High-salinity waters beneath the margin of the West Antarctic ice sheet - evidence from ANDRILL porewater studies

Nadine Quintana-Krupinski and Slawek Tulaczyk
Department of Earth and Planetary Sciences, University of California, Santa Cruz, CA 95064, USA

Stefan W. Voge
Department of Geological and Environmental Sciences, Northern Illinois University, IL 60115, USA

Porewater chemistry in Antarctic sediments may provide important archives of past ice sheet interactions with their substrata. Here we report preliminary results from analyses of porewater chlorinity and stable isotopes on samples taken from the 1.2-km-deep core collected from McMurdo Ice Shelf (MIS) in the austral 2006/07 season as part of the ANDRILL project. Chlorinity and stable isotopes have been selected for this study because they represent relatively conservative chemical indicators of physical processes, such as melting, freezing, or mixing.

Sediments collected close to the modern seabed have porewater composition similar to that of seawater. However, at depths ranging between dozens of meters to ~600 meters, porewater stable isotopic composition becomes significantly more negative than that of seawater, indicating influence of ice-porewater interactions. The same depth interval is characterized by elevated chlorinity, reaching nearly twice the chlorinity of seawater. Below ~600 m, both stable isotopic composition of water and its chlorinity return to values close to seawater values.

The depth of the core interval showing signs of ice-porewater interactions is consistent with onset of these interactions within the last few million years. This timing is in agreement with the pronounced onset of colder climatic conditions inferred from sedimentary properties of the MIS ANDRILL core (Naish et al., 2007). The elevated chlorinity of the 'cryo-altered' porewater indicates that ice-porewater interactions were characterized by predominance of basal freezing over basal melting during the last few million years.

Our findings aid reconstructions of glacial conditions and history at the MIS ANDRILL core site. In addition, we will discuss the potential implications of these results for modeling of ice sheet thermodynamics and understanding of chemical boundary conditions for deep microbial subglacial life in Antarctica.

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