Mid-Tertiary buoyancy modification and its relation to rock exhumation, cooling, and subsequent extension at the eastern margin of the Colorado Plateau

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Abstract—In the Southern Rocky Mountains (SRM) and Rio Grande Rift (RGR) regions, rock cooling from apatite fission track (AFT) data and net exhumation from rock preservation patterns spatially correlate with areas of voluminous mid-Tertiary caldera complex magmatism. We use these observations and gravity data to constrain calculations of the isostatic effects of mid-Tertiary magmatism and accompanying lithospheric modification. Our models predict that mid-Tertiary magmatism drove spatially-variable rock uplift and thermal perturbations that, coupled with variable exhumation, can explain the AFT cooling and rock preservation patterns. During isostatic response to magmatism, if rock uplift exceeds exhumation then the resulting surface uplift combined with thermal weakening of the lithosphere can influence subsequent extension. Lithospheric modification during caldera complex magmatism should, therefore, be considered an important mechanism for profoundly influencing lithospheric dynamics.

Introduction

Deformation in the SRM and eastern Colorado Plateau changed from shortening during the Laramide orogeny (late Mesozoic to early Tertiary) to variable degrees of mid-