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Tectonic implications of footwall incisement on fault-slip rates and exhumation in the Bullfrog Hills-Bare Mountain metamorphic core complex, western Nevada

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The Bullfrog Hills-Bare Mountain metamorphic core complex (BFBM-MCC) near Beatty, Nevada contains multiple low-angle normal faults (LANFs) that accommodated transtensional deformation within the southern Walker Lane. Samples for apatite and zircon (U-Th)/He dating (n=40) were collected along a 30 km long, NW-SE slip-parallel transect to determine fault-slip rates and the significance of footwall incisement on cooling within the BFBM-MCC. Sample density was concentrated along the two LANFs faults in the Bullfrog Hills and multiple detachment splays at NW Bare Mountain. Structural repetition of footwall blocks along multiple faults, caused by isostatic footwall uplift and changes in detachment position (incisement), can affect accurately determining the cooling history and fault-slip rates along LANFs. Insufficient sample density will not resolve footwall incisement and may lead to an overestimation of slip rates. The different closure temperatures of the apatite and zircon (U-Th)/He systems, ~70° C and 180° C, respectively, can bracket temperature conditions of footwall incisement. (U-Th)/He ages may also indicate whether incisement is an early or late stage feature in the development of LANF systems, if multiple detachments are active simultaneously, and if fault-slip rates change temporally. Differing cooling age across faults will also indicate what detachment surfaces exhumed significant crustal sections and what depth these rocks were exhumed from. Determining the importance of incisement and brittle deformation within the footwall has broad implications for the accuracy of thermochronometrically-derived fault-slip rates within metamorphic core complexes throughout the western Cordillera of North America and other extensional provinces.

Keywords: Low-angle normal faults, metamorphic core complex, (U-Th)/He dating, southern Walker Lane, fault-slip rates