

EVIDENCE FOR AN EARLIEST OLIGOCENE ICE SHEET ON THE ANTARCTIC PENINSULA

Online Supplemental Material

Linda C. Ivany¹, Stefaan Van Simaey², Eugene W. Domack³, and Scott D. Samson¹

¹Department of Earth Sciences, Syracuse University, Syracuse NY 13244, USA,
lcivany@syr.edu, sdsamson@syr.edu

²Historical Geology, University of Leuven, Leuven B-3000, Belgium,
svansimaey@yahoo.com

³Department of Geosciences, Hamilton College, Clinton New York 13323, USA,
edomack@hamilton.edu

Sample Preparations:

Grain Size: Subsamples from different portions of the diamict and from the pebbly mudstones above and below were disaggregated and analyzed using a Malvern Mastersizer E laser diffraction system to assess grain size distributions. For pebbly mudstone samples in Fig. 2, sample a = .5m below; b = immediately beneath; c = ~.5m above; and d = immediately above the contact with the diamict.

Photomicrographs: Quartz grains from the diamict were separated from the sediment, soaked in dispersant, ultrasonically cleaned, and mounted for scanning electron microscopy.

Sr Isotope Analysis: Samples of bivalve aragonite for Sr isotope analysis come from three shells (*Eurhomalea* sp.) from 2 localities in the highest shell-bearing bed of the La Meseta Formation. Samples were dissolved in 0.5 M acetic acid, centrifuged, and the supernatant dried in preparation for Sr separation. Procedures for Sr separation, filament loading, and mass spectrometry followed those described by Samson et al. (1995). The range of values for NIST standard 987 measured during the course of analysis was 0.71025–0.71027.

Palynology: Approximately 20 g of sediment from two samples below, one within, and two samples above the diamict were processed using standard palynological techniques. Three slides of each sample were scanned for palynomorphs using a plain transmitted light microscope. The palynomorph assemblage is dominated by aquatic, organic-walled dinoflagellate cysts (dinocysts). See also Williams et al. (1998) for taxon IDs. Note that Brinkhuis et al. (2003) is available online:
<http://www-odp.tamu.edu/publications/189_SR/VOLUME/CHAPTERS/105.PDF>.

Prediction for offshore sections:

Greater preservation of Paleogene sequences presumably characterizes sediments offshore of Seymour Island, toward the east northeast (Anderson, 1999). If E-O glacial units begin to interfinger with Tertiary strata in the NW Weddell Sea, their more proximal expression would be discontinuous lenses or channels cut into contemporaneous, non-glacial sequences; the relative thickness of glacial strata would amplify toward the outer shelf, where subsidence allows for the preservation of thicker packages (Barker et al., 1998). Observed stratal relationships are therefore in accord with that expected at the onset of glaciation on the Antarctic continental margin, and predict that correlative sediments offshore should reveal a thicker sequence of glacial deposits.

A note on Barnacle Identification:

The barnacles encrusting cobbles on the upper surface of the diamict have been identified as balanid barnacles, perhaps *Balanus laevis* Bruguiere, known from the Quaternary of the Falkland Islands and the Miocene of Europe and North Africa (John Buckeridge, pers. comm., 2004). If our age assessment is correct, this becomes the earliest reported occurrence of the taxon. A number of other La Meseta Fm taxa show a similarly anomalous stratigraphic distribution, suggesting early evolution in the high southern latitudes and subsequent Neogene dispersal to lower latitudes (Zinsmeister and Feldman, 1984).

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