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PINNING OF THE SOUTHERN MCMURDO ICE SHELF (SMIS) BY A VOLCANIC SEAMOUNT

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Pioneering glaciological and geophysical research was carried out on the Southern McMurdo Ice Shelf (SMIS), at the north-west edge of the Ross Ice Shelf, over four Antarctic field seasons (2002-2005). Fieldwork was conducted as part of ANDRILL's exploration for potential drill sites in southern McMurdo Sound. During reconnaissance traverses of the SMIS in the 2002/03 field season, a localised topographic high was discovered. Establishing the origin of this ice rise was motivation for a comprehensive investigation in subsequent field seasons.

Over the 2003-05 austral summers, nine intersecting 50 MHz ground-penetrating radar (GPR) profiles were acquired from a vehicle-towed system in order to image ice thickness across the ice rise. The depth of the sea-floor was calculated from seismic reflection bathymetry soundings at discrete sites along a N–S transect. Kinematic GPS was used to record ice surface topography along all survey lines and to map the location of cracks and blue ice patches. Ice movement data was obtained from repeat Fast Static GPS occupation of a regional network of marker poles over a 1-2 year interval.

The ice rise is an elongate dome with an elevation range of 14 m and aerial dimensions of 1.5 x 2 km. It is delineated on its southern and western margins by concentric cracks. The seismic and GPR data reveal that, below the ice rise, the SMIS is penetrated by a crater-shaped bathymetric high that rises steeply (>45°) from the seafloor. The ~500 m wide crater floor is undulating at 90-110 m below the ice shelf surface. The crater rim is 'C' shaped and lies at 55-80 m below the ice shelf surface. There is no rim on the E/NE side. GPS velocities indicate that the SMIS has a regional westward flow that diverges either side of the ice rise and forms an eddy in its lee.

The bathymetric feature is interpreted to be a volcanic seamount on the basis of its geometry and coincidence with a high amplitude magnetic anomaly on a recent ANDRILL aeromagnetic survey map. The seamount appears to be an important pinning point with implications for evaluating the flow dynamics and potential instability of the SMIS.