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Multi-Observable Probabilistic Tomography Reveals the Thermochemical Structure of Central-Western US

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The Central-Western US region has undergone extensive tectono-magmatic activity since the Laramide orogeny (80-45 Ma), including episodes of flat subduction, crustal shortening, lithospheric delamination/alteration, crustal extension, voluminous volcanism, and epeirogenesis. Despite being one of the better studied regions in the world, a number of questions regarding its nature and tectonic evolution remain contentious. Foremost among these are the subsurface thermochemical structure, the causes and timing of the uplift of the Colorado Plateau (CP), and the relative contributions of the various deep (e.g. large scale dynamic topography) and shallow (e.g. small-scale convection or lithospheric heating) processes proposed to explain it. Here we present a thermochemical model of the Central-Western US based on a new 3D multi-observable inversion method based on a probabilistic (Bayesian) formalism (Afonso et al., 2013a,b) using high-quality geophysical, geochemical and geological datasets. Working within this internally and thermodynamically consistent framework allows us to move beyond traditional methods and jointly invert P-wave and S-wave teleseismic arrival times, Rayleigh wave phase dispersion data, Bouguer anomalies, long-wavelength gravity gradients, geoid height, absolute elevation (local and dynamic), and surface heat flow data. In this presentation, we will discuss a number of robust features from our models that carry important implications for supporting or disapproving current evolutionary models for this region.