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## Geophysical and Visual Identification of Chemosynthetic and Non-Chemosynthetic Communities Near Perdido Canyon, Northwest Gulf of Mexico

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### Abstract

High-resolution geophysical data define a seafloor shaped by numerous geological processes. Nature and ages of these processes needed to be assessed to properly site and design oil field production facilities and associated infrastructure. In addition to a topography shaped by mass-wasting and erosion by bottom currents, areas of the seafloor showed signs of hydrocarbon seepage. The near-surface stratigraphy, as defined by subbottom-profiler data, generally consisted of an acoustically transparent drape overlying sequences of numerous closely spaced reflections. High-amplitude, nearly amorphous signatures just beneath the seafloor defined areas of probable hydrocarbon seepage. Sonar records showed that within the amorphous zones there were patches of seafloor with high backscatter and a rough microtopography. Visual observations using a remotely operated vehicle (ROV) confirmed the existence of hydrocarbon seepage and detected the presence of chemosynthetic communities.

Seepage zones occurred within a trough-like feature (gully) trending sub-parallel to the face of the Great White Escarpment and south of Perdido Canyon. ROV images detected a variety of bottom types within the gully ranging from discolored sediments laced with white bacterial mats to small clusters of tubeworms. Droplets of oil seeped from the seabed, but no gas bubbles or hydrates were observed. In addition to the bacteria *Beggiatoa*, chemosynthetic organisms included mussel beds and tubeworms. Tubeworm and mussel beds were generally small, scattered patches, associated with small mounds and pockmarks. Chemosynthetic communities occurred only in areas underlain by acoustically amorphous sediments. However, a large portion of the seafloor above the acoustically amorphous sediments showed no evidence of seepage or chemosynthetic organisms. In addition, no chemosynthetic communities occurred outside areas of anomalous seafloor, as defined by high-resolution data. The seafloor outside of seepage-affected areas was featureless with the exception of patches of sea whips and sea pens. Presence of these organisms indicated that the seafloor was generally unaffected by bottom currents despite presence of downslope and cross slope trending furrows in the area around Perdido Canyon.

### Introduction

The study area is centered on Block 857 of the Alaminos Canyon (AC) protraction area, located approximately 220 miles south of Galveston, Texas (Figure 1). This area occurs on the lower continental slope northwest Gulf of Mexico, along the southern margin of Perdido Canyon (Figures 1 and 2). The original exploration well was drilled in the southwest quadrant of AC 857 in 2002. Since that time, several additional wells have been drilled in AC 857, AC 813, and surrounding blocks. Production facilities and the supporting infrastructure are now being installed in AC 857. Geohazard assessment for exploration wells was completed, using conventional and re-processed 3-D data. Resolution of these data was sufficient to site exploration and appraisal wells. However, in order to plan field development, data of greater resolution was needed in the area. In 2004, 973 km of high-resolution geophysical data were collected in the field area, using an autonomous underwater vehicle (AUV). These data defined features and conditions that could impact location and design of production facilities, as well as supporting infrastructure. In addition, these data provided a framework for geotechnical investigations to determine soil types and strengths, and to collect biostratigraphic information for defining the age and intensity of geologic and oceanographic processes. Side-scan sonar and subbottom-profiler data revealed areas of possible hydrocarbon seepage. Video and still photographs were obtained in 2005 using a remotely operated vehicle (ROV) to determine whether “high-density” chemosynthetic communities existed in seepage areas.