to be diluted for trace element analysis, with a target dilution of 2500x of the original powder weight. The appropriate number of 125mL acid washed, low-density polyethylene (LDPE) bottles were labeled. The sample solution was transferred from the Savillex beaker to the LDPE bottle. Subsequently, the beakers were rinsed three times using a 2% HNO_3 solution containing 1ppm In, with each rinse being added to the LDPE bottle. Samples were further diluted with the 2% HNO_3 solution until the solution was at 125g (2500x the original powder weight). Solutions were then sonicated for 30 minutes.

Samples, standards, and total procedural blanks were analyzed for their elemental compositions via a Thermo iCap Inductively Coupled Plasma Mass Spectrometry (ICP-MS) coupled to a CETAC ASX-560 autosampler at the Trace Element and Radiogenic Isotope Laboratory (TRAIL) at the University of Arkansas. The ICP-MS was calibrated by using two multi-element standards (68 A, High Purity Solutions; 71B Inorganic Ventures). Calibration curve measurements were made using a series of seven dilutions with concentrations ranging from 1 ppb to 1000 ppb. The elements measured were Na_2O, MgO, Al_2O_3, P_2O_5, CaO, Sc, TiO_2, V, Cr, MnO, FeO*, Co, Ni, Cu, Zn, As, Rb, Sr, Y, Zr, Nb, Cs, Ba, La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Ha, Ta, Pb, Th, U (see Table 1).