Dynamics of Tear Faults in the Salt-Detached Systems of the Gulf of Mexico

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The extensive salt in the Gulf of Mexico has resulted in a broad region of Neogene tectonic float connecting updip normal faults with downdip toe thrusts, all driven by gravitational sliding above the mobile substrate. Differential movement between various portions of the detached sedimentary cover has resulted in the development of numerous well-defined strike-slip tear faults. These tear faults are clearly imaged in seafloor bathymetry and their evolution can be studied in 3D seismic data. In general, these structures tend to interconnect between thicker salt bodies, which make up the weak points in the system. In the autochthonous salt system of the eastern GoM, where the underlying salt is thin or largely welded and the base-of-salt surface is relatively planar, these tear faults can form long linear trends with only minor jogs across local salt diapirs. Step-over zones of extensional pull-apart tend to provide conduits for escape of deeply buried salt. In the allochthonous salt system of the central GoM, where the underlying salt consists of a connected canopy and the base-of-salt surface is more irregular, the tear faults tend to exist as short segments separating minibasins sliding at different rates. In particular, when sliding minibasins ground out they tend to slow down, and tear faults of opposing vergence tend to form on either side as the adjacent minibasins continue downslope. Classic examples of grounded minibasins show these lateral tears to be matched by salt overthrusting from the north as the updip minibasin converges, and salt stretching to the south as the downdip minibasin pulls away. A range of structural styles associated with this spectrum of tear faults will be examined.