Sedimentary Passive Margin Development and Breakage from Seafloor to Lithosphere: A Continuum of Sequence Stratigraphy

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ABSTRACT

Exploration of passive continental margins, i.e., the northern Gulf of Mexico, suggests that these margins are structurally dynamic over megascales—from minute to basin-spanning. In this review, disconnections/breakages within sediments from seafloor to crust/lithosphere are explored with novel relationships suggested. Volumetric, 3D dynamics occurs contemporaneously over the entire 15-20 km (~9.3-12.4 mi) thick sedimentary wedge.

Multi-size, shape, and type of sand, silt, and clay particles are deposited at varying rates at the sediment-water interface of a sedimentary wedge. Clay particles that are electrically charged form aggregates with marine snow (organic matter) and begin the early developmental history in a continuum from deposition of soft sediment to rigid deep subsurface rock that ultimately forms the continental margin sequence stratigraphy. Numerous types of depositional fabrics from the early nanometer-, micrometer-, to millimeter-scale (sub-inch scale) aggregates and ultimately to later mega-scale sedimentary structural units interplay during the developmental continuum of sequence stratigraphy. The microstructure (fabric and physicochemistry) thus contributes to the characteristics of potential stress fields and fracture patterns ranging over all scales and thus an essential part in the development of vertical/polygonal faults and fluid migration pathways, each an essential component of an advancing sedimentary wedge. Along a passive continental margin are disconnections, faults, flexures, and joints coming into and out of existence often contemporaneously from seafloor to lithosphere/basement during margin migration. Regional extensions often provide effective fluid pathways, enhancing diagenetic reactions along fractures within sediments/rocks of the margin.

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