

A REGIONAL 17-18 MA THERMAL EVENT IN SOUTHWESTERN ARIZONA
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A regional thermal event in southwestern Arizona 17-18 Ma ago is suggested by discordances between fission track (FT) and K-Ar dates in Tertiary volcanic and sedimentary rocks, by the abundance of primary hydrothermal orthoclase in quenched volcanic rocks, and by the concentration of Mn, Ba, Cu, Ag, and Au deposits near detachment faults. A high conodont alteration index (CAI) of 3 to 7, is found in Paleozoic rocks of southwestern Arizona (1). The high CAI may have been caused by this mid-Tertiary thermal event.

Resetting of temperature-sensitive FT dates (2) to 17-18 Ma with respect to K-Ar dates of 24 and 20 Ma has occurred in upper plate volcanic rocks at the Harcuvar and Picacho Peak detachments (3). Discordances between FT and K-Ar dates are most pronounced at detachment faults. However, on a regional scale FT dates from volcanic and sedimentary rocks approach 17-18 Ma, even in areas away from known detachment faults (fig. 1). Effects of detachment faulting on the K-Ar system suggest that dates of correlative rocks will be younger as the detachment fault is approached (4).

Anomalously high K_2O is common in volcanic and sedimentary rocks in the southwestern United States (5,6). In Arizona, anomalously high K_2O is present at the Harcuvar Mountains, 12 weight percent K_2O (7) and Picacho Peak detachments, 13 weight percent K_2O (8), and in listric faulted terrane in the Vulture Mountains area, 12 weight percent K_2O (9).

Introduction of hydrothermal potassium has resulted in anomalous orthoclase (2 to 10 microns) in upper plate volcanic rocks at the Picacho Peak, Harcuvar, and Trigo detachments. K-Ar dates on metasomatized rocks are suspect because the date becomes a function of potassium available upon eruption and potassium introduced during the detachment/metasomatic event 17-18 Ma.

Mineralization and potassium metasomatism caused by hydrothermal fluids is common near the detachments. Mn and Ba as well as Ag, Au, Cu, Pb, and Zn deposits are localized near most detachments (10,11,12,13). The presence of metasomatized and mineralized rock at the detachment faults indicates that the faults were likely pathways for the mineralizing fluids. Zirconium, considered to be an immobile element, occurs in concentrations as great as 350 ppm at the Picacho Peak detachment and decreases to a normal concentration of about 180 ppm (14,15) 7 km from the surface trace of the fault. Li, As, Zn, Ce, and Cd are also spatially distributed.

Paleozoic rocks with a high conodont alteration index (CAI of 3 to 7) indicate that a minimum regional temperature of 250°C was reached in southwestern Arizona. Correlative rocks in northeastern Arizona have a much lower CAI of 2 or less (1) where regional metamorphism should have affected the rocks equally. Also, several of the high CAI sites in southwestern Arizona are not near any mapped intrusions. Therefore, alteration of the conodonts by the 17-18 Ma thermal event seems likely.

A regional thermal event is postulated for southwestern Arizona 17-18 Ma. The event caused reheating, as indicated by discordances between FT and K-Ar dates; potassium metasomatism as indicated by primary hydrothermal orthoclase in volcanic rocks; and concentration of Mn, Ba, and Zr as well as Cu, Ag, and Au at detachment faults in southwestern Arizona.

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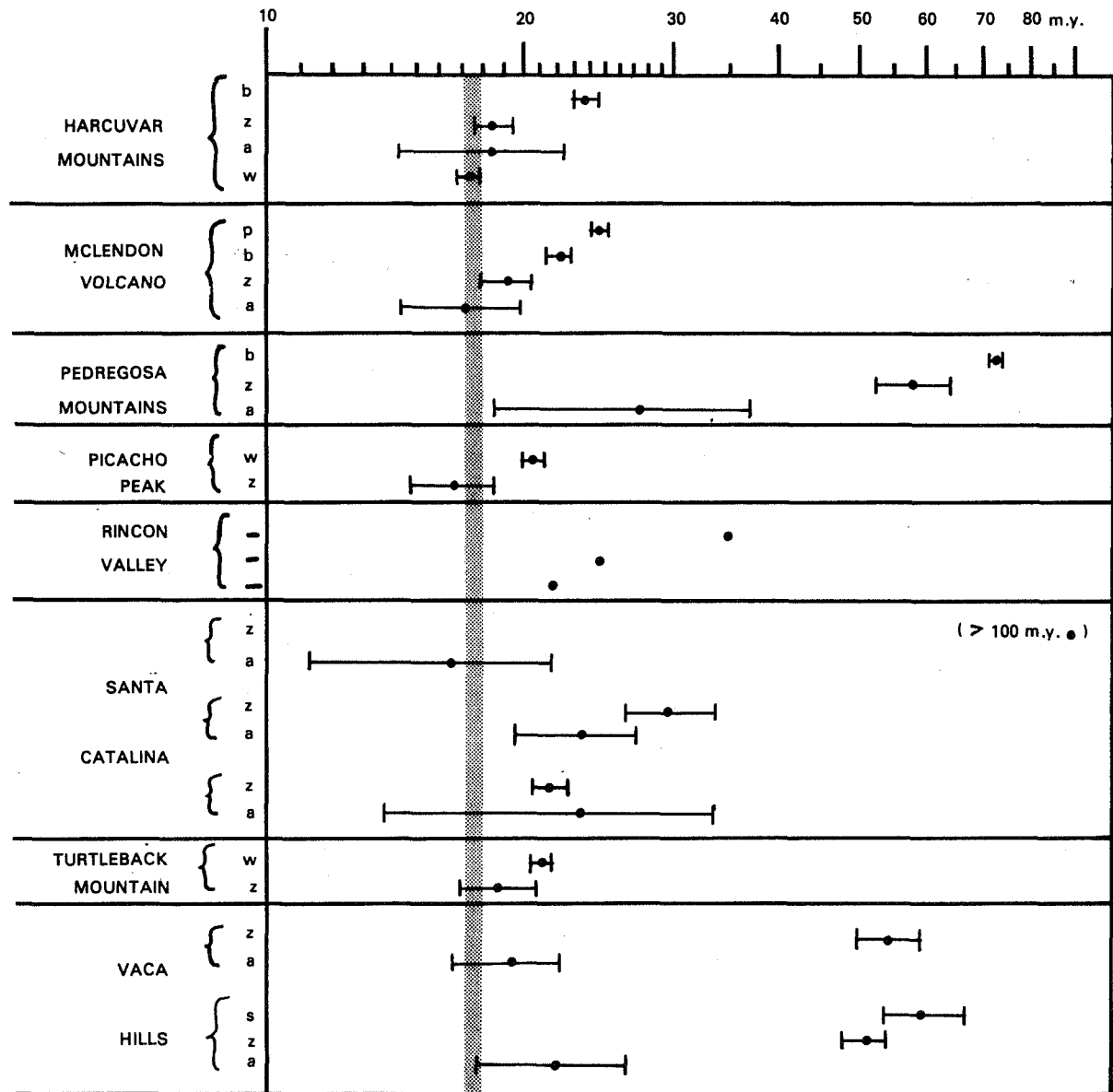


Figure 1.--Discordant FT and K-Ar dates from southwestern Arizona. Stippled pattern emphasizes 17-18 Ma. Brace indicates dates from a single sample; FT, a-apatite, z-zircon, s-sphene; K-Ar, b-biotite, p-plagioclase, w-whole rock. Harcuvar Mountains detachment, volcanic, b-(16), w-(17); McLendon volcano, volcanic, p-(18), b-(16); Pedregosa Mountains, volcanic, b-(16); Picacho Peak detachment, volcanic, w-(8); Rincon Valley, volcanic, - no mineral or standard deviation given, (19); Santa Catalina detachment, sedimentary (20); Turtleback Mountain, volcanic, w-(21); Vaca Hills, volcanic, (22); all other dates by author.

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