Geophysical Research Abstracts
Vol. 16, EGU2014-4474, 2014
EGU General Assembly 2014

Late Pliocene/Early Pleistocene environments inferred from the Lake El'gygytgyn pollen record

Andrei Andreev (1), Volker Wennrich (1), Pavel Tarasov (2), Elena Raschke (Morozova) (3), Julie Brigham-Grette (4), Norbert Nowaczyk (5), and Martin Melles (1)

(1) Cologne University, Institute for Geology and Mineralogy, Cologne, Germany (aandreev@uni-koeln.de), (2) Free University Berlin, Institute of Geological Sciences, Palaeontology Branch, Malteser Str. 74-100, Haus D, 12249 Berlin, Germany (ptarasov@zedat.fu-berlin.de), (3) Arctic and Antarctic Research Institute, Bering St. 38, St. Petersburg, 199397 Russia (elena.morozova@aari.ru), (4) Department of Geosciences, University of Massachusetts, North Pleasant Str. 611, Amherst, MA 01003, Amherst, USA (juliebg@geo.umass.edu), (5) Helmholtz Centre Potsdam, GFZ German Research Centre for Geosciences, Section 5.2 - Climate Dynamics and Landscape Evolution, Telegrafenberg, 14473 Potsdam, Germany

The Arctic is known to play a crucial role within the global climate system. The mid-Pliocene (3-3.5 Ma) is considered to be the most probable scenario of the future climate changes. However, reliable climate projections are hampered by the complexity of the underlying natural variability and feedback mechanisms. An important prerequisite for the validation and improvement of the future projections is a better understanding of the long-term environmental history of the Arctic. Unfortunately, formation of continuous paleoenvironmental records in the Arctic was widely restricted due to repeated glaciations. Continuous sequences that penetrate the entire Quaternary and further into the Pliocene are highly desired and would enable to validate the temperature rise during the mid-Pliocene that was proposed by former studies. Such a record has now become available from Lake El′gygytgyn (67º30'N, 172º05E') located in a meteorite impact crater in north-eastern Siberia.
The impact nearly 3.6 Ma ago formed an 18 km wide hole in the ground that then filled with water. The retrieved lake sediments have trapped pollen from a several thousand square-kilometer source area providing reliable insights into regional and over-regional millennial-scale vegetation and climate changes of the Arctic since the Pliocene.
The "El′gygytgyn Drilling Project" of ICDP has completed three holes in the center of the lake, penetrating about 318 m thick lake sediments and about 200 m of the impact rocks below. Because of its unusual origin and high-latitude setting in western Beringia, scientific drilling at Lake El′gygytgyn offered unique opportunities for paleoclimate research, allowing time-continuous climatic and environmental reconstructions back into the Pliocene.
Late Pliocene and Early Pleistocene pollen assemblages can be subdivided into 55 pollen zones, which reflect the main environmental fluctuations in the region 3.55-2.15 Ma BP. Pollen-based climate reconstructions show that conditions in the study area were the warmest about 3.55-3.4 Ma BP when spruce-pine-fir-hemlock-larch-Pseudotsuga forests dominated in nowadays tundra area. After ca 3.4 Ma BP dark coniferous taxa gradually disappeared from the vegetation. Very pronounced environmental changes are revealed about ca 3.35-3.275 Ma BP when treeless tundra and steppe habitats dominated.
Treeless and shrubby environments are also indicative after ca 2.6 Ma. Dry and cold climate conditions were similar to those during the Late Pleistocene. The Early Pleistocene sediments contain pollen assemblages reflecting alternation of treeless intervals with cold and dry climate and warmer intervals when larch forests with stone pines, shrub alders and birches were also common in the region. Very dry environments are revealed after ca 2.175 Ma BP. High amounts of green algae colonies (Botryococcus) in the studied sediments point to shallow-water conditions ca 2.55, 2.45, and ca 2.175 Ma BP.
Thus, pollen studies show that sediments accumulated in Lake El′gygytgyn are an excellent archive of environmental changes since 3.55 Myr BP. The record well reflects main regional paleoenvironmental fluctuations. The further high-resolution palynological study of the core will reveal climate fluctuations inside the main glacial/interglacial intervals and will give the first continuous and detailed scheme of environmental changes for a whole Arctic.