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The synrift subsidence deficit at rifted margins

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Across rifted margins, the prerift continental crust thins from $\sim$ 30 km, reaching zero at the continent-ocean transition (COT) beyond which either oceanic crust or unroofed mantle forms top basement. As a result of the crustal thinning, considerable subsidence is both expected and observed. However at several margins, subsidence appears to have occurred largely after rather than during rifting. Examples of such behaviour described in the literature include the West Iberia margin, the salt basins of the South Atlantic, and the Exmouth Plateau margin. This synrift subsidence deficit can be explained by crustal depth-dependent stretching, in which much of the crust is withdrawn after the end of rifting, but considerable problems arise with this model. They can however also be explained at magma-rich margins by thermal uplift during rifting, the addition of igneous intrusions to the lithosphere during rifting, and the partial depletion of the mantle. At magma-poor margins, mantle serpentinization has a similar effect, although as serpentinization can only occur once the entire curst has become brittle, this is likely to be important only at high degrees of stretching. An alternative explanation may be the influx of asthenosphere warmer than the relatively cool sublithospheric mantle observed beneath several continents and which is one explanation for the lack of melt at many rifted margins. These different models would thus imply some modification to the McKenzie model for lithospheric stretching, arising because of the geodynamic processes accompanying continental breakup. But it is also possible that synrift subsidence has been systematically underestimated if local water level was substantially below global sealevel. The presence of thick evaporites at many rifted margins indicates that this was true at the end of rifting. As rifting leading to continental breakup by definition occurs within a continent, it may be expected that the rift initially develops isolated from the global ocean, with consequently unusual salinities and water levels very different from global sealevel. In summary, there are thus several explanations for the synrift subsidence discrepancy which are to be expected at rifted margins formed during continental breakup.