

IODP Expedition 318: Wilkes Land Glacial History

Site U1358 Summary

2 March 2010

Site U1358 (WLSHE-08A) is located on the continental shelf off the Adélie Coast at 499 m water depth. The main objective at Site U1358 was to core across the regional unconformity WL-U8. This unconformity marks a distinct change in the geometry of the progradational wedge from low-dipping strata below to steeply dipping foresets above (Eittrheim et al., 1995; Escutia et al., 1997; De Santis et al., 2003). It is inferred to represent a significant change from intermittent glaciers to persistent oscillating ice sheets, either during the Late Miocene (Escutia et al., 2005; Cooper et al., 2008) or during the late Pliocene (~3 Ma; Rebesco et al., 2006). The steep foresets above WL-U8 are thought to likely consist of ice proximal (i.e. till, diamictite and debris flows) and open-water sediments deposited as grounded ice sheets extended intermittently onto the outer shelf – similar to sediments recovered during ODP Site 1167 on the Prydz Bay Trough fan (O'Brien et al., 2001).

Site U1358 lies at the westernmost edge of the Mertz Bank and receives drainage from the East Antarctic Ice Sheet through the Wilkes Subglacial Basin. At Site U1358, unconformity WL-U8 occurs at ~165 mbsf (0.84s TWTT). Multichannel seismic reflection profiles crossing Site U1358 show gently dipping strata on the shelf that are truncated near the seafloor. This provided a unique opportunity to sample across the unconformity by drilling at very shallow penetration. The record from Site U1358 is also to complement the more distal (i.e., glacial-interglacial cycles) record from Site U1359 located on the continental rise.

We drilled two short holes at Site U1358 in a water depth of 499 m. Unfortunately, we were only able to penetrate to 35.6 mbsf before the drill collars failed and we had to abandon the hole.

Hole U1358A was drilled to a total depth of 2.0 meters below sea floor (mbsf) and Hole U1358B to a total depth of 35.6 mbsf, both using the Rotary Core Barrel (RCB) system. The upper 8.2 m are unconsolidated and moderately to strongly disturbed by drilling. Below 8.2 mbsf, the sediments are consolidated and only slightly disturbed by drilling. Holes U1358A and U1358B penetrated diamictons and diamictites and are placed within a single lithostratigraphic unit. The diamictons in the upper 8.2 mbsf were probably deposited from floating ice. The diamictites below 8.2 mbsf were either deposited from floating ice, where crudely stratified and laminated, or subglacially, with possible remobilization through glacial debris flow.

Sediments from Holes U1358A and U1358B contain siliceous and organic microfossils. Diatom biostratigraphy provides tentative stratigraphic control throughout the section. Pliocene strata (9.32 to 28.62 mbsf) are overlain by uppermost Pleistocene to Holocene strata. Dinocysts and radiolarians were encountered in trace amounts only, and provide no further age constraints. Foraminifers were not encountered in holes drilled at Site U1358. Diatom assemblages suggest a high-nutrient, open-water environmental setting, similar to that of the modern day Southern Ocean north of the winter sea ice extent. Palynological associations are a mix of reworked and in situ palynomorphs. The in situ protoperidinioid dinocysts confirm a nutrient-rich environment. High abundances of reworked Mesozoic-Paleozoic microfossils indicate a significant input of eroded sediments.

Whole-core magnetic susceptibility was measured at 2.5 cm intervals (2 s measurement time). The raw data values range from 3 to 2834 instrument units (IU). However, the majority of measurements vary between 200 and 400 IU, with some peaks in Core U1358B-4R representing gravel clasts. Variations in GRA density reflect variations in the composition of the Pliocene-Pleistocene diamictite that varies between clast-rich muddy and clast-rich sandy lithologies.

References

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