



Cenozoic East Antarctic Ice Sheet Evolution from Wilkes Land Continental Margin Sediments-IODP Expedition 323

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Integrated Ocean Drilling Program (IODP) Expedition 323 will drill the Antarctic Eastern Wilkes Land margin to provide a long-term record of Antarctic glaciation and its relationships with global climatic and oceanographic change. Stratigraphic interpretations indicate that the Wilkes Land record will include the critical periods in Cenozoic Earth climate evolution when the cryosphere formed and evolved to assume its present day configuration. The drilling sites have been selected to 1) obtain the timing and nature of the first arrival of ice at the Wilkes Land margin (referred to as the 'onset' of glaciation), which is inferred to have occurred during the earliest Oligocene (Oi-1 isotope event), 2) obtain the nature and age of the changes in the geometry of the progradational wedge, which is interpreted to correspond with large fluctuations in the extent of the East Antarctic Ice Sheet and possibly coincides with the transition

from a wet-based to a cold-based glacial regime (Late Miocene-Pliocene?), 3) obtain a high-resolution record of Antarctic climate variability during the late Neogene and Quaternary, and 4) to obtain an unprecedented, ultra-high resolution (i.e., annual to decadal) Holocene record of climate variability.

The age and paleoenvironment of deposition of seismically inferred glacial sequences in the Wilkes Land margin are essential to ground-truth the existing glacial-stratigraphic and ice-sheet volume models for this margin. These models suggest that the Wilkes Land margin became glaciated in the later stages of East Antarctic glaciation, after Prydz Bay and the Weddell Sea, and is presumed to be more sensitive to future temperature changes. Moreover, the East Antarctic Ice Sheet (EAIS) in the Eastern Wilkes Basin is grounded below sea-level and thus may have been more sensitive to climate changes in the late Neogene. The sedimentary sections on the Wilkes Land margin may therefore not only hold the record of the time when the EAIS first reached this margin, but also the record of ice sheet fluctuations during times when the EAIS is thought to be more stable (after 15 Ma-recent). To understand Antarctic ice sheet dynamics and stability is of special relevance because state-of-the-art climate models combined with paleoclimatic proxy data suggest that the main triggering mechanism for initial inception and development of the Antarctic glaciation were the decreasing levels of CO₂ concentration in the atmosphere. Based on IPCC 2007 forecasts, an increase of 2x CO₂ or 1.8°-4°C equivalent for the end of this century is expected. Such temperature conditions have not existed on Earth for the past 10-15Ma years, at a past time when only the Antarctic Ice Sheet existed. Therefore, the record from drilling the Wilkes Land is critical for developing reliable models of future Ice Sheet behavior.

IODP Expedition 323, scheduled for January-March 2009, will be a contribution by the IODP and the ACE (Antarctic Climate Evolution) Program of SCAR (Scientific Committee on Antarctic Research) to the International Polar Year.