Post-Rift Sag/Salt Sections Result from Dynamo-Thermal Subsidence as Dynamically Elevated Magma-Rich Rifts Migrate off Plumes

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ABSTRACT

Magma-rich rifting and breakup generally occur over plumes; magma-poor rifting and breakup generally do not. Plumes generate up to 2 km of dynamic elevation at magma-rich rifts and can dominate synrift subsidence, exposing rift architectures at positive elevations (e.g., Ethiopia, Red Sea/Afar, East Africa in general). Many ancient magma-rich rifted margins were likewise subaerial despite tectonic extension and expected subsidence, evidenced by deeply eroded top-rift unconformities that we argue formed due to dynamic elevation. Magma-rich margins also tend to show anomalously fast early post-rift subsidence, evidenced by thick, short-lived sag/salt sections with only minor faulting of sag sections and base-salt unconformities. Sag/salt isopach maps and age constraints attest to thick and rapid sediment accumulation for which syn-depositional thermal subsidence cannot be fully responsible, and the paucity of significant faulting suggests crustal thinning is not, either, together pointing to dissipation of dynamic topography (dynamic subsidence) as the additional parameter for subsidence.

We outline the magma-rich rift settings for the central South Atlantic and Gulf of Mexico salt-bearing margins relative to former plumes, showing that anomalously rapid, fault-poor sag/salt section deposition occurs as the margins migrate off the plume flanks while rifting continues over the plume, for both dip (South Atlantic) and strike sections (Gulf of Mexico). We find dynamic subsidence significantly augments predicted early post-rift thermal subsidence, together leading to rapid and thick sag/salt deposition. How-

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ever, the basement beneath the sag/salt section must first be rifted and/or eroded during the period of dynamic elevation for that basement to fall below its initial level prior to the dynamic uplift/subsidence cycle. We propose new terms: "dynamo-thermal subsidence" creates "dynamo-thermal accommodation," which are the sum and combined result of thermal plus dynamic subsidence (i.e., dissipation of dynamic elevation), respectively. Dynamo-thermal subsidence appears to negate the need for models of strongly sub-sea level, subaerial depressions for the accumulation of thick, fault-poor sag/salt sections, because it can be fast enough that accommodation need not pre-date sag/salt deposition, which therefore may occur near sea level. Differences in dynamic elevation during salt deposition across a given basin also explains differences in autochthonous salt thickness across the basin.