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DRIP, DROP, REBOUND: A NEW MODEL FOR THE CRETACEOUS TO PALEOGENE TECTONIC EVOLUTION OF THE RUBY CORE COMPLEX AND SEVIER BELT HINTERLAND IN NORTHEASTERN NEVADA

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The Ruby Mountains – East Humboldt Range – Wood Hills – Pequop Mountains metamorphic core complex (REWP) of the hinterland of the Late Cretaceous to Paleogene Sevier orogenic belt poses a long-standing problem in Cordilleran tectonics— how could upper crustal rocks as young as Mississippian have been metamorphosed to pressures up to 9 kb (paleodepths >35 km) even as correlative rocks in neighboring ranges remained unmetamorphosed, mostly uneroded, and only modestly deformed? And once so deeply buried, how did these rocks return to the surface?

I offer a testable new hypothesis for the tectonic evolution of part of the Sevier hinterland that could resolve these problems. (1) Relatively modest (~15 km), pre-Late Cretaceous tectonic shortening, possibly associated with the Central Nevada thrust belt, drove faulting that penetrated the crust at relatively high angle (≥40°), causing enough thickening to eclogitize a relatively mafic lower-crustal layer, thus densifying the crust and suppressing surface uplift. (2) A heating event at ~78–85 Ma, possibly with renewed shortening, triggered partial melting and nonlinear weakening of the middle crust leading to the sinking and detachment of the densified lower crustal layer. This process stretched and pulled mid-crustal rocks to paleodepths as great as 35–40 km without requiring comparable dislocation of the upper crust. (3) Completion of the “drip phase” left the crust locally far out of gravitational equilibrium, with a buoyant, partially molten deeper crust that then began to flow laterally and/or rise diapirically returning the partially subducted rocks to mid-crustal depths. Large-scale mid-crustal recumbent folds accommodated vertical shortening and lateral spreading during this phase. This deep-crustal flow could have occurred beneath a mid-crustal decoupling zone with little upper crustal deformation, or it may have led to modest local extension. In either case, the end result was to modulate crustal thickness-- too weak to support large-scale Moho relief, the deeper crust was also too weak to support major surface relief, thus forming a broad hinterland high plateau (the “Nevadaplano” invoked by many workers). The stage was set for final capture and exhumation of the REWP during Cenozoic extensional tectonism.

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