

Numerical Modeling Constraints on the Uplift of the Atlas Mountains in Morocco

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Despite the Moroccan Atlas being among the highest alpine orogens, it is characterized by minor tectonic shortening and nearly absence of foreland sediments. Dating of volcanic rocks, structural, and isostatic studies, suggest that a mantlesourced buoyant force is responsible for about half of its present topography, but the mechanism responsible for such load and the timing of its emplacement remain unknown. Here, we estimate the amount of erosion along two geological transects that we use to constrain a cross-section numerical model incorporating simple approaches to tectonic shortening, buoyant subcrustal loading, flexural isostasy, and erosion/sedimentation. Parameterization of this model indicates that, fixing the tectonic parameters, large erosion rates imply smaller foreland basins because erosion reduces thrust loading and thus reduces the space available for sediments in the foreland. Finding a set of parameters that reproduces the present absence of sediment in the forelands, estimated erosion volumes, shortening rates and mean orogen topography brings quantitative constraints on the age of subcrustal buoyant loading.