Introduction

The De Soto Valley is a submarine canyon formed by depositional and erosional processes and cuts through the broad continental shelf and slope in the northwest portion of the Gulf of Mexico. Though it is one of the least studied areas in the Gulf, the valley is known to contain a variety of geologic features, biologic habitat, and potential hydrocarbon reserves.

The area studied spans a 100 to 2500 m depth range over a 150.6 km lateral field, with major depth changes occurring in the S-shaped De Soto Canyon and in the greater valley below the canyon formation. After exiting the De Soto canyon structure, the depth of the abyssal plain continues to drop very dramatically until reaching the Uchupi Dome, a salt diapir formation. 

From the Pliocene to present day, minor salt domes have been identified (MacRae and Watkins, 1992), including the Uchupi Dome seen in this dataset. Because of these diaps, the petroleum industry has studied the area for oil and natural potential. Some issues of extracting petroleum in this region include the challenging water depth (>1800 m), high infrastructure investments, sour crude quality, additional refining costs and low yield (Piles and Weimer, 2001). GeoBAR mosaics, and 3-Dimensional imaging created in CARIS HIPS and SIPS 7.1 provided insight into sediment type, and geomorphology of the region investigated, shedding light on the above relationships.

Methods

• Hydrographic survey data was collected by the NOAA Ship OKEANOS EXPLORER
• Multibeam data were collected from Feb.-Mar., 2012
• Sonar data collected by Kongsberg EM 302 multibeam collection device with a SIS acquisition system
• Data processed using CARIS HIPS 7.1
• CUBE BASE surface created with 25 m resolution
• Implemented backscatter data using Geocoder to create a mosaic to estimate sediment size and density
• Target areas include morphological characteristics of the De Soto Canyon, “Knife Point” escarpment feature, and the Uchupi Dome salt diapir in the western region of focus.

Results

The De Soto Canyon formation is S-shaped with scour marks through the valley (Fig. 2). There is a “Knife Point” shaped escarpment formation in the grid-BASE surface with symmetrical escarpment faces descending with depth.

Backscatter data using Geocoder for grain size analysis supports evidence that regional drainage from the Mississippi Delta influence the variability of sediments in the region in regards to depth and location. 

Discussion

The De Soto Valley (and associated Canyon) is a unique topographic feature shaped by erosion, deposition and the presence of salt diaps. After analyzing the bathymetry and data collected from the Okeanos Explorer, we found the bottom depths of the De Soto Canyon range from 300 to 1000 m and roughly 42.7 km on a linear axis from the head to foot. The canyon shows scours (Fig. 2, I) in the middle region indicating it was carved by turbidity currents (Harbinson, 1969) and the S-shape appears to be from transgression and regression of sea level as no related erosion manifests at the canyon foot indicating that regressional water flow carved the canyon while transgressing seas levels deposited sediments over the valley drainages. Three specific features of the North-South trending Canyon (Fig. 2, II) have been noted: The Northern bank, Southern bank, and Eastern/Western slopes. The northern bank is an ancient shoreline (Harbinson, 1969) and the canyon itself was carved as the ocean’s sea level rose and fell over time. The Southern bank is an ancient buried salt formation (Pyles, 2001). The Eastern and Western slopes of the canyon were formed in conjunction, with erosion delivering sediment from the east and depositing it on the western border (Pyles, 2001).

Other features in the focus region include the sharp, pointed escarpment feature, referred to here as the “Knife Point” escarpment. Due to the symmetrical relationship of the escarpments (Fig. 3) transgression most likely carved these as well. As seafloor drops, the escarpment gains depth within the valley, as observed by a series of symmetrical erosional features and bathrump ring-like marks in the valley. The similarity in shape of these erosional features suggests they formed under similar marine conditions, and their receding depth indicates a regressing sea level (Fig. 3, III). Diaps, in the De Soto valley are interpreted as salt domes due to size, shape, fault characteristics and associated salt domes in close proximity to those to the west in the Mississippi delta proper. The specific dome studied in our area was the Uchupi Dome. This dome measured 6.4 km (north-south) by 9.3 km (west-east). The Uchupi Dome has a potential for hydrocarbon extraction (Harbinson, 1969) but may be too deep for efficient extraction in conjunction with lower yield than surrounding areas, although oil and gas platforms are located in the De Soto Valley region. The surrounding channels (Fig. 4, III, IV) are from ancient Mississippi River delta drainage, when lower sea levels would have brought the river closer to the De Soto Valley region (Catuneanu, 2006).

References


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Abstract

The De Soto Valley is located in the northeast portion of the Gulf of Mexico, approximately 100 km offshore of Pensacola, Florida. This S-shaped, submarine canyon exhibits many interesting features including a gentle slope, erosional and depositional features, as well as nearby salt diaps. Although there has been studied since the 1960s, the most recent mapping expedition was conducted in 2012 by the NOAA Ship Okeanos Explorer with a Kongsberg EM102 multibeam sonar system. Using CARIS HIPS and SIPS 7.1 for post-processing of bathymetric and backscatter data, suspected hydrocarbon deposits regarding the evident diaps were examined. The research will allow further exploration of the morphology and sediment characteristics in the De Soto Valley, benefiting both the economy, ecology and geologic understanding of the region.