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Contrasting detrital geochemistry of Eocene vs. Neogene glacial strata, ODP Site 1166, Antarctica

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Sediment geochemistry and particle size records for upper Eocene through Pleistocene strata at ODP Site 1166, Prydz Bay, were collected to assess differences in continental weathering conditions and provenance between Paleogene greenhouse and Neogene icehouse strata. A sharp change in datasets occurs at $\sim$135 mbsf, where Pliocene strata directly overlie upper Eocene strata spanning an unconformity of $\sim$ 30 million years. The Paleogene sediments are chemically weathered to a great extent, whereas the Neogene strata are unaltered throughout. The chemical index of alteration (CIA) of the Paleogene strata is similar to those of average shales (69-78), whereas the CIAs of Neogene strata (54-58) are similar to those of modern glacial deposits and Neogene strata recovered elsewhere in Antarctica (Ross Sea). The CIA should be viewed primarily as a precipitation proxy indicating a shift to dryer climates across the Paleogene-Neogene boundary.

Site 1166 provides the oldest relatively well-dated evidence of glaciation in Antarctica. The pronounced chemical alteration of the upper Eocene strata in combination with the presence of ice-rafted debris and glacially reworked sand grains, indicate a cool-temperate proglacial environment. Small ice caps most likely existed in East Antarctica, combined with stretches of coast exposed to maritime climates. Chemical weathering in the late Eocene was probably severe due to the large amount of finely comminuted debris available upon initial glaciation and the high concentrations of carbon dioxide in the atmosphere (Pagani et al., 2005). It is noteworthy that extensive silicate weathering is a considerable carbon sink, but at present data is insufficient to estimate its significance in the processes governing the greenhouse to icehouse transition.