

de Silva, S.L., Roberge, J., Bardelli, L., Báez, W., Ortiz, A., Viramonte, J.G., Arnosio, J.M., and Becchio, R., 2021, Magmatic evolution and architecture of an arc-related, rhyolitic caldera complex: The late Pleistocene to Holocene Cerro Blanco volcanic complex, southern Puna, Argentina: *Geosphere*, <https://doi.org/10.1130/GES02294.1>.

Supplementary File S1: Methodology of $^{40}\text{Ar}/^{39}\text{Ar}$ Dating

Mineral Separation

The sample CB6 was crushed and sieved; material from the fraction size 355-500 μm was separated and cleaned thoroughly in deionized water before drying overnight at 55°C. Magnetic crystals and groundmass such as magnetite, biotite, and amphibole were separated from the nonmagnetic minerals (sanidine, plagioclase, and quartz) using a Frantz Isodynamic Separator. Lithium Heteropolytungstate (LST) heavy liquid was used to separate sanidine from plagioclase and quartz. Individual sanidine crystals were handpicked from CB6 to select euhedral and unfractured crystals with few to no inclusions. The sample was then leached in 15% Hydrofluoric Acid (HF) for eight minutes to remove adhered glass before being ultrasonically cleaned in triple distilled water and dried overnight at 55°C. The sample was sieved again to remove any fine-grained particles produced during the acid leaching process.

$^{40}\text{Ar}/^{39}\text{Ar}$ Dating

Sanidine crystals were then handpicked under a binocular microscope to a purity of >99.9%. 20 handpicked crystals (>10mg) were packed into aluminum capsules and subsequently vacuum-sealed in quartz vials. Standard crystals of a known age (FCT-NM; Fish Canyon Tuff sanidine standards produced from the New Mexico Geochronology Research Laboratory in Socorro, New Mexico) were packed into copper capsules and loaded in the quartz vials to measure the neutron flux in the reactor to ultimately obtain a J-curve needed for the age calculations. The heights of each packed sample were recorded and determined using vernier calipers before being irradiated. The quartz vials were irradiated at the TRIGA (Cadmium-Lined In-Core Irradiation Tube (CLICIT)-position) nuclear reactor at Oregon State University for 30 minutes (16-OSU-02). After the two-week cool down period, all the capsules were unpacked and the standards (flux monitors) were separated from the samples. Individual crystals for both the flux monitors (FCT-NM) and the samples were individually loaded into copper (Cu) planchettes for analysis on the ARGUS-VI multi-collector mass spectrometer outfitted with four Faraday collectors (each outfitted with 1012 Ω resistors) and an ion-counting CuBe electron multiplier (CDD), located next to the lowest mass Faraday collector. This set up allows for all argon isotopes (mass 36 on the multiplier; mass 37, 38, 39, 40 on the four Faradays) to be measured simultaneously. The Cu-planchettes were then loaded in an ultra-high vacuum sample chamber. Furthermore, the ARGUS-VI can be run in full multi-collector mode, while the highly sensitive electron multiplier measures the lowest mass peak (mass 36). This multiplier has a high peak/noise ratio and low dark/noise ratio. The flux monitors were analyzed first by the total fusion method on individual crystals to create a J-curve for the age calculation. Individual J-values for each sample were calculated by parabolic extrapolation of the measured flux gradient against the irradiation height and typically give 0.1-0.15% uncertainties (1σ).

Single crystals from CB6 were analyzed as single crystal total fusions. The total fusion of the crystals used a defocused 25 W CO₂ laser beam, scanning across the crystal in preset patterns to heat each sample evenly. After heating, reactive gases within the laser chamber and extraction line were cleaned using a SAES Zr-Al ST101 getter operated at 400°C for 90 seconds then exposed to two SAES Fe-V-Zr ST172 getters for 30 seconds; One getter is operated at 200°C and the other is operated at room temperature.

⁴⁰Ar/³⁹Ar Age Calculation

The ages were calculated using the ArArCALC v2.7.0 software (Koppers, 2002) and analyzed against the flux monitors, the Fish Canyon Tuff standard (28.201 ± 0.046 Ma; 2σ; calibrated to Kuiper et al. 2008). Ages within the ArArCALC software (available from <http://earthref.org/ArArCALC/>) were calculated as both a weighted mean age (with 1/σ² weighting factor; Taylor, 1997) and as a YORK2 least-squares fits (with correlated errors; York, 1969). Ages were calculated using the corrected decay constant 5.530 ± 0.097 x10⁻¹⁰ yr⁻¹ (at 2σ) (Steiger and Jäger, 1977; Min et al., 2000). Other constants used in the age calculations can be found in Koppers et al. (2003; Table 2 within). Calculated ages and error estimates include the corrections for blanks, baselines, irradiation production ratios, mass fractionation, and radioactive decay.

Ages measured and calculated are single-crystal total fusion ages. Total fusion ages (a total gas age) were calculated for each sample by weighting the averages of all the ages of all the gas fractions for each sample; this age is comparable to a conventional K-Ar age, but in this case for a single crystal. The single crystal ages define an age probability spectrum or ideogram (Deino and Potts, 1992) that is the sum of the gaussian probability distributions of the individual analyses based on their estimated analytical uncertainties. These ideograms therefore reveal clustering of ages of cognate grains (autocrysts) vs older accidental (antecryst, xenocrysts). The eruption age is assumed to be represented by the youngest age cluster. Accordingly, a weighted mean age of the youngest population (n=7) of 54.6±0.6 ka was calculated following the ideogram approach (population density plots) using the ArArCALC v2.7.0 software. See table S1 for data and age calculations.

Deino, A., and Potts, R., 1992. Age-Probability spectra for examination of single-crystal ⁴⁰Ar/³⁹Ar dating results: Examples from Olorgesailie, Southern Kenya Rift. *Quaternary International* v.13/14, p. 47-53.

Min, K., Mundil, R., Renne, P. R., and Ludwig, K. R. A test for systematic errors in ⁴⁰Ar/³⁹Ar geochronology through comparison with U/Pb analysis of a 1.1-Ga rhyolite. *Geochimica et Cosmochimica Acta* **64**(1), 73-98 (2000).

Koppers, A., 2002, ArArCALC—software for ⁴⁰Ar/³⁹Ar age calculations: *Computers & Geosciences*, v. 28, no. 5, p. 605-619

Koppers, A. A., Staudigel, H., Pringle, M. S., and Wijbrans, J. R. 2003. Short-lived and discontinuous intraplate volcanism in the South Pacific: Hot spots or extensional volcanism? *Geochemistry, Geophysics, Geosystems* **4**(10), e1089.

Kuiper, K. F., Deino, A., Hilgen, F. J., Krijgsman, W., Renne, P. R., and Wijbrans, J. R. 2008. Synchronizing rock clocks of Earth history. *Science* **320**(5875), 500-504.

Taylor, J., 1997. Introduction to error analysis, the study of uncertainties in physical measurements: Mill Valley, California, University Science Books, 327 p.

Steiger, R., and Jäger, E., 1977. Subcommittee on geochronology: convention on the use of decay constants in geo-and cosmochronology. *Earth and Planetary Science Letters* **36(3)**, 359–362.