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Seismic Images of Structures Associated with Gas Hydrates Near the Sea Floor: Initial Results

Obtaining very-high-resolution seismic images of structures immediately below the sea floor in deep water is fraught with problems. The conventional approach has been to tow a subbottom profiler near the sea floor but, if the water is a kilometer or more deep, vessel speed and manoeuvrability become so restricted that the level of effort required increases enormously. Moreover, the energy levels of seismic sources deployed at depths of a kilometer or more are so restricted that subbottom penetration is limited to a few tens of meters. A research program at the University of Mississippi has been attempting to overcome these difficulties and produce seismic images of structures near the sea floor in deep water of the Gulf of Mexico. The ultimate objective is to image structures associated with gas hydrates, and to do so with a reasonable level of effort. Several data-gathering cruises have been associated with the project. Various seismic sources and receivers have been used and special software has been written. The best results to date have demonstrated decimeter-scale resolution near the sea floor in a kilometer of water. These results are illustrated by several profiles. One such profile crosses a well in which shallow flowing sand had been encountered about 300m below the bottom. Resolution at the top of the sand is better than three meters. A number of profiles cross what apparently are mud diapers, one of which has been documented to contain gas hydrates. Other profiles display intriguing patterns within the shallow sediment layers. The true significance of these patterns is not yet known because ground truth concerning them has not yet been obtained. Data analysis has revealed the acoustic structure of one such pattern, however, and provides a basis for interpretation.