Detrital zircon and metatuff age constraints for provenance and the Mesoproterozoic orogenic evolution of southwest Laurentia

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Detrital zircon studies from Proterozoic rocks in Arizona and New Mexico reveal a regional distribution of ca. 1.50–1.60 Ga detrital zircon that are uncommon elsewhere in the western US, except for the Belt Supergroup. Source rocks for these grains are not common in North America and they may represent sediments derived from Australia/Antarctica, suggesting an early Mesoproterozoic connection with Laurentia.

The recognition of detrital zircon and metarhyolites clasts as young as ca. 1.45 Ga in key lithostratigraphic sequences from New Mexico and detrital zircon as young as ca. 1.48 Ga in Arizona shows that deformation attributed to the ca. 1.65 Ga "Mazatzal Orogeny" is no longer a viable model to explain regional metamorphism and deformation in many areas across the southwestern United States. In northern New Mexico, U-Pb detrital zircon geochronology and zircon crystallization ages from metatuff layers show that deposition began prior to 1.52 Ga and continued until ca. 1.45 Ga. Metarhyolite clasts from the syn-orogenic Marqueñas metaconglomerate yield crystallization ages of ca. 1.45 Ga. Thrust burial, regional metamorphism and deformation appears to overlap depositional ages and began as early as 1.46 Ga and continued until ca. 1.40 Ga, in New Mexico. In Arizona, ca. 1.60-1.48 Ga detrital zircon are included in the Mesoproterozoic Yankee Joe and Blackjack Formations that rest disconformably on Paleoproterozoic White Ledges Formation. An argillaceous unit from Four Peaks, Arizona has detrital zircon ages of ca. 1.57 Ga. The metasedimentary succession at Four Peaks is folded into a doubly, inward plunging, northwest vergent, synform previously interpreted to be deformed by the 1.65 Ga Mazatzal Orogeny. We propose that the Mesoproterozoic Picuris Orogeny recorded in northern New Mexico also extends along strike to Arizona.