1-1-2006

The Sedimentary Environment Below Earth's Polar Ice Cap as a Microbial Habitat

David C. Smith
University of Rhode Island, dcsmith@uri.edu

Stephanie Forschner-Dancause
University of Rhode Island, sdancause@uri.edu

David C. Rowley
University of Rhode Island, drowley@uri.edu

Steven D'Hondt
University of Rhode Island, dhondt@uri.edu

The Sedimentary Environment Below Earth's Polar Ice Cap as a Microbial Habitat

Keywords

Microbial habitat; sedimentary environment; polar ice cap; Earth

Disciplines

Marine Biology | Oceanography

Publisher Statement

Presented at the Astrobiology meeting in 2006.

The Sedimentary Environment Below Earth's Polar Ice Cap as a Microbial Habitat

David C. Smith
Graduate School of Oceanography
University of Rhode Island
Narragansett, RI 02882
USA
dcsmith@gso.uri.edu

Stephanie Forschner
Department of Biomedical and Pharmaceutical Sciences
University of Rhode Island
USA

David C. Rowley
Department of Biomedical and Pharmaceutical Sciences
University of Rhode Island
USA

Steven D'Hondt
Graduate School of Oceanography
University of Rhode Island
USA

Due to low energy and anaerobic conditions, deeply buried marine sediments provide an opportunity to study microbial diversity and adaptation to subsurface life under conditions that may mimic extraterrestrial subsurface conditions. The URI team of the NASA Astrobiology Institute recently participated in the first scientific drilling expedition to the ice-covered central Arctic Ocean (Integrated Ocean Drilling Program expedition 302). With an armada that consisted of three icebreakers, this expedition successfully cored the entire 428 m sediment stack on the Lomonosov Ridge during August and September 2004. The drill sites were located ~250 km from the North Pole under ~1300 m of water. The sediments accumulated over the past ~56 Ma. The recovered cores vary from siliciclastic sediment low in organic carbon (< 0.2 %) to organic-rich black sediments that rapidly accumulated in the early middle Eocene. Three geochemical environments were characterized based on chemical analyses of porewater: an upper ammonium oxidation zone, a carbonate dissolution zone and a deep (> 200 meters below sea floor) sulfate reduction zone. We are using phylogenetic markers to assess the diversity of microbes within each zone. We will analyze these data in the context of sediment lithology and porewater geochemistry, to document the environmental properties that control occurrences of these microorganisms and to guide sampling efforts for future subsurface exploration.