

Revised chronostratigraphy of DSDP Site 270 and implications for Ross Sea seismic stratigraphy and late Oligocene to early Miocene paleoenvironment

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Abstract

Deep Sea Drilling Project (DSDP) Site 270 was cored to 422.5 m below seafloor (mbsf) in the Ross Sea and recovered an Oligocene to lower Miocene sequence (386–20 mbsf) of silty claystone with ice rafted debris (IRD). This site provides important temporal constraints on regional stratigraphy and insights into ice-sheet dynamics; however, previous age models were based on limited data. Here we provide a revised age model using a combination of biostratigraphy, magnetostratigraphy, Sr-isotope stratigraphy, and K-Ar dating. We also use the microfossil assemblages to make inferences about paleoenvironment. We divide the sequence into four chronostratigraphic intervals (CSI). The base of CSI1 (386–352 mbsf) is dated to $\sim 25.9 \pm 1.6$ Ma based on K-Ar dating of glauconite, which is supported by the highest occurrence (HO) of dinocyst *Lejeunecysta rotunda* (24.5 Ma) at 384 mbsf. We correlate a paleomagnetic reversal between 378 and 376 mbsf to the C8r/C8n.2r boundary (25.987 Ma). These data indicate an age of ~ 25 –26 Ma for CSI1. A distinct change in the benthic foraminifer assemblage at 352 mbsf marks an unconformity and the base of CSI2 (352–146 mbsf), which must be < 25.44 Ma based on the HO of nannofossil *Chiasmolithus altus* at 345 mbsf. The top of CSI2 is < 23.13 Ma based on the HO of nannofossil *Dictyococcites bisectus* at 150.5 mbsf. Within this 200 m interval we correlate seven magnetic reversals to chrons C8n.2n to C6Cr (25.3–23.3 Ma). Our line of correlation suggests rapid sedimentation (~ 80 m/my) during deposition of CSI2. Microfossil and lithologic evidence suggest a distal marine setting with a paleo-water depth of ~ 200 m at 345 mbsf, with deepening above. Another unconformity at ~ 146 mbsf marks the boundary between CSI2 and CSI3 (146–112 mbsf). The base of CSI3 is < 23.13 Ma and Sr-isotope stratigraphy indicates an age of $\sim 23 \pm 1$ Ma for the sediment at 113 mbsf. We place the Oligocene/Miocene boundary between 146 and 141 mbsf near the base of CSI3 and just above an unconformity. Benthic foraminifers indicate continued deepening in the earliest Miocene and finer-grained sediment with less IRD suggests a more ice-distal setting. The boundary between CSI3 and CSI4 (112–20 mbsf) is marked by an unconformity spanning at least 2.5 my based on the lowest occurrence of dinocyst *Batiacasphaera cooperi* (20.71 Ma) at 111 mbsf. Additionally, a diatom-rich sample from 105 mbsf contains *Kisseleviella tricornata*, which ranged from the late Oligocene to early Miocene (~ 20.5 Ma). A major unconformity separates lower Miocene sediments below from Pliocene and younger sediments above 20 mbsf. Late Oligocene to early Miocene pollen assemblages from Site 270 suggest a tundra landscape of low-growing

Nothofagus, Podocarpaceae, and Proteaceae scrub in warmer locations with a relatively stable terrestrial environment over that interval.

Keywords: DSDP Site 270, Ross Sea, chronostratigraphy, late Oligocene to early Miocene paleoclimate