Appendix A: Methods

Powdered rock samples were prepared for X-ray diffraction (XRD), X-ray fluorescence spectroscopy (XRF), and laser-ablation inductively coupled plasma-mass spectrometry (LA-ICP-MS) analyses. The surfaces of chips from core samples were scraped with a diamond disk to remove contamination from the rock cutting saw. After cleanup of the surface, the chips and whole pumice pebbles were cleaned with ion-exchanged water in an ultrasonic bath for more than 30 minutes. The samples were then dried in an oven for more than 24 hours. The dried samples were crushed in a tungsten carbide mortar as coarse crushing, and were then ground in a tungsten carbide mill.

XRD analyses of the bulk powders were conducted using a diffractometer (Rigaku RINT 2000) with Cu Kα radiation in the GSJ-Lab, at GSJ/AIST. XRD conditions were as follows: voltage = 40 kV, current = 100 mA, goniometer scan = 3°–70° 2θ, step size = 0.02° 2θ, scan speed = 2.0° 2θ/min, and count time = 1 s. An interactive software package (PANalytical HighScore Plus, version 3.0e) was used to identify the primary minerals. Identifications were based on multiple peak matches using the mineral database provided with HighScore Plus. Whole-rock major element compositions were measured by XRF spectrometer (PANalytical Axios) in the GSJ-Lab, using fused glass bead method (sample: flux = 1: 10), according to the

method reported by Yamasaki (2014). Whole-rock trace element compositions were measured using a LA-ICP-MS system at the GSJ Lab that consisted of an LA system (New Wave Research NWR213) coupled to a quadrupole ICP-MS (Agilent 7700x). Detailed instrumental information and analytical methods are given in Yamasaki and Yamashita (2016). The data quality of the XRF and LA-ICP-MS analyses was monitored according to measurements of USGS and GSJ geochemical reference materials, respectively. Analytical results of the reference materials are shown in Appendix Table 1.

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