8-27-2007

Antarctica, the southern ocean, and climate evolution: Insights from drilling, coring, and geophysical surveys

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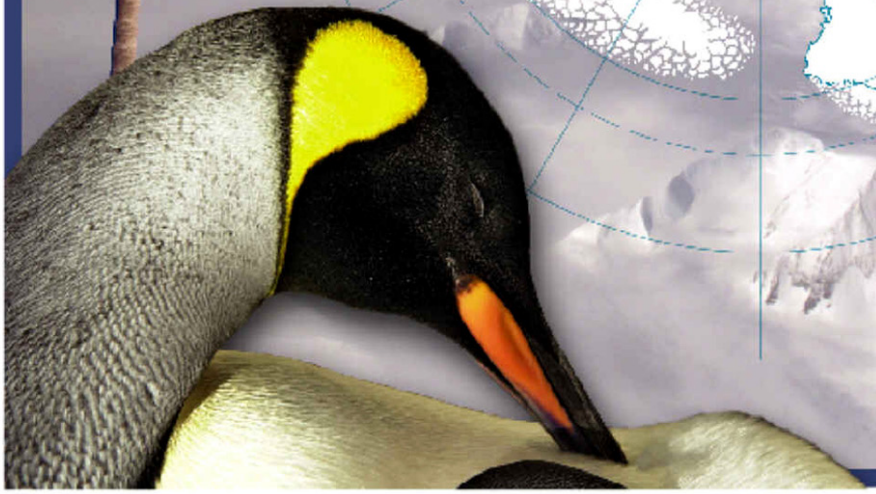
Citation: Cooper, A.K. et al. (2007), Program book for the 10th International Symposium on Antarctic Earth Sciences: in Antarctica: A Keystone in a Changing World-Online Proceedings of the 10th ISAES, edited by A. K. Cooper and C. R. Raymond et al., USGS Open-File Report 2007-1047, **141** p.

10th International Symposium on Antarctic Earth Sciences




August 26 – August 31, 2007

ISAES 2007
UC Santa Barbara



1.P2.A: Antarctica, the southern ocean, and climate evolution: Insights from drilling, coring, and geophysical surveys ORAL

1.P2.A-1: The diatom record of the ANDRILL – McMurdo Ice Shelf project drillcore

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The inaugural drilling season of ANDRILL, recovered a 1,285 m core, AND-1B, with ~99% recovery. The core contains a superb record of Antarctic continental shelf sediments, providing an unparalleled record of climate change through a critical interval in Earth history. The upper c. 600m of core, reflecting Pliocene and early Pleistocene deposition, is composed of alternating glacial diamictites and diatomites, with episodic volcanic facies. The diatomites document extended periods of open marine conditions with reduced ice, in an area currently covered by a thick ice shelf. The diatomites reflect high biosiliceous productivity, and most reflect warmer than present conditions with variable sea ice and ice rafting. Many likely represent an absence of a large ice shelf, whereas diamictites reflect glacial advances. Analysis of the diatom assemblages will result in a new biostratigraphic zonation and high resolution paleoenvironmental reconstructions.

1.P2.A-2: Preliminary $^{40}Ar/^{39}Ar$ results from the AND-1B core

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Preliminary $^{40}Ar/^{39}Ar$ dating of 13 volcanic samples from four stratigraphic intervals within the AND-1B core provide key age constraints for the development of an accurate age-model. To date seven analyses have yielded statistically robust and stratigraphically meaningful ages. The four different stratigraphic intervals represented by the seven successfully dated samples are: 1) 85.53-85.85 mbsf felsic tephra (1.014±0.004 Ma), 2) ~112-145 mbsf basaltic tephra (1.65±0.05 to 1.67±0.05 Ma), 3) 646.30-649.34 mbsf basaltic lava flow (6.48±0.13 Ma), and 4) ~1280 mbsf volcanic clasts (maximum depositional age 13.57±0.13 Ma).

1.P2.A-3: Preliminary chronostratigraphy for the upper 700 m (upper Miocene–Pleistocene) of the AND-1B drillcore recovered from beneath the McMurdo Ice Shelf, Antarctica

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Chronostratigraphic data available for the preliminary age model for the upper 700 m for the AND-1B drill core include diatom biostratigraphy, magnetostratigraphy, $^{40}Ar/^{39}Ar$ ages, $^{87}Sr/^{86}Sr$ ages and surfaces of erosion identified from physical appearance in the drill core. The age data allow a relatively well-constrained age model to be constructed. ~70% of the AND-1B magnetic polarity stratigraphy can be correlated with the Geomagnetic Polarity Time Scale (GPTS). Unique correlation is not possible in several coarse diamictite intervals with closely spaced glacial surfaces of erosion and sparse microflora. However, the age model indicates relatively rapid (up to 1m / k.y.) accumulation punctuated by several half to million year hiatuses representing more than half of the last 7 m.y. in the drillcore. The mid-late Pleistocene is represented by superimposed diamictite units separated from late Pliocene alternating diamictites / diatomites by a ~ 1 m.y. hiatus.

1.P2.A-4: Future geological drilling in Antarctica – a discussion paper on ANDRILL and beyond

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Geological drilling technology developed over the last quarter century has provided access to critical knowledge on the climatic and tectonic history of the Victoria Land margin of Antarctica, giving us a new understanding of the history and behaviour of the Antarctic ice sheet in this region over the last 34 million years. The challenge now is to develop a framework within the Antarctic science and logistics communities and other relevant groups for further projects to extend this technology to other areas both around the Antarctic margin and into the interior. This paper reviews some of the issues and offers a way forward.