Geomorphologic Character of an Upper Leonardian Mass Transport Deposit, Midland Basin: Insights from 3D Seismic Data



1.ABSTRACT

The Leonardian Series of the structurally complex Permian basin had shelf to open marine depositional environment with many sedimentary features. In the Midland Basin of West Texas, the Leonard Series (Lower Permian) include siliciclastic and carbonate rocks that were deposited in deep-water marine environments. Previous studies show the sediments were deposited as a large basin-floor submarine fan system and are commonly interpreted as deposits of turbidity currents. A different mass movement feature was observed on 3D seismic that is characteristic of a Mass Transport Deposit (MTD). The following study aims at characterizing the internal and external architecture of a MTD observed within the Upper Leonard interval in the medial basin centered portion of the Midland Basin using 3D seismic. The feature mapped in the study area is 5 miles wide and extends up to 14 miles basinward. We incorporated geometric attributes to understand the shape, size and anatomy of the MTD and how the paleobathymetry controls the geologic evolution of the MTD.

2. STUDY AREA AND GEOLOGIC SETTING



Figure 1: Paleogeography of Permian Basin in early Permian time showing study area in the red box (modified from Ruppel, 2009). Spraberry trend highlighted in yellow.



simplified stratigraphic chart correlating shelf to basin facies (modified from Handford, 1981). The red box indicates the stratigraphic interval in which the MTD was deposited.



Figure 3: Interpreted regional 2D line trending NW-SE illustrating the prograding carbonate platform basinward due to forced regression (modified and used with permission after Trentham, 2018).

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Figure 4: a) A small MTD observed in the Austrain Alps; b) Compression and extension associated with mass transport deposit. Modified after Posamentier (2017).







Figure 9: A) NW-SE and B) W-E seismic cross section showing internal reflector configuration o the MTD and interpreted line diagram.



