



Classification and characteristics of mass movement deposits in the 3.6 Ma sediment record of Lake El'gygytyn, Chukotka, NE Siberia

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Lake El'gygytyn (67°30' N, 172°05' E), formed after a meteorite impact 3.6 million years ago, is situated in the high Arctic of Chukotka, NE Siberia, 100 km north of the Arctic Circle in an area thought to have escaped continental wide glaciation. The lake was drilled by the ICDP El'gygytyn Drilling Project in spring 2009 near the center of the lake at a depth of 170 m. Three overlapping cores were recovered forming a unique 317-m long paleoclimate archive from the terrestrial Arctic reaching back to the Pliocene. The coring site was selected based on a pre-site survey that indicated undisturbed and layered units in the lake center. On the lake slope, seismic survey and pilot cores have revealed thick debris flows thinning toward the lake floor.

Detailed studies of earlier pilot cores, with a maximum length of 16 m blf, revealed altogether 28 mass movement events incised into 'pelagic' sediment in the lake center (Melles et al. 2007, Juschus et al. 2009). These event layers are for the most part normally graded beds, interpreted as non-erosive turbidites (Juschus et al. 2009) that originated as debris flows on the steep lake slope and transformed into turbidity flows on their way toward the lake floor. Since mass movement deposits potentially erode the underlying sediment and therefore cause hiatuses in the paleoclimatic record, investigations of the mass movement events in all of the new cores are underway.

The recovered lacustrine sediment record is repeatedly interrupted by short-lived mass movement deposits. These deposits are macroscopically distinguishable from the 'pelagic' sedimentation according to their characteristics, e.g. normal grading, grain size and color. Their macroscopical identification was further confirmed by evaluation of radiographs and high-resolution elemental analyses. These methods, as well as thin-section analyses, revealed more details and internal structures of the mass movement deposits.

The mass movements deposits in the El'gygytyn sediment record are mostly normally graded beds (turbidites) that have a sharp contact to the underlying sediment. Thicknesses of the turbidite beds vary between millimeters and tens of centimeters. The grain sizes are from sand to clay and show often clear internal boundaries indicating changes in grain size. Homogenous gravelly/sandy to silty debrites are also found, often overlain by a turbidite. These debrites frequently include disturbed or occasionally undisturbed lenses of 'pelagic' sediment. In addition, sequences of redeposited, folded or bended sediment were discovered in the core, a result of more extensive deformation of sediment. These units have thicknesses between half a meter and a few meters and show distinct repetition of specific layers, e.g. tephra or turbidite. The new cores were correlated to the pilot core to create a record of mass movement deposits covering the whole history of the lake.

Reference:

Juschus O., Melles M., Gebhardt A.C. & Niessen F. (2009): Late Quaternary mass movement events in Lake El'gygytyn, north-eastern Siberia. *Sedimentology*, 56, 2155-2174. DOI: 10.1111/j.1365-3091.2009.01074.x

Melles M., Brigham-Grette J., Glushkova O. Yu., Minyuk P., Nowaczyk N. R. & Hubberten H.-W. (2007): Sedimentary geochemistry of a pilot core from El'gygytyn Lake - a sensitive record of climate variability in the East Siberian Arctic during the past three climate cycles. *Journal of Paleolimnology*, 37, 89-104.