Intercalibration of the $^{40}Ar/^{39}Ar$ biotite standard MD-2 from Mount Dromedary, Australia

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GA-1550 Biotite Standard

The $^{40}Ar/^{39}Ar$ dating method is dependent on the availability of well calibrated standards of accurately known age. GA-1550 biotite, from the Mount Dromedary monzonite in New South Wales, Australia, was prepared as an intralaboratory standard by the Australian National University [1, 2]. This biotite has become increasingly important as an intercalibration and international dating standard, because: i) GA-1550 biotite has been shown to be homogeneous at the single grain scale to precision levels of ~0.2% [2, 3, 4]; ii) it is a well characterised 'primary' $^{40}Ar/^{40}K$ standard [1,2]; and iii) it is Cretaceous in age (97.9 ± 0.9 Ma [1]; 98.79 ± 0.96 Ma [3]; 98.5 ± 0.0 Ma [2]) and thus applicable over a wide age range (~1 Ma to ~1 Ga). As a 'primary' $^{40}Ar/^{40}K$ standard [1, 2], GA-1550 has been used to inter-calibrate other standards such as the well known Fish Canyon (FC) sanidine [2, 3, 4]. However, published inter-calibration factors for GA-1550 versus FC sanidine are somewhat disparate, with R-factors ranging from 3.575 ± 0.005 [2] to 3.596 ± 0.004 [3].

MD-2 Biotite Standard

Given the importance of this biotite as a $^{40}Ar/^{39}Ar$ dating standard, ~52 kg of fresh monzonite was collected from a Mount Dromedary quarry, within ~100 m of the original GA-1550 site [1]. To avoid confusion with GA-1550 (which could be termed MD-1), the current collection is designated MD-2. To date ~5g of biotite has been separated from non-magnetic (0.5 – 1.0 mm) size fractions of MD-2 for geochemical and inter-calibration studies. Aliquots of MD-2 have been irradiated at McMaster Nuclear reactor in Canada, together with packets of FC sanidine and GA-1550 biotite. Preliminary inter-calibration results indicate that $^{40}Ar/^{39}Ar$ ratios of MD-2 and GA-1550 are indistinguishable. R-values for MD-2 versus FCs are analagous to those determined by Baksi *et al*. [4] and Renne *et al*. [3].

[1] McDougall & Roksandic (1974) *Geol. Soc. Austr. J.* **21**, 81-89. [2] Spell & McDougall (2003) *Chem. Geol.* **198**, 189-211. [3] Renne, Swisher, Deino, Karner, Owens & DePaolo (1998) *Chem. Geol.* **145**, 117-152. [4] Baksi, Archibald & Farrar (1996) *Chem. Geol.* **129**, 307-324.

The CRONUS-Earth Project: Current results and future plans

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The CRONUS-Earth Project was funded by the U.S. National Science Foundation in 2005 to improve understanding of the systematics of cosmogenic nuclides produced on the surface of the earth. About the same time the CRONUS-EU Project was initiated in Europe. After four years, results from both projects are fairly mature. CRONUS-Earth has sampled five major geological calibration sites and several more minor ones. At least partial data are available from most of them. Evaluation of these data show much greater consistency than previous calibration data sets. We have developed a comprehensive parameter-and-uncertainty estimation model for synthesis of these data. An international analytical intercomparison project has been launched. The first results from analyses of neutron-beam targets for cross-section estimation are now available. A suite of globally distributed saturated ^{14}C analysis is available for comparison with scaling models. We have implemented web-based calculators for ^{10}Be, ^{26}Al, and ^{36}Cl, and calculators for other nuclides are soon to follow. The synthesis of all these activities in the next two years should place cosmogenic nuclide applications on a much firmer footing.