Geophysical Research Abstracts,
Vol. 11, EGU2009-1781, 2009
EGU General Assembly 2009

Do biosiliceous laminated sediments reveal sea ice seasonality in the middle Eocene Arctic Ocean?

C.E. Stickley (1,2), N. Koc (2,1), R.B. Pearce (3), and A.E.S. Kemp (3)

(1) Department of Geology, University of Tromsø, N-9037 Tromsø, Norway (catherine.stickley@npolar.no), (2) Norwegian Polar Institute, Polar Environmental Centre, N-9296 Tromsø, Norway, (3) National Oceanography Centre, Southampton, University of Southampton, Southampton, UK

We present initial microfabric analyses of finely laminated middle Eocene biosiliceous sediments from the IODP Expedition 302 "ACEX" cores (central Arctic, Lomonosov Ridge). Backscattered electron imagery (BSEI) of polished thin sections and scanning electron microscope secondary electron imagery (SEI) of lamina-parallel fracture surfaces are used to analyse the laminations in 2 short intervals dated at approximately 46 Ma. Our data offer insight into the cryospheric history of the central Arctic from a siliceous microfossil perspective during a significant phase in Cenozoic climate evolution—the start of the transition from a greenhouse to an icehouse world. Importantly, the BSEI technique offers the detail of information which can not be achieved by bulk sediment analysis.

These organic-rich sediments, deposited under an anoxic benthic environment, are also rich in heavily silicified endemic marine to brackish (diatoms, ebridians, silicoflagellates) and in situ freshwater (chrysophyte cysts) siliceous microfossils. They also contain the weakly silicified needle-like diatom *Synedropsis* spp., an indicator of sea ice and the world's oldest known fossil record of sea ice dwelling diatoms (Stickley et al., in press; Stickley and Koc, Session CL33 this conference). Their presence highlights an exceptional preservational environment along the Lomonosov Ridge at this time. *Synedropsis* spp. show the Arctic Ocean supported sea ice-based life from 47 Ma, yet episodes of melting must have occurred to allow their preservation in the sediments. Initial investigations indicate *Synedropsis* spp. form mono-specific laminations or elongate lenses of, on average, 25 μm thickness, and normally always in association with ice rafted debris (IRD) through the studied intervals, indicating discrete productivity events of this enigmatic diatom. Analogy with sea ice-associated laminated diatomaceous Holocene sediments from the Antarctic shelf suggests they may represent spring or summer sea ice melt episodes and the quasi-simultaneous flux of sea ice diatoms and IRD. This is far from clear cut however since the ACEX sediments are highly disturbed in places and laminations are commonly not continuous so the classic annual "varves" in this senses, are difficult to ascertain.

We attempt to understand the temporal significance of these mono-specific laminations and lenses in terms of melting episodes by examining their thickness, continuity and sequential relationship with other laminations/lenses in the scanning electron microscope. Initial examination of some of these other laminations/lenses gives further clues about the formation of this rich sediment archive, and the effects that middle Eocene ice initiation had on the central Arctic ecosystem.