



Late Eocene Antarctic climate variability during the transition to a full glacial state

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The middle Eocene to early Oligocene was an important transition of the global climate system from a warm greenhouse world to today's icehouse conditions. A long-term cooling trend, which was marked by reorganization of global ocean circulation patterns and significant global turnover in the marine and terrestrial biota, is reflected in a progressive increase in the benthic foraminiferal oxygen isotope record through the middle and late Eocene. An abrupt increase in $d_{18}O$ values in earliest Oligocene times is thought to mark the sudden and widespread glaciation of East Antarctica. The climatic history of the Antarctic region and the extent of glacial activity prior to this event, however, are not well known, although multiple lines of evidence suggest that Oi-1 cooling event was predated by several distinct late Eocene warming and cooling phases. Here we present ocean sediment records of magnetic properties and bulk-sediment $d_{18}O$ spanning the late middle Eocene to early Oligocene interval from high-latitude sites on the southern Kerguelen Plateau. The magnetic records show clear evidence of a major and sudden pulse in the flux of terrigenous material shed from East Antarctica during Late Eocene. This event is interpreted to represent an abrupt increase in Antarctic weathering during a warming and deglacial phase that ends a ca. 4 million year-long cooling trend through the late middle Eocene. These results provide strong evidence of significant climatic fluctuations in Antarctica during the late Eocene and several episodes of minor glaciation prior to major continent-scale glaciation in the early Oligocene.