

THE IMPACT Project 2000: Terrestrial History of El'gygytyn Crater Lake: an International Multidisciplinary PaleoClimate Project

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In 1998 we recovered what is now the longest lacustrine paleoclimate record in the Arctic at 400 ka from El'gygytyn Lake, in Northeast Siberia. Because this lake lies inside a non-glaciated impact crater created 3.6 million years ago, we have the potential to recover a straightforward climate record representative of the western Arctic dating back to the middle Pliocene. Core analyses thus far have shown, for example, that boreal treeline migrated north and then south of the crater during the last interglacial, demonstrating a sensitivity to land/climate interactions. Field studies this year provided data important to the interpretation of the 1998 core and an understanding of the modern processes, including modern limnology, geomorphology, coring, stream and lake hydrology, local meteorology, and a 2-fold seismic program including airgun and 3.5 kHz high-resolution profiles.

Initial field results from the seismic data indicate that the total sediment fill in the basin is more than of 200 m draped over a small central impact cone in this crater nearly 18 km in diameter. These data also indicate the best sites for a deep drilling program. Fragments of paleoshorelines at elevations roughly 45 m, 18 m, 8 to 12 m and 6 m, especially around the east and south shores, indicate that lake level has been higher in the past; the highest levels probably occupied early in the lake history but difficult to date. The present topography would suggest that at shorelines over +30 m, the lake water should have exited via a northern outlet; however the geomorphology of this earlier outlet stream lacks any significant terraces. Alluvial fans with slopes of 3-4 degrees around more than half of the lake margin consist primarily of alluvium and soliflucted colluvium at the current surface; emergent lacustrine shelf sediments occur in only a few sections. Nearly half of the lake basin lacks any wide shelf, including large areas fronting larger alluvial fan complexes. Modern beaches around the lake are coarse with high storm berms related to waves and ice shoving created by the long fetch and strong regional winds. Detailed studies of the sedimentology, modern and down core studies of the pollen, diatoms, and geochemistry are ongoing.

El'gygytgyn Lake is ice covered roughly 9 months of the year, becoming ice-free usually by early-mid July. Once ice-free, our measurements show the lake mixes completely by wind stress maintaining a temperature of 2 to 3 degrees C; there is no significant thermocline. Lake temperature, lake level, and meteorology equipment have been installed at the lake to provide us with several years of in situ data. Initial meteorology data suggest that the local climate of El'gygytgyn is representative of regional synoptic climatology indicating that the paleoclimate record from this lake is a proxy of broad scale western arctic environmental change. Analysis of the 1998 core confirms this by showing teleconnections with the GISP core, which contains a time-series less than half as long as the El-gygytgyn core.