Geophysical Research Abstracts
Vol. 12, EGU2010-981, 2010
EGU General Assembly 2010
© Author(s) 2009

Environmental magnetic evidence for a dynamic Taylor Glacier during the mid-Pliocene warm period

Christian Ohneiser (1), Gary Wilson (1,2), and Fabio Florindo (3)

(1) Department of Geology, University of Otago, PO Box 56, Dunedin, (2) Department of Marine Science, University of Otago, PO Box 56, Dunedin, (3) Istituto Nazionale di Geofisica e Vulcanologia, Via di Vigna Murata, 605, Roma, Italy

The current understanding of the Neogene history of the East Antarctic Ice Sheet (EAIS) is limited spatially and temporally by a paucity of sedimentary records. This has led to the assumption that the Antarctic Glacio-climatic system has been in stasis since middle Miocene times and such an interpretation is not in conflict with deep-sea stable isotope records. However, rare stratified glacigene deposits exposed in the Transantarctic mountains and recovered from beneath Antarctic fjords by drilling suggest a more dynamic history of the EAIS.

We apply environmental magnetic methods to drill cores previously collected from McMurdo Sound in an effort to track processes, transport methods and conditions and environments of deposition through the late Neogene. Additionally, we assess the robustness of the earlier magnetostratigraphies from the DVDP-10 and -11 cores by undertaking the first comprehensive paleomagnetic study of discrete paleomagnetic samples with complete thermal and alternating field demagnetisation and polarity determinations from principal component analysis.

Here we present results from an investigation of the magnetic properties of the DVDP-10 and DVDP-11 drill cores from New Harbour, southern Victoria Land. Magnetic properties were determined for 400 samples by measuring their magnetic susceptibility, thermomagnetism and natural and anhysteretic remanent magnetism (NRM/ARM) at the Otago Paleomagnetic Research Facility and hysteresis and isothermal remanent magnetism (IRM) at the Istituto Nazionale di Geofisica e Vulcanologia in Rome, Italy.

The initial analyses indicate that only minimal diagenetic alteration has occurred and that a primary environmental magnetic signal is intact. We divide these records into three intervals based on magnetic characteristics. The upper interval (Interval I) comprises latest Pliocene to Pleistocene age Ross Sea Ice derived sediments which have high concentrations of fine grained magnetite reflecting the contribution of McMurdo Volcanic material to the signal. At $\sim$200 meters in DVDP-11 and $\sim$155 m in DVDP-10 a major mid-Pliocene hiatus truncates a $\sim$40 meter thick interval (Interval II) of muds and diamicts which represents the mid-Pliocene warm period. Magnetically, this interval is unique within the cores because it has relatively low concentrations of magnetite and an upward fining of the magnetic grainsize. We suggest that this interval represents a retreated Taylor Glacier system under warm conditions followed by a re-advance under cooler conditions. The glacial advance immediately prior to the unconformity is marked by increasing magnetite concentration in parallel with decreasing magnetic grain size. The unconformity itself marks a switch from Taylor Valley or EAIS-derived sediments below to Ross Sea Ice or WAIS-derived sediments above.

Below Interval II and to the base of each core are mid-Pliocene to latest Miocene Taylor Valley derived diamicts. Magnetic grainsizes and concentrations are variable over this interval indicating a dynamic Taylor Glacier which underwent multiple advances and retreats.

Efforts are underway to correlate the magnetic properties of these cores with comparable interval in the ANDRILL MIS and SMS cores in order to build a more comprehensive regional understanding of this period.