

Reconstructing Farallon Plate Subduction beneath North America back to the Late Cretaceous

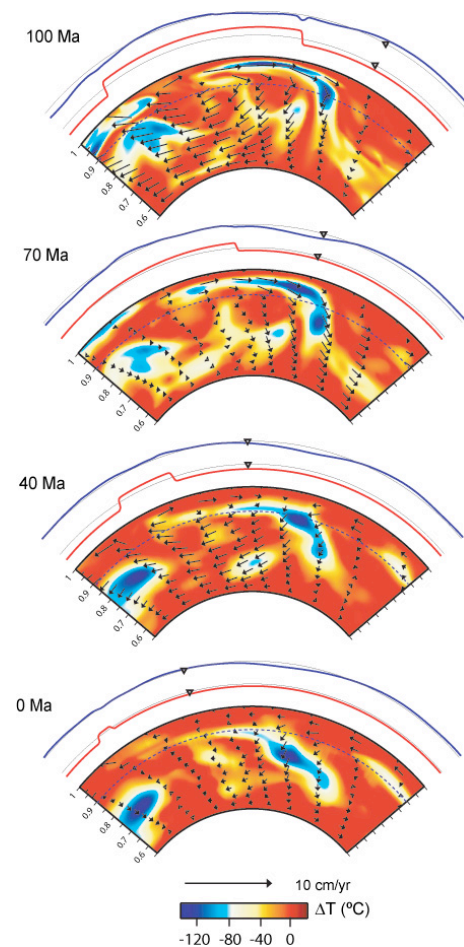
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Using an adjoint mantle convection model (*CitcomS*) that assimilates global seismic tomography and plate motions, we reconstruct the subduction of the Farallon plate beneath North America back to 100 Ma [Liu *et al.*, 2008]. The associated surface dynamic topographies allow reproduction of paleoshorelines, sediment isopachs and tectonic borehole subsidence, whose spatial and temporal evolution constrains the depth dependence of mantle viscosity and buoyancy. Our best model has an upper mantle viscosity of 1×10^{21} Pa s, a lower mantle 1.5×10^{22} Pa s and an effective temperature anomaly associated with present day Farallon remnants of 160 °C.

In our preferred model that satisfies stratigraphy, the Farallon slab was flat lying in the Late Cretaceous (Figure). Furthermore, we find an extensive zone of shallow dipping subduction that extends beyond the flat-lying slab further east and much further north (by up to 1000 km) than previously inferred, implying a much broader region of Cretaceous subsidence over the North American craton. Following the demise of flat lying subduction, the models are consistent with the flat lying segment moving vertically in the mantle. The limited, along-strike region of flat lying subduction is consistent with subduction of an oceanic-plateau. The results imply that seismic images of the mantle provide more powerful constraints on tectonic events than previously recognized.

For the adjoint models, we modified Version 2.0 of *CitcomS* that we obtained from CIG. Details are in Liu and Gurnis [2008].

Figure (right). Cross section of effective temperature at 41°N with velocity (east-west component) in red and dynamic topography in blue.



References

Liu, L., and M. Gurnis, Simultaneous inversion of mantle properties and initial conditions using an adjoint of mantle convection, **Journal of Geophysical Research**, **113**, B08405, doi:10.1029/2008JB005594, 2008.

Liu, L., S. Spasojević, and M. Gurnis, Reconstructing Farallon plate subduction beneath North America back to the Late Cretaceous, **Science**, **322**, 934-938, DOI:10.1126/science.1162921, 2008.