Early Cretaceous suturing of the Alisitos volcanic arc to North America and the role of the Ancestral Agua Blanca Fault in the Western Peninsular Ranges of Baja California, Mexico

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The Cretaceous Santiago Peak and Alisitos arcs comprise the western Peninsular Ranges batholith of southern and Baja California. A dramatic break in the geology between these two arcs occurs across the ancestral Agua Blanca fault (aABF), which is an Early Cretaceous, NW-SE trending, dominantly SW-vergent reverse, sinistral oblique shear zone, located ~2 km south of the active Agua Blanca fault.

The aABF lies within a coeval, ~17 km wide fold-thrust belt that extends into both arcs. Here the Santiago Peak arc is mostly composed of andesitic to dacitic volcanic units, whereas the Alisitos arc is composed of various lithologies including ash flows, ash fall tuffs, limestones, volcaniclastic sandstones, and argillites. All units display a NW-SE trending, moderately-dipping, bedding-parallel foliation and down-dip stretching lineation that are folded into regional, NW-SE trending folds. In both arcs fabric intensity increases and fold geometries change from open to isoclinal with increased proximity to the aABF. Although several smaller faults with NE-side up, reverse kinematics exist in the area, the aABF is the broadest and only fault with a mylonitic fabric.

Constraints from detrital zircons suggest intra-arc deposition atop Alisitos volcanics between ~115 and 110 Ma with a continental source that grew more proximal as the basin deepened. U/Pb zircon crystallization ages from post-kinematic plutons intruding deformed basin sediments suggest that the majority of contraction ceased by ~108 Ma. However, reverse shear across the aABF continued until at least 105 Ma.

The data support significant contraction and a subordinate amount of sinistral translation in the study area. Development of deformation gradients towards the aABF suggests that this fault is the dominant structure in this part of the fold-thrust belt. However, whether the aABF represents a non-terminal suture between two geologically different arc segments or is a master fault in a fold-thrust belt that accommodated collapse of the fringing Alisitos arc remains unresolved. Regardless of the tectonic interpretation of the aABF, the dramatic crustal thickening inferred from the chemistry of post-kinematic plutons of the Sierra San Pedro Mártir is not supported by coeval plutons in this study area.

2007 GSA Annual meeting in Denver, CO