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Whole-rock $^{40}Ar/^{39}Ar$ geochronology, geochemistry, and stratigraphy of intraplate Cenozoic volcanic rocks, Central Mongolia

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Supplementary Information

$^{40}Ar/^{39}Ar$ Geochronology Methods

Samples were processed for whole-rock $^{40}Ar/^{39}Ar$ geochronology to isolate groundmass material for dating by removing alteration products and phenocrysts. Following crushing in a Rocklabs steal ring mill for <10 seconds, fine material was washed away using distilled water, samples were then dried and sieved and material between 180 and 250 microns was retained. Samples were then washed in a sonic cleaner in 1.5 M nitric acid for 15 minutes to remove alteration products, then for an additional 15 minutes in deionized water. Once dry, magnetic material was removed using a hand magnet prior to picking under a binocular microscope. Clean unaltered groundmass was selected for dating and any visible phenocrysts were removed. Samples that showed a strong reaction with nitric acid or appeared highly altered were not dated. Samples were rated based on their purity and are described in detail in the supplemental Table DR1.

Approximately 1-2 mg of groundmass was picked for total-fusion analyses and 10-20 mg of groundmass was picked for step-heating analyses.

Samples for total-fusion analysis were packaged in aluminum foil, while samples intended for step-heating analysis were packaged in copper foil. Both step-heat and total-fusion samples were loaded into Pyrex tubes along with GA1550 biotite (98.79 Ma; Renne et al., 1998) spaced at known intervals to serve as flux monitors. Calcium and potassium salts were also included in all irradiations to monitor interfering nuclear reactions on Ca and K. Samples were irradiated in several batches: I52 was irradiated at Oregon State University TRIGA reactor, I48, I55 and I57 were irradiated at the McMaster Univeristy reactor, and I58 was irradiated at the USGS TRIGA reactor.

Total-fusion analysis was completed on 225 samples, GA1550 flux monitors and salts using a Merchantek CO_2 laser system coupled to an automated extraction line and Argus VI noble gas mass spectrometer. Following irradiation, samples analyzed by total fusion were unpacked and loaded into a copper planchet. The CO_2 laser was then used to completely fuse each 1-2 mg sample. Gas released into the extraction line was cleaned using a cold finger cooled with LN_2, and additional cleanup was completed using two Zr-Al alloy SAES GP 50 getters for five minutes before gas was released into the mass spectrometer for analysis. An additional ten samples underwent step-wise outgassing in a Modifications Ltd. double-vacuum resistance furnace coupled to the mass spectrometer. Analyses of atmospheric argon were used to constrain the mass discrimination of the mass spectrometer. Blanks were analyzed before each sample for the step-heat samples and after every four samples for the laser total-fusion analyses. Optical-

grade CaF_2 and vacuum-fused K_2SO_4 salts irradiated with each irradiation were analyzed to monitor interferences from Ca and K.

Analytical data were reduced using ArArCALC v2.5.2 (Koppers, 2002). The analyzed blank values were used to blank-correct all analyses. J parameters were calculated from the total-fusion analysis of the GA-1550 flux monitors. Measurements of the position of each sample relative to flux monitors were used to interpolate a J-parameter for each sample. Ages were then calculated taking into account the calculated J parameter, blank-corrected data, mass discrimination and inference corrections. Plateau ages are reported for the samples that were dated by step-wise outgassing. All ages are reported at the 1σ confidence interval; quoted errors include all contributions from the analyses, uncertainty in the flux-monitor age, and uncertainty in the decay constant.

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Tables

Tables DR1-DR4

KML File

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