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A NOVEL OVER-SEA-ICE SEISMIC REFLECTION SURVEY IN SOUTHERN MCMURDO SOUND, ANTARCTICA

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During the austral spring of 2005 approximately 27 km of high-quality over-sea-ice seismic reflection data were recorded over Southern McMurdo Sound (SMS), Antarctica, in support of the ANtarctic Geological DRILLing (ANDRILL) Program. The ANDRILL SMS seismic survey incorporated several new survey techniques that improved both the quality and quantity of these data. Previous over-sea-ice seismic experiments have had limited success because of (1) poor source coupling caused by thin sea-ice, or (2) source bubble-pulse effects caused by seismic sources placed in the water column. To mitigate these problems, a Generator-Injector (GI) air gun was used as the seismic source. The GI gun was lowered into the water column through holes drilled in to the sea-ice. The GI gun minimized the source bubble effects that had plagued previous over-sea-ice experiments. Moreover, the GI gun allowed the ANDRILL team to stack data at each shot location and thereby increase the signal-to-noise ratio. A 60-channel seismic snowstreamer consisting of vertically oriented gimbaled geophones with 25-m takeout spacing was employed to aid rapid data collection. The snowstreamer was pulled between shotpoints without the need for time-consuming hand placement of conventional spiked geophones. Two processing steps were essential to improving image quality of these data: (1) a frequency-wavenumber (FK) filter was used to remove guided waves from the data; and (2) Radon transform filtering techniques were used to suppress the ocean bottom multiple. Additional surveys that will employ and build upon our current knowledge of these new methods are planned for Granite Harbor and offshore New Harbor in McMurdo Sound.