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Introduction: The ANDRILL McMurdo Ice Shelf (MIS) and Southern McMurdo Sound (SMS) Drilling Projects

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Notes

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Some of the greatest uncertainties in our understanding of Cenozoic global tectonics and climate can be traced back to our relatively meager knowledge about Antarctica's continental lithosphere and its overlying continental glaciers (Steinberger et al., 2004; Raymo and Huybers, 2008). A trove of information about past tectonism and the behavior of the continental ice sheets lies buried along the submarine continental margins of Antarctica. Searching for and recovering this information presents a unique and significant suite of logistical challenges that have precluded extensive drilling on the continent. However, over the last few decades there have been several international efforts to drill Cenozoic stratigraphic sequences within basins in the West Antarctic Rift system in the southern Ross Sea (e.g., CIROS-1, 2; CRP-1, 2, 3; AND-1B; and AND-2A in Fig. 1). These drilling projects yielded stratigraphic sections with remarkably high core recovery (>98%) and have provided fundamental advances toward understanding past climate and tectonic patterns, as well as the contemporary geodynamic state of the Antarctic continent.

The most recent of the Ross Sea drilling projects was part of the ANDRILL initiative (http://www.andrill.org) in which scientists from Germany, Italy, New Zealand, and the United States collaborated to acquire two high resolution slim hole sedimentary cores from the southern Ross Sea (AND-1B and AND-2A in Fig. 1).

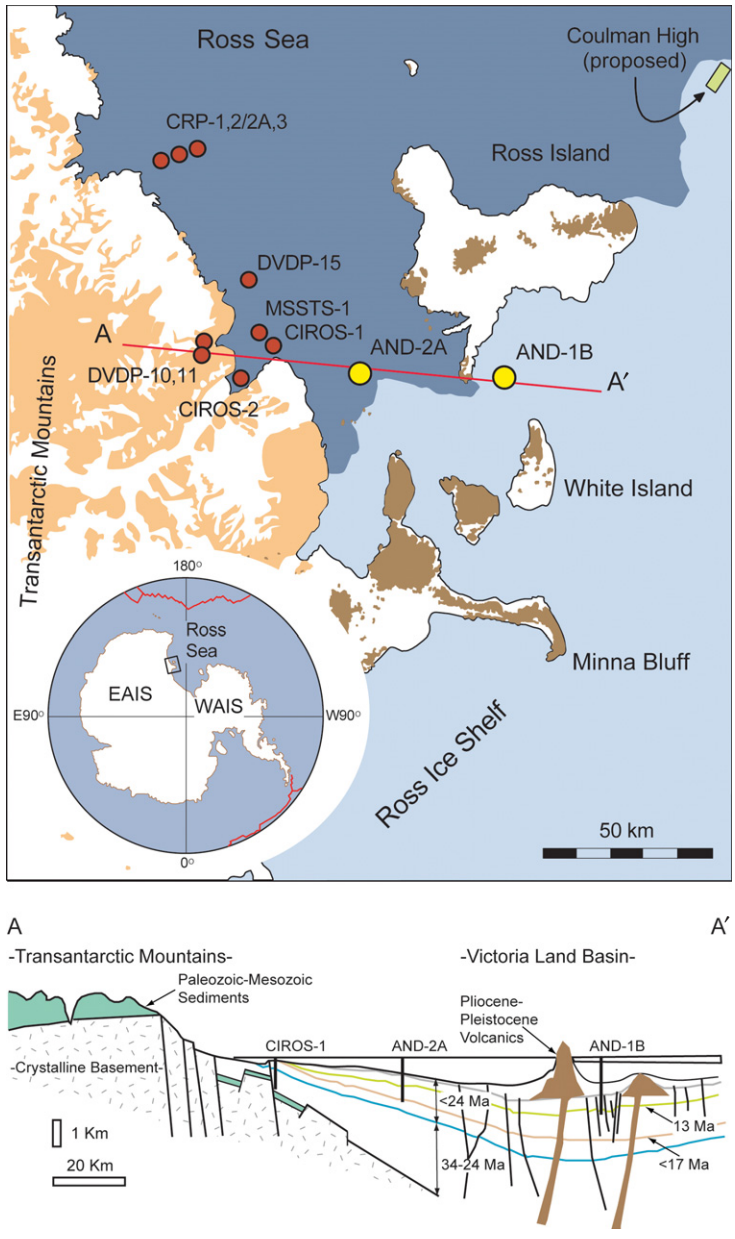

Figure 1. Map and cross section along A–A′ showing the locations of drilling projects (circles on map) in the Victoria Land basin of the West Antarctic Rift system in the southern Ross Sea. Map modified from Del Carlo et al. (2009), and cross section modified from Naish et al. (2009).

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The first drilling project, the McMurdo Ice Shelf Project, obtained a ~1285 m drill core (AND-1B) by drilling from a platform located on the McMurdo Ice Shelf at the Windless Bight region of the Ross Ice Shelf in 2006. The stratigraphic succession recovered by AND-1B records a Late Miocene to Pleistocene climate and tectonic history at the site. The second drilling project, the Southern McMurdo Sound Project, obtained an ~1138 m drill core (AND-2A) by drilling from a platform located on multiyear sea ice in the austral spring of 2007. The stratigraphic succession recovered by AND-2A comprises an expanded Early to Middle Miocene record.

The science program for these two ANDRILL projects had a holistic design in which comprehensive studies were planned for the drill cores, as well as the boreholes, by a group of scientists with different areas of expertise and levels of training. The first measurements on the drill cores were made by a small team of scientists immediately upon core recovery at the drill site science lab. A larger team of scientists conducted investigations at the Crary Science Lab in McMurdo Station, as well as at home institutions (Naish et al., 2007; Harwood et al., 2008–2009). Borehole measurements were made at different stages of each drilling phase.

The papers within this *Geosphere* themed issue, "The ANDRILL McMurdo Ice Shelf (MIS) and Southern McMurdo Sound (SMS) Drilling Projects," examine results associated with these projects. The papers are ultimately a result of significant efforts by a new generation of scientists who were willing and able to take the reins of leadership at the close of ANDRILL's ancestor, the Cape Roberts Project. It is therefore seemingly appropriate that both ANDRILL projects made significant contributions toward training the next generation of scientists by designing science teams that included postdoctoral, graduate, and undergraduate students, as well as senior scientists. With the public and an even younger generation in mind, the ANDRILL program also focused significant efforts on outreach activities during and after drilling that included teachers in programs such as ARISE (http://www.andrill.org/arise) and Project Iceberg (http://www.andrill.org/iceberg).

The common goal that served as the glue for the international group of scientists who spearheaded the formation of ANDRILL was drilling Antarctica's continental margins to unlock the secrets of the Neogene that are buried beneath the ice. At the time of the writing of this introduction, a new phase of ANDRILL drilling has been proposed at Coulman High (Fig. 1; http://www.andrill.org/science/ch), and an international review is once again under way. The papers within this themed issue speak to the importance of multidisciplinary science and international cooperation, and hopefully come at the dawn of further drilling and investigations of the scientific frontier represented by Antarctica's continental margins.

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REFERENCES CITED

Del Carlo, P., Panter, K.S., Bassett, K., Bracciali, L., Di Vincenzo, G., and Rocchi, S., 2009, The upper lithostratigraphic unit of ANDRILL AND-2A core (Southern McMurdo Sound, Antarctica): Local volcanic sources, paleoenvironmental implications and subsidence in the western Victoria Land Basin: Global and Planetary Change, v. 69, p. 142–161, doi:10.1016/j.gloplacha.2009.09.002.

Harwood, D.M., Florindo, F., Talarico, F., and Levy, R., 2008–2009, Studies from the ANDRILL Southern McMurdo Sound Project, Antarctica: Initial Science Report on AND-2A: Terra Antarctica, v. 15, 253 p.

Naish, T., Powell, R., and Levy, R., 2007, eds., Studies from the ANDRILL McMurdo Ice Shelf Project, Antarctica: Initial Science Report on AND-1B: Terra Antarctica, v. 14, 328 p.

Naish, T., Powell, R., Levy, R., Wilson, G., Scherer, R., Talarico, F., Krissek, L., Niessen, F., Pompilio, M., Wilson, T., Carter, L., DeConto, R., Huybers, P., McKay, R., Pollard, D., Ross, J., Winter, D., Barrett, P., Browne, G., Cody, R., Cowan, E., Crampton, J., Dunbar, G., Dunbar, N., Florindo, F., Gebhardt, C., Graham, I., Hannah, M., Hansaraj, D., Harwood, D., Helling, D., Henrys, S., Hinnov, L., Kuhn, G., Kyle, P., Läufer, A., Maffioli, P., Magens, D., Mandernack, K., McIntosh, W., Millan, C., Morin, R., Ohneiser, C., Paulsen, T., Persico, D., Raine, I., Reed, J., Riesselman, C., Sagnotti, L., Schmitt, D., Sjunneskog, C., Strong, P., Taviani, M., Vogel, S., Wilch, T., and Williams, T., 2009, Obliquity-paced Pliocene West Antarctic ice sheet oscillations: Nature, v. 458, p. 322–328, doi:10.1038/nature07867.

Raymo, M.E., and Huybers, P., 2008, Unlocking the mysteries of the ice ages: Nature, v. 451, p. 284–285, doi:10.1038/nature06589.

Steinberger, B., Sutherland, R., and O'Connell, R.J., 2004, Prediction of Emperor-Hawaii seamount locations from a revised model of global plate motion and mantle flow: Nature, v. 430, p. 167–173, doi:10.1038/nature02660.