Influence of deformation on Ar retention in white mica: Devonian reactivation of the Silurian Dover fault, Newfoundland Appalachians, Canada

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Radiogenic ^{40}Ar stored in white mica may be disturbed or reset by a variety of processes including deformation, recrystallization, and diffusion. Ductile shear zone mylonites are ideal for examining the effects of deformation and dynamic re-/neo-crystallization on white mica at temperatures for which thermal diffusion of Ar is inefficient. Here we investigate Ar behaviour in white mica from Late Silurian syn-tectonic granitoids emplaced into the trailing edge of the Ganderian microcontinent, Newfoundland Appalachians. Subsequent regional metamorphism and development of the broad Wing Pond shear zone are interpreted to record Acadian orogenesis, resulting from the docking of Avalonia to Ganderia (composite Laurentian margin) by sinistral-oblique transpressional collision. The suture was later reactivated as a lower temperature, narrow dextral-sense shear zone. The window for sinistral and dextral slip is constrained by emplacement of the syn-tectonic granitoids and a post-tectonic pluton that stitches the Dover fault at 377 ± 4 Ma.

In this study we combine in situ ^{40}Ar/^{39}Ar analyses with deformation temperatures from quartz c-axis fabrics to investigate the influence of deformation on Ar retention in white mica for differing structural positions. Zircon U-Pb ages indicate granitoid emplacement ca. 430–425 Ma. Monazite U-Pb ages that span ca. 429–403 Ma are interpreted to record recrystallization during high temperature metamorphism and deformation. High spatial-resolution in situ ^{40}Ar/^{39}Ar laser analyses of white mica range from ca. 403 Ma to 390–375 Ma (depending on sample) such that ages reflect the structural field relationships. Relatively low deformation temperatures, single-grain age transects inconsistent with Dodsonian diffusion, and localization of older and younger age domains at thin section scale argue for deformation-induced loss of ^{40}Ar. These data demonstrate the potential of spatially controlled ^{40}Ar/^{39}Ar age data in elucidating thermal and deformational histories of deformed and metamorphosed rocks.

Atlantic Geology, 2016, Volume 52
Atlantic Geoscience Society Abstracts 42nd Annual Colloquium & General Meeting 2016
doi: 10.4138/atlgeol.2016.004