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Beringian & Arctic Climate Change recorded in El'gygytgyn Crater Lake, NE Siberia: The science justifying deep drilling

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Sediment piston cores from Lake El'gygytgyn (67˚N, 172˚E), a 3.6 million year old meteorite impact crater in northeastern Siberia, have been analyzed to extract a multi-proxy millennial-scale climate record extending to nearly 250 ka, with distinct fluctuations in sedimentological, physical, biochemical, and paleoecological parameters. Five major themes emerge from this research. First the pilot cores and seismic data show that El'gygytygn Crater Lake contains what is expected to be the longest, most continuous terrestrial record of past climate change in the entire Arctic back to the time of impact. Second, processes operating in the El'gygytygn basin lead to changes in the limnogeology and the biogeochemistry that reflect robust changes in the regional climate and paleoecology over a large part of the western Arctic. Third, the magnetic susceptibility and other proxies record numerous rapid change events. The recovered lake sediment contains both the best-resolved record of the last interglacial and the longest terrestrial record of millennial scale climate change in the Arctic, yielding a high fidelity multi-proxy record extending nearly 150,000 years beyond what has been obtained from the Greenland Ice Sheet. Fourth, the potential for evaluating teleconnections under different mean climate states is high. Despite the heterogeneous nature of recent Arctic climate change, millennial scale climate events in the North Atlantic/Greenland region are recorded in the most distal regions of the Arctic under variable boundary conditions. And finally, deep drilling of the complete depositional record in Lake El'gygytgyn, now planned for spring and summer 2008, will offer new insights and, perhaps, surprises into the late Cenozoic evolution of Arctic climate.

The cores are likely to provide a unique Arctic record capturing the mechanisms and dynamics of glacial/interglacial and millennial-scale change over the duration of the “41 ka world” and late Cenozoic “100 ka world” for comparison with other long records from the N. Atlantic, N.Pacific, but especially the tropical oceans to evaluate and model systemic teleconnections and leads/lags relative to insolation forcing. This record will also provide insight as to whether rapid change events identified during the last glacial cycle are typical of earlier glacial periods. This core will also include sediments deposited a million years prior to the first major glaciation of the Northern Hemisphere. Thus, these records will allow us to address questions concerning the evolution and mode of Arctic climate change via the transition from the warm middle Pliocene to the onset of major Northern Hemisphere glaciation at millennial-scale temporal resolution.