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Neogene biosiliceous sedimentation in the Ross Embayment, Antarctica

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The ANtarctic geological DRILLing Program (ANDRILL), an international collaboration between scientists, drillers, engineers, educators, and technicians from Germany, Italy, New Zealand and the United States working together in the spirit of the 4th International Polar Year (IPY), successfully completed its two inaugural drilling campaigns in 2006 and 2007 (http://www.andrill.org). The primary objectives of ANDRILL's McMurdo Ice Shelf Project (MIS) and Southern McMurdo Sound Project (SMS) were to recover and examine stratigraphic records of sedimentary rock from the Antarctic continental margin that document key steps in Antarctica's Cenozoic climatic and glacial history, and reveal events in the development of the Transantarctic Mountains and West Antarctic Rift System. The MIS Project successfully recovered a 1284.87 meter-long drillcore record of climate and glacial variability spanning the past ∼14 million years from beneath the McMurdo Ice Shelf. The SMS Project successfully recovered a ∼1138.34 meter-long drillcore record, including an expanded 600 m-thick sedimentary record of the middle Miocene Climatic Optimum. The drillsites were influenced by three elements of the Antarctic cryosphere system: East Antarctic Ice Sheet (EAIS), Ross Ice Sheet/West Antarctic Ice Sheet/Shelf, and Ross Embayment sea-ice. In addition, this region experienced repeated phased of open water conditions in the western Ross Sea when diatoms bloomed and siliceous sediments were deposited across broad regions of the Ross Embayment. Diamictite and diatomite sedimentary units are interbedded through the MIS and SMS drillcores, through the last 15 million years. An excellent chronostratigraphic framework provides age control for the drillcores and the network of seismic lines in the western Ross Sea. The timing of open marine conditions, and deposition of diatomite in the western Ross Embayment reflect times when the extent of the West Antarctic Ice Sheet was reduced substantially. Deglaciated continental shelf settings provide new locations where shallow deposition of biosiliceous sediments may have impacted the global silica and carbon budgets. If modern levels of high diatom production in interior shelf settings also extended across wide areas of West Antarctica during the periods reflected in the MIS and SMS drillcore records by diatomite units, we would expect to see coeval excursions in deep-sea carbon isotope records. Duration of deglacial periods, burial and non-removal of diatomite units across the Ross Embayment by subsequent glacial advance, and other processes may complicate this record of episodic biosiliceous sediment accumulation.