Interrogation of 'apparent' age dispersion in $^{40}Ar/^{39}Ar$ neutron fluence moniotor minerals

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New generation noble gas multi-collector mass spectrometers (e.g., Thermo Scientific ARGUS VI and Nu Instruments Noblesse) demonstrate potential to obtain exceptionally precise measurements. Thus far, such measurements have resulted in discordant $^{40}Ar/^{39}Ar$ age spectra for common neutron fluence monitor minerals such as the Fish Canyon sanidine (FCs). The inference is that the increased precision allows for resolution of discordance that was previously hidden by less precise measurements using older generation mass spectrometers. As such, processes such as Ar-recoil, for example, have been invoked to explain the discordance.

This contribution will adopt a systemaic approach to interrogating high-precision noble gas multi-collector mass spectrometer measurements (ARGUS and HELIX) from the FCs, Taylor Creek Rhyolitie sanidine, Alder Creek sanidine and GA1550 biotite. Critical to utilisation of exceptionally precise measurements is (1) precise gas handling and equilibration, (2) the accuracy of corrections for collector intercalibration and collector linearity (with appropriate robust uncertainties), and (3) data treatment, including accounting for correlated uncertainties. Accurate determination of uncertainty budgets is key when dealing with high-precision data as it is very easy to introduce analytical artefacts (i.e., scatter) which may induce discordance in otherwise concordant data.

As the $^{40}Ar/^{39}Ar$ dating technique requires the use of neutron fluence monitor minerals to determine the irradiation parameter J (i.e., amount of ^{39}Ar transmuted from ^{39}K during neutron irradiation), understanding their Ar-systematics and degasing behaviour is critical to utilisation of the technique in Earth Sciences.