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Stratigraphy, subsidence and uplift history, and tectonic evolution of the United Arab Emirates foreland basin

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Seismic reflection profile, gravity, and commercial well data have been used to determine the structure and evolution of the foreland basin that flanks the northern Oman Mountains. The basin is of tectonic significance because it is believed to have formed by ophiolite obduction and flexural loading of an underlying Tethyan rifted margin. Existing stratigraphic data shows that the margin is characterized by an early syn-rift sequence of mainly Triassic age that is overlain by a post-rift sequence of early Jurassic to Late Cretaceous age. Backstripping of well data provide new constraints on the age of initial rifting, the duration and amount of extension, and the flexural effects of ophiolite load emplacement. The rifted margin subsidence and uplift history can be generally explained by either a uniform extension model with an initial age of rifting of 210 Ma and a stretching factor Γ of 2.5 or a depth-dependant extension model with crustal extension factor, Δ, of 1.3 and a mantle extension factor, Δ, of 2.5. While both models account for the general exponential decrease that is observed in the tectonic subsidence between 210 Ma and 95 Ma, we prefer the depth-dependant model because it better accounts for the gravity anomaly data. However, there are discrepancies that we attribute to uncertainties in paleobathymetry, sea-level, and stratigraphic ages. Irrespective, the backstrip curves suggest that there was a significant thinning of the continental crust prior to ophiolite emplacement. The timing of the emplacement cannot be constrained precisely, but our backstrip curves suggest that ophiolite loading was initiated during the Late Cretaceous and resulted in a broad flexure that was flanked by a peripheral bulge that migrated from east to west across the basin.

The bulge is presently located beneath the Abu Dhabi region where it is obscured by at least 2 km of sediment, possibly because of dynamic effects associated with the subduction of the Arabian plate beneath the Eurasian plate.