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Initial geochemistry and FTIRS data of deep-drilling cores from Lake El'gygytgyn, NE Siberia, and their implications for the Pliocene and Quaternary climate history of the Siberian Arctic

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High arctic Lake El'gygytgyn (67°30' N, 172°05' E) is a 3.6 Ma old meteorite crater lake situated in Chukotka/NE Siberia. With its continuous and undisturbed sequence since the Pliocene, the lake comprises the most long-lasting climate archive of the terrestrial Arctic. In spring 2009, the ICDP El'gygytgyn Drilling Project recovered the 315-m long lacustrine sediment record of Lake El'gygytgyn. Here we present initial results of elemental analyses as well as infrared spectroscopy of this record.

The elemental composition of the lake sediment was investigated by a combination of high-resolution element analyses using an ITRAX X-ray Fluorescence (XRF) core scanner (Cox Analytics), and conventional XRF spectrometry. The results well reflect variations in sedimentation, weathering, lake hydrology and productivity mostly triggered by glacial-interglacial cycles. Furthermore, due to the high spatial resolution of the ITRAX even short-term fluctuations of those proxies could be detected, displaying the sensitivity of the Lake El'gygytgyn sediments to regional and global climate changes on a decadal to centennial scale.

Measurements of Fourier Transform Infrared Spectroscopy (FTIRS) in the mid-infrared (MIR) region were conducted to quantitatively estimate contents of biogenic silica (BSi), total nitrogen (TN), total organic carbon (TOC), and total inorganic carbon (TIC) in Lake El'gygytgyn sediments. Simultaneous inference of these components is possible because IR-spectra in the MIR-region contain a wide variety of information on minerogenic and organic substances. The technique requires only small amounts (0.01g dry weight) of sample material and negligible sample pre-treatments. FTIRS calibrations for BSi, TN, TOC, and TIC based on core catcher samples of the sediment sequence yielded good statistical performances and emphasize the potential of the technique for high-resolution investigations of long sediment successions.

Based on these initial results of the El'gygytgyn deep drilling cores, first conclusions about the climatic evolution of the Arctic back to the Pliocene can be drawn. First geochemical and FTIRS data suggest highly variable climatic and/or environmental conditions in NE Siberia during the Quaternary, which was drilled with almost 100 % recovery. Within the Pliocene, corresponding to the lower app. 200 m of the sediment sequence, various distinct climatic variations are indicated.