This buckling model provides a mechanical explanation for the distinction between

- "thin-skinned" Sevier-style and contemporaneous and younger
- "thick-skinned" Laramide-style deformation,

which depends upon the decoupling or coupling of the lithospheric layers.

The classic tectonic model for formation of the Laramide Orogeny involves shallow subduction of a Cretaceous oceanic plate (Farallon plate) beneath North American crust. In this model, shear must be transmitted directly to the overlying crust to produce contractional structures far from the continental margin, requiring stripping of mantle lithosphere. The buckling model presented here better explains the collisional "style" of the orogeny, and is uniquely consistent with the observation of mantle xenoliths that require preservation of western North America's mantle lithosphere throughout the orogeny.

Additionally, growing evidence for dextral shearing within the foreland block uplifts suggests an alternate model for oblique terrane accretion as the ultimate cause of the Laramide orogeny.

Inversion tectonics in the Central Apennine fold and thrust belt

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Structural evolution in the Central Apennines is traditionally considered to have resulted from thrusting of sedimentary cover along a major sub-horizontal detachment above a magnetic, crystalline basement. Models based on this hypothesis typically predict that large displacements (>150 km or 40 %) have occurred as a result of this. Alternatively, exactly the same surface geology and well data can be reinterpreted using a basement-involved, inversion tectonic model with relatively low displacement. In such a model, reactivation of Mesozoic and Tertiary extensional faults occurred during Miocene compressional deformation in the overall context of Africa–Europe collision.

Several lines of evidence support an inversion model for the structure of this Central Apennine area. The pre-existing rifted architecture is demonstrated by abrupt lateral variations in facies and thickness of the stratigraphy. Analysis of geological maps of key areas reveals the presence of short-cut thrust faults in the footwalls of pre-compressional normal faults. Some thrusts have small-scale structures indicating NE vergence and yet show net extensional throws of the Mesozoic stratigraphy (e.g., the Filletino–Vallepietra thrust: Cretaceous in the hangingwall against Triassic in the footwall). This configuration is consistent with compressional reactivation of a pre-existing normal fault where the extensional displacement was greater that the thrust displacement.

The large displacements predicted by detachment-style models require the formation of a hypothetical passive-roof duplex at the mountain front, yet such structures are considered to be mechanically unlikely. In contrast, the lower displacement involved in an inversion model means that such structures are not required. Furthermore, the CROP deep seismic line across the Tuscany/Marche Apennines shows that the basement and Moho are imbricated as a result of compression in that part of the thrust belt; again, this is consistent with inversion tectonics.

This poster contrasts an existing detachment-style model and the new inversion model using balanced cross-sections through the Central Apennines. The inversion model has been constructed to incorporate the features described above, and is further supported by seismic data from the Adriatic foredeep which has similar characteristics.