Weakly Confined Minibasins: A Study of Architecture and Depositional History

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Controls affecting the depositional style within intraslope minibasins include glacially-controlled sea-level fluctuatons (eustacy), the dynamic 3D movement of basin-confining salt (halokinetic) and the alternation between depocenters (autocyclic). In this study, three-dimensional seismic-data from minibasins of Western Green Canyon (northern Gulf of Mexico) record the interplay of eustatically and halokinetically controlled depositional processes.

The ~500 sq. mile study area comprises two salt-confined minibasins that are separated by an extensional fault. Six laterally extensive seismic surfaces interpreted as condensed sections were used to define intervals of stratigraphy at up to 5 seconds. Interval analysis reveals the two minibasins to have previously behaved as one single, larger basin. This single-basin morphology was initially altered by salt emergence then subsequently by extensional faulting. These changes in basin morphology acted to divide the two minibasins. Both stages of salt emergence and extensional faulting affected resultant depositional architectures, and topographically steered basin-filling events.

Deposits observed within these intervals include mass transport deposits, turbidite sheets, overbank accumulations, and hemipelagic drapes. We categorize the intervals as being eustatically and halokinetically controlled, and show how their period of deposition correlates to just 4 glacially controlled global-highstands. Intervals identified as being eustatically controlled are punctuated by hemipelagic drapes, turbidite sheets, channelized regions and mass transport deposits. The absence of mass transport deposits in one eustatically controlled interval may be due to the proximal location of the study area relative to the shelf edge. One interval identified as halokinetically controlled comprises widespread mass transport deposits and turbidite sheets that accumulated during a period of considerable fault movement. It is likely that the faulting was driven by salt dynamics, which also led to mass wasting on over steepened basin margins at salt upwellings, thus creating high frequency mass transport complexes.