Characterization of a Mass Transport Deposit Using Seismic Attributes:
Upper Leonard Interval, Midland Basin, West Texas*

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Abstract

The Permian Basin is a structurally complex sedimentary basin with an extensive history of tectonic deformation. As the Basin evolved through time, sediments dispersed into the basin floor leading to various mass movements that are well documented in the Permian period. One such mass movement was observed on 3D seismic in the Upper Leonard interval (Middle Permian) of the Midland Basin that is characteristic of a Mass Transport Deposit (MTD). The Leonardian stratigraphy in the Midland Basin records deposition in an intracratonic deep water basin, bounded by shallow water carbonate platforms. Wireline correlations indicate that cyclic Leonardian platform deposits started prograding towards the basin into massive, clinoformal carbonates on the slope, which in turn, grade into flat lying calcareous and siliciclastic intervals. Previous studies done in the upper Leonard interval characterizes MTDs using wireline and image logs, as well as outcrop studies, that aims at understanding the soft sediment deformation of these types of deposits.

Although, mass movements have been extensively studied within the Permian Basin, little work has been published on the nature of these MTDs and their related geomorphological expression on seismic. This 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 7 miles wide and extends up to 15 miles basinward. Geometric attributes such as coherence and structural curvature are used to delineate the different features (lateral wall, thrust faults, slide/slump) that comprises the discontinuous MTD. A different phenomenon was observed within the MTD that is interpreted as gravity spreading. Well log analysis shows the MTD is a mix of carbonates and shales and interpreted as slope strata.
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1. ABSTRACT

The Midland Basin is a structurally complex sedimentary basin with an extensive history of tectonic deformation. As the basin broke through a series of sedimentary basins on the basin floor from surrounding carbonate platforms leading to various mass movements. One such mass movement was observed on 3D seismic in the Upper Leonard interval (Upper Permian) of the Midland Basin which is characterized as a Mass Transport Deposit (MTD). The following study aims to characterize the internal and external architecture of a MTD observed in the Midland Basin using 3D seismic.

2. STUDY AREA AND GEOLOGIC SETTING

3. MTD ARCHITECTURE AND PREVIOUS STUDIES IN THE PERMIAN

4. SEISMIC ATTRIBUTE ANALYSIS

5. DISCUSSION

6. CONCLUSIONS

REFERENCES


[Other references related to MTDs in the Permian Basin and seismic attribute analysis]