Testing Geomechanical Models of Deformation Associated with an Evolving Reef Margin, Capitan System (Permian), Guadalupe Mountains, Texas and New Mexico, U.S.A

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Stratal geometries of folded rocks can provide constraints for the prediction of fracture distribution and density in the subsurface. In this study, we use stratal geometries and facies specific rock properties as input for geomechanical models. The models simulate deformation associated with the sequential development of a prograding/aggrading carbonate reef complex. Our attention is focused on the Capitan reef system (Permian), Guadalupe Mountains, Texas and New Mexico, USA. The models are based on the postulate that the geometry (Saller, 1996; Longley, 1999) and growth faults (Hunt et al., 2002) of the near back-reef "fall-in" beds record a sequential record of compaction-driven down-warping of the reef margin.

Results are presented from forward models of reef deformation. Starting stratal geometries for the forward models are obtained from idealized reef-perpendicular cross-sections found in the literature (e.g. Harris and Saller, 1999). Target geometries for the deformed state are constrained by field surveys of sequence boundaries and a high resolution digital elevation model of the study area. Strain and stress concentrations obtained from model runs are compared with field observations of fault and fracture occurrence. While this work focuses specifically on the Capitan margin, geomechanical models such as ours should be applicable to the general reef margin case where one has access to a two- or three-dimensional facies characterization and a conceptual model for reef growth.