Low-grade metamorphism of the Cordilleran miogeocline and implications for illite/muscovite $^{40}Ar/^{39}Ar$ thermochronology

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The thermal history of the Cordilleran miogeocline has implications for Paleozoic paleogeography, timing of Paleozoic-Mesozoic thrusting, and patterns of Cenozoic extension. An important step in understanding this history is quantifying regional variations in low-grade metamorphism of Paleozoic strata that arise from burial beneath the westward-thickening passive margin sequence and structural position within thrust sheets. We utilize the illite to muscovite transformation to quantify low-grade metamorphism of the oldest pelitic rocks that are widespread in both cratonic and miogeoclinal sections: the Middle Cambrian Bright Angel Shale on the Colorado Plateau and the correlative Carrara Fm. in the southern Great Basin. With increasing metamorphic grade, illite crystallinity decreases (individual illite crystallites thicken) and there is an increase in the proportion of muscovite (the 2M1 polytype of illite). Illite data were measured on Middle Cambrian shales from nine locations along a 500 km cross-margin transect extending from Death Valley in the west to the Grand Canyon in the east. In terms of both illite crystallinity and polytypes, there is an overall increase in metamorphic grade to the west. Most of this regional variation occurs between Frenchman Mtn. and the Resting Spring Range, corresponding with the transition from cratonal to miogeoclinal facies and also with the leading edge of the Sevier thrust belt. $^{40}Ar/^{39}Ar$ step-heating spectra from eastern samples containing thin illite crystallites are staircase-shaped and may represent the mixture of illite crystallites of multiple ages grown during a prolonged phase of diagenesis and low-grade metamorphism. Spectra from western samples, on the other hand, are plateau-like, and appear to reflect an illite population with a single, or dominant, age. Such spectra may contain thermochronologic information relevant to the tectonic evolution of the Cordillera.