**Supplemental Analytical Techniques**

**I. Sample preparation for major and trace element analyses of volcanic samples**

Weathered surfaces were removed from samples using a rock saw, and 200 g of fresh material powdered in an agate ball mill. 2 g of powder was ignited at 900 °C for two hours in clean ceramic crucibles to determine loss on ignition (LOI). Rock powders were prepared as solutions by lithium metaborate fusion: 0.1 g was mixed with 0.6 g of lithium metaborate flux in an acid-washed platinum crucible; 6 drops of lithium iodide was added to the mixture, which was then fused on a Claisse Fluxy automated fusion system. The mixture was dissolved in 20 ml of 10 % HNO3 and 30 ml of 18 MΩcm de-ionised water in a 250 ml Teflon beaker. Any glass on the crucibles was dissolved by submerging the crucibles in the acid solution. The samples were heated at 70 – 80°Con a hotplate for 15 – 20 minutes and once fully dissolved, 1 ml of 100 ppm rhodium (Rh) spike was added. The solution, with washings, was transferred to a 100 ml nalgene volumetric flask and made up to 100 ml with de-ionised water.

**II. Sample preparation for Sr isotope measurements of carbonate samples**

Different parts of the carbonate rock samples were selected for Sr isotope measurement. Approximately 0.2 gram powder samples were drilled out using a Dremel tool and stored in pre-cleaned centrifuge tubes. Samples were dissolved in 2 ml 0.5 mol/L acetic acid to reduce potential contamination from detrital silicate minerals. The solution (with about 500 ng of Sr) was then processed through strontium separation on the PFA micro-columns containing ~100 ul of pre-cleaned Sr Spec resin (Philip Horwitz et al., 1992). Matrix elements were eluted using 2 ml of 3 mol/L HNO3 before collecting Sr in 1.5 ml milli-Q water.

**References**

Philip Horwitz, E., Chiarizia, R., Dietz, M.L., 1992. A novel strontium-selective extraction chromatographic resin. *Solvent extraction and ion exchange* 10, 313-336.