Northeastern Section - 53rd Annual Meeting - 2018

Paper No. 5-5
Presentation Time: 9:45 AM

UNRAVELING FAULT REACTIVATIONS AND THEIR TECTONIC SIGNIFICANCE USING INTEGRATED STRUCTURAL DATA AND $^{40}AR/^{39}AR$ GEOCHRONOLOGY, EXAMPLES FROM NW VERMONT AND SW NEW ZEALAND

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Many large fault zones record multiple reactivations that can be difficult to resolve and interpret in the field. Here, we use examples from Vermont and New Zealand to illustrate how structural data combined with $^{40}Ar/^{39}Ar$ geochronology can be used to reconstruct fault reactivation histories and interpret their possible origins. In SW New Zealand, the Spey-Mica Burn fault zone parallels a transpressive boundary between the Pacific and Australian plates. Integrated structural and $^{40}Ar/^{39}Ar$ data obtained from pseudotachylyte, mylonite, and other fault rocks allow us to distinguish successive phases of faulting (i.e., reactivations) from cases where different styles of brittle and ductile deformation occurred simultaneously (or nearly so) in the fault zone. Apparent age spectra from multiple minerals show age gradients that reveal four reactivations spanning ~20 Ma. The style and timing of these events correlate well to times of increased convergence rate and collisions between oceanic ridge segments and a nearby trench. Fault zones in NW Vermont also record different styles of reactivation. The Hinesburg Thrust (HT), which juxtaposes Late Proterozoic-Early Cambrian rift clastic rocks against Ordovician carbonate rocks of the Champlain Valley belt, includes a ~30 m thick zone of mylonite that is cut by a cataclastic fault and deformed by folds. $^{40}Ar/^{39}Ar$ data suggest the mylonite formed during the Ordovician Taconic orogeny and later was folded into a series of domes and basins during the Late Silurian-Devonian Acadian orogeny. Farther west, the Champlain thrust fault (CT) juxtaposes Cambrian dolostones against Ordovician calcareous shales. Superposed faults within the foot wall of the CT show a progressive change in movement direction from W-directed thrusting, to NW-directed thrusting, to N-S slip, and NE-SW slip. These changing slip directions appear to reflect wholly Taconic motion along a north-dipping lateral ramp between Burlington and Shelburne where the CT cuts up section to the south. Acadian reactivation of the CT appears restricted to late folding similar to the HT. These examples highlight the utility of combining structural data with $^{40}Ar/^{39}Ar$ geochronology to unravel slip histories in continental fault zones and to distinguish among the different styles and origins of fault reactivation.

Session No. 5

T27. New Perspectives on the Evolution of Brittle and Ductile Fault Zones I: A Session Honoring The Work of Robert D. Jacobi
Sunday, 18 March 2018: 8:00 AM-12:00 PM

Emerald Ballroom III (DoubleTree by Hilton)

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