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Late Holocene climate history recorded in Karakel lake sediments, Central Caucasus

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The Holocene climatic history in Caucasus is poorly studied. Two lake sediment cores up to 180 cm long retrieved from the Karakel lake (N 43° 26' 12,13" E 41° 44' 34,72" H=1335 m, Teberda valley, Western Caucasus) in 2010 provide a unique opportunity for the high resolution reconstruction of climate and environment in the Late Holocene in this region. For this purpose we used the scanning X-ray Fluorescence Analyses on Synchrotron Radiation technique (SRXFA) (0.1 mm resolution equal to 4 years), providing data of distribution of more than 50 micro- and macroelements, the loss-on-ignition, magnetic susceptibility, water content, wet and dry bulk density and other physical properties of the sediments as well as palynology (10 mm resolution approximately equal to 40 years).

The surface of the lake Karakel is 140x280 m, the lake is 6-8 m deep and is dammed by an old moraine covered by a sparse pine forest. Two units are clearly distinguished in the sediments: the uppermost part (0-54 cm) consists of dark brown to black organic reach sediments, the lower part is light gray laminated clay, poor in organic. Three radiocarbon dates (AMS) from the depth 30-31 cm (1550 $\pm$ 30 BP), 52-54 cm (2235 $\pm$ 35 BP), 143-145 m (9760 $\pm$ 80 BP) provide the chronological control for the sedimentation rate. The hiatus between the lower and upper units is possible, while the uniform continuous accumulation rate 0.22-0.23 mm/year without major episodes of erosion is supposed for the upper part of the sediments. Seven years from the uppermost part of the sediments is lost in the column collected by the borer in comparison with those retrieved by the box.

The late Holocene unit is subdivided into four palynological zones characterizing the changes in the surrounding vegetation and climate. The very good correspondence exists between the total pollen productivity, especially for the tree pollen, and the bromide content in the sediments, which is in turn correlative with the total bio-productivity. The bromide content correlates with the longest instrumental records of warm period temperature (April-September, 11-years running mean, AD1890-1990) in Tbilisi. According to our reconstruction, the climate in the second millennium AD was more favorable for the thermophyllus vegetation, than one of the first part of the late Holocene. The major peak of the broad live forest distribution occurred in 9-14 centuries, the second, shorter warm period occurred in 18 century, while the broad lives pollen productivity decreased around 400-500 and 200-250 years ago. These findings agree with the radiocarbon dates of buried soils deposited during the warm and humid periods, the dates of Little Ice Age moraines and the archeological data in this area.