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Highly retentive core domains in K-feldspar preserve argon ages from high temperature stages of granite exhumation

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Retentive core domains are characterized by diffusion parameters that imply K-feldspar should be able to retain argon even at temperatures near or above the granite solidus. In this case it should be possible to date granite emplacement using argon geochronology, and the same answer should be obtained as by using other methods. We present one case study where this is the case, from the elevated Capoas granite stock on Palawan, in the Philippines, and another where it is not, from the South Cyclades Shear Zone, on Ios, Greece. We attempt to determine the factors such as the role of fluid ingress in triggering the in situ recrystallization that can eliminate and/or modify the core domains, leading to relatively youthful ages. Thermochronology is still possible, because less retentive diffusion domains exist, but different methods need to be applied to interpret the data.

The work also demonstrates that K-feldspar can be sufficiently retentive as to allow direct dating of processes that reduce the dimensions of diffusion domains, e.g., cataclased and/or recrystallized K-feldspar in fault rock and/or mylonite.

These are important developments in the methodology of 40Ar/39Ar geochronology, but to further advance we need to clarify the nature of these highly retentive core domains. In particular, we need better understand how they are modified by microstructural processes during deformation and metamorphism. We need also to assess the role of any crystal structural changes during step-heating in vacuo.