

Closure temperature of single grain biotite by laser step heating experiment

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The concept of closure temperature has been applied in estimating regional cooling and uplift in various geologic settings. It was first applied in K-Ar system, but several problems were pointed out such as complex geometry in diffusion, or distribution of domain sizes in minerals. These findings made difficult for geologists to apply the concept. As a result, it is applied in various cases without assuming an appropriate cooling rate, or a broad range of temperature is assigned (650 - 900°C in U/Pb zircon T_c).

Closure temperature was calculated using $^{40}\text{Ar}/^{39}\text{Ar}$ data in laser step heating experiments of single grain biotites assuming simple cylindrical geometry. The diffusion parameters were calculated from Arrhenius plot in the temperature range where dehydration effects are minimal (below 800°C). Although the characteristic radius r is about 250 microns, it always appears as D_0/r^2 . Change of r does not affect the results.

Three types are recognized in Arrhenius plots, depending on the activation energy and dehydration effects. However, these differences do not seem to affect very much on the resulting closure temperature. Relation between the characteristics of diffusion and age spectra is discussed.

Keywords: closure temperature, laser step heating $^{40}\text{Ar}/^{39}\text{Ar}$, biotite