Development of a large sediment drift near the mouth of Marguerite Trough, Antarctic Peninsula as a record of past ice stream dynamics

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Abstract

Large sediment drifts on the continental rise west of the Antarctic Peninsula have developed since the Middle Miocene and contain continuous, high-resolution records of ice sheet and oceanographic change. New high-resolution multichannel seismic data, multibeam echo sounding data and acoustic sub-bottom profiles were collected around proposed drill sites on several different drifts during RRS *James Clark Ross* cruise JR298 in January–February 2015. Seven piston cores were also collected, all but one of which were from locations close to the proposed drill sites. In this presentation we will focus on results from Drift 5, which is located close to the mouth of Marguerite Trough and thus ideally located to record dynamic changes in the major ice stream that flowed along the trough during Quaternary glacial maxima. The proposed drill site on the crest of Drift 5 is 30 km from the shelf edge at the mouth of the trough. In the Pliocene the mouth of Marguerite Trough was located further south along the margin, and migration of the trough to its present position influenced development and morphology of the drift.

Nine new multichannel seismic lines covering 580 line-km were collected over Drift 5 and the surrounding area, providing an unprecedented opportunity to examine its internal structure and development. The data confirm a very simple 'layer cake' stratigraphy beneath the crest of the drift, showing continuous, parallel reflectors with a very gentle seaward dip that extend to within 25 km of the continental shelf edge. Connections to sparse older seismic lines allow age control to be established by correlation to ODP Leg 178 sites and DSDP Site 325. The new multibeam echo sounding data combined with previous data now provide complete coverage of the drift and reveal evidence of extensive mass wasting on its flanks. Acoustic sub-bottom profiler data collected along the seismic lines show evidence of localised fluid escape structures that are likely pathways for expulsion of fluids released by silica diagenesis at depth. A 9.4 m-long piston core recovered at 2647 m water depth near a proposed drill site on the crest of the drift did not penetrate into Marine Isotope Stage 5. In a 12.9 m-long piston core recovered at 3000 m water depth on the crest of the drift further away from the continental slope, Marine Isotope Stage 5.5 is identified near the base of the core below 11 mbsf, indicating an average sedimentation rate of >9 cm/kyr through the last glacial cycle. We conclude that a drill site on the crest of Drift 5 has the potential to provide an expanded, continuous record of past dynamics of the Marguerite Trough palaeo-ice stream.

Keywords: sediment drift, multichannel seismic, palaeo-ice stream, sediment core