Diffusion model of excess argon observed around an intrusive

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Excess argon in K-Ar age dating is often found in metamorphic rocks, and sometimes in contact aureoles. The origin of excess argon is generally unkonw in most cases, but a possible origin is a result of interaction between two minerals with low-closure-temperatre (Tc) and high-Tc. In this model, only volume diffusion is assumed. Heat source is a dyke intrusion. A cooling of a dyke intrusion is well described by a mathemtical model (e.g., Calslow and Jaeger, 1959). Existence of two virtual minerals are assumed; K-feldspar (low Tc) and biotite (high Tc). Using finite difference method, time variation of fractional loss in minerals are calculated at each location from the contact. The result is shown in Fig. 1a and 1b. As seen from the figures, wave like pattern proceed from the contact both in time and distance. Fluid circulation which is strongly controlled by permeability of the host rock, possibly plays an important role to determine pattern and magnitude of excess argon.

Reference

Carslaw, H.S. and Jaeger, J.C. (1959) Conduction of heat in solids, 2nd ed. Clarendon Press, Oxford

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