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Stability and Structural Strength Along Continental Margins

The passive continental margin model of previous decades was of general stability. The margin itself may itself be dynamic as it slides into the basin. There are processes that individually, collectively, and synergistically, weaken the margin in such a way that it moves minutely, locally, and regionally, each unit possibly moving independently, yet forming a single tapestry of deformation.

The critical cohesive Coulomb wedge was described as a wedge of deformed/deforming material, tapering toward the deformation front, a basal decollement with most dynamics above that, and applied to subduction zones. This interpretation may be afixed to dynamic continental margins such as those of the northern Gulf of Mexico and the Gulf of Cadiz, both with major gravitational tectonic over-prints.

With large gravity-driven, down-slope mass-wasting and migrating critical wedges can generate compression, yielding fold-belts. Farther down-slope, the down-dip generated compression stresses may be more diffuse and ineffective. Stress transmitters are the entire continental margin itself or the extrusives: salt, shale, and/or crustal blocks/salt. Both may be operative, yet at different rates, establishing a heterogeneous stress field.

At multi-km depths, the water pressure commenses to be sufficient so that natural gases remain in solution and hydrates may or may not be formed. Hydrate existence changes stresses within sediments and hydrate absence denies the chance of buoyant free gas build-ups. The role of hydrocarbons, be they gas, liquid, and/or solid and of whatever origin-biogenic or abiogenic, given their sheer abundance and ubiquity, needs to be re-examined.