REDUCING SYSTEMATIC ERRORS IN 40AR/39AR GEOCHRONOLOGY

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The 40Ar/39Ar system is the most broadly utile geochronometer available today, and offers exemplary precision and age resolution. Unfortunately, absolute accuracy is limited to about 2% by uncertainties associated mainly with isotopic data for standards and 40K decay constants. Review of existing data and current capabilities suggests that further improvements can be made using conventional methods. However, several unconventional approaches may be more productive, including calibrations based on more potentially accurate methods such as U/Pb, and utilization of data from historically dated events like the 79 AD eruption of Vesuvius. Analysis of error propagation indicates that such approaches already provide superior accuracy, and new data will be presented demonstrating the current state of the art as well as prognoses. An alternative age equation requiring only knowledge of the total 40K decay constant, and not the branching ratio, facilitates this approach. A growing body of U/Pb zircon data for Late Cenozoic volcanic rocks enables comparison with high-precision 40Ar/39Ar data and allow, in principle, the evaluation of magma residence time recorded by zircons and the extent to which such effects might bias the intercalibration of U/Pb and 40Ar/39Ar systems. The Milankovitch-based astronomical time scale offers another independent basis for comparison