



Ar-Ar dating of biotite – grain size dependent ages and possible interpretations

Blanka Sperner, Jörg A. Pfänder, Alexandra Scherer, and Lothar Ratschbacher

TU Bergakademie Freiberg, Geologisches Institut, Freiberg, Germany (blanka.sperner@geo.tu-freiberg.de)

Ar-Ar dating of biotite is a well-established method in geochronology and can be used to date rocks as young as several 100 ka. We tested the grain size dependence of Ar-Ar ages of biotite for samples from eastern Tibet. The size of the studied minerals ranged from 80 to 2500 μm ; up to four different size fractions were measured for one and the same rock sample. Sample weight was between 1 and 7 mg. Dating was performed by step-heating (in most cases with 20-25 steps) using a CO₂ thermal laser. Gas purification was achieved by two SAES AP10N getter pumps, and Ar isotope compositions were measured using the ARGUS multicollector gas mass spectrometer at Freiberg (see abstract of Pfänder et al., same session). Weighted plateau ages reveal differences in age between different grain size fractions in the order of a few percent and show a negative correlation between grain size and age: the larger the grains, the younger the apparent age. Due to diffusion theory and the concept of closure temperature an opposite trend would be expected. Low cooling rates (as we revealed for these rock samples) could explain the range of ages we measured, but still the trend should be opposite (larger grain size resulting in older ages). A possible explanation for the measured trend could be the loss of ³⁹Ar during irradiation (recoil effect) which mainly affects small grains. Alternatively, optically invisible alteration (e.g. chloritization) may be responsible for the age range observed.

Despite of the high precision of the Ar-Ar method, age variations in the range of several percent (i.e. multiple times the measurement error) should not be overinterpreted. They might be the effect of sample treatment, e.g. by choosing a specific grain size fraction, or may result from secondary phase transitions and related argon loss. Competing trends in the correlation between age and grain size (recoil effect with older smaller grains vs. closure temperature with older larger grains) complicate the interpretation.