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The role of the Precambrian rift-transform margin and superterrane translation during Cretaceous-Paleogene mountain building in the western United States

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The Precambrian rifting of western Laurentia (Rodinia breakup) formed a series of ~330 oriented rift margins and ~060 oriented transform boundaries. This rifting results in a series of promontories and recesses on the continental margin. A significant promontory existed in northern Nevada and a smaller promontory existed on the US-Canadian border. These promontories acted as barriers to movement of outboard terranes. We infer that the Antler, Sonoman, and early (125-100 Ma) Sevier orogenies all resulted from southward, margin-parallel terrane motion that collided with the northern Nevada promontory. A brief, N-vergent extensional phase occurred at ca. 102 Ma in northern Nevada, during the sinistral-to-dextral transition. The most significant orogenic event (Sevier-Laramie) in the western U.S. started at ca. 100 Ma, as a result of the oblique (right-lateral), collision of the Insular superterrane. This collision initiated dextral transpressional shear zones in the Sierra Nevada and Idaho batholiths, lead to widespread volcanism, significantly increased shortening rates in the Sevier fold-and-thrust belt, and caused basement-cored uplifts in the far foreland. Starting at 85 Ma, the Insular superterrane rapidly moves northward, resulting foreland deformation and rotation of a major crustal block in central Idaho and adjacent Oregon. The rotation explains the large amount of crustal melting that formed the Idaho batholith, why east-central Idaho and adjacent Montana formed the highest elevations in the western U.S., and why orogenic collapse started there at ca. 55 Ma. The Sevier-orogenic belt has the hallmarks of a collisional orogeny, because it was one. Further, paleomagnetic data from Insular and Intermontane superterrane indicate that these bodies were in the right place at the right time – and affected by promontories – to cause the mountain building.