$^{40}Ar/^{39}Ar$ dating of single muscovite crystals

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Muscovite $^{4o}Ar/^{39}Ar$ ages are ideally suited for evaluation of crystallization and thermal histories of the middle crust and also the provenance and depositional histories of sedimentary basins. This stature is due to the muscovite's widespread occurrence and stability, the relative ease with which it can be related to petrology and deformation, and the fact that it generally contains highly radiogenic argon. An overwhelming wealth of empirical and experimental data indicate that muscovite and other micas have cylindrical diffusion geometries, with the result that crystals can be cleaved easily along the main pathway for ^{4o}Ar diffusion, parallel to (001).

Laser-extraction techniques for *in situ* $^{4o}Ar/^{39}Ar$ dating permit intracrystalline muscovite ages to be measured in the context of a crystal's shape and dimensions. Many *in situ* studies have measured core-to-rim $^{4o}Ar/^{39}Ar$ age profiles in muscovite crystals, over intracrystalline scales of millimeters and indicating times of formation up to ca. 100 million years. A common finding in such studies is that ages determined for the cores of large muscovite crystals are comparable to those of thermochronometers with relatively high closure temperature (e.g. $^{4o}Ar/^{39}Ar$ ages of coexisting hornblende, or U/Pb ages of titanite); ages measured along the rims (outer tens of microns) of larger, slowly-cooled muscovite crystals tend to approximate ages for smaller coexisting micas and also regional cooling events. When such age variation exists, diffusion models of the $^{4o}Ar/^{39}Ar$ age profiles (based on empirical data for cylindrical, grain-scale diffusion) indicate time-temperature evolutions that are consistent with formation during cooling from ca. 500-300 °C.

Analytical strategies for muscovite $^{4o}Ar/^{39}Ar$ dating should allow measurement of the distribution of age in a population of crystals from a given sample. It is most obvious and direct to evaluate the age distribution of such a population by measuring the ages of single crystals. Metamorphic rocks with simple, monotonic cooling histories tend to yield Gaussian age distributions for single crystals of muscovite, whereas samples with complex thermal or crystallization histories will yield correspondingly complex age distributions. The age population distributions of muscovite that are characteristic of source terrains can be compared more directly to age distributions of detrital muscovite in associated sedimentary basins.

Breakthrough in sensitivity for elemental and isotopic analysis

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The presentation will describe modifications of a sector field ICP mass spectrometer which will result in significantly enhanced sensitivity, ion transmission and subsequently detection power. We will describe the technical details which will allow ultra-trace determinations below ppq levels and isotope ratio analysis at single digit ppt levels. Beside that we will present a further development for sector field ICP mass spectrometry which will significantly improve the precision for isotope ratio analysis of interferred isotopes such as for Sulfur, Iron, Cr.