Geophysical Research Abstracts
Vol. 13, EGU2011-8752, 2011
EGU General Assembly 2011

Holocene environmental changes in an Arctic lake

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High Arctic lakes are among the most sensitive ecosystems and are highly responsive to climate change and anthropogenic pollution. Human activities have more than doubled the atmospheric nitrogen in the biosphere and this problem will greatly exacerbate Arctic ecosystem responses to climate change. Svalbard, the high Arctic archipelago, has been identified as a region with high climatic sensitivity because of its location at the rim of the Arctic Ocean and east of the northern branch of the North Atlantic thermohaline circulation, the West Spitsbergen Current. Climate warming in Svalbard was pronounced especially during the recent decades and increased anthropogenic pollution has influenced Svalbard during the last century. To study climate and anthropogenic impacts in the Arctic environment, sediment cores and water samples have been obtained from three lakes in Svalbard: Hajeren, Blokkvatn and Kongressvatn. These lakes were selected based on their size and maximum depth, and their catchment characteristics, especially the absence or scarcity of glacier and seabird nutrient deposition, and distance to the ocean. Three short sediment cores (12-26 cm) were taken for multi-proxy analyses including biologic (diatoms, organic parameters) and abiotic parameters (bulk geochemistry, nitrogen (^{15}N, ^{14}N) isotopes). In addition, two long cores (450 cm) are available from Kongressvatn. Dating is based on ^{210}Pb, ^{137}Cs, and ^{241}Am for recent sediment sections and on ^{14}C for older core sections. Preliminary results show that the nitrogen and carbon content in the sediment were generally low (0.01-0.26% N, 0.15-1.8% C), variable and showing a similar trend throughout the cores. In the long cores from Kongressvatn, the nitrogen and carbon contents decreased in the middle, but increased towards the top sediment section. In the short sediment core from Blokkvatn nitrogen and carbon both increased from the older to the younger layers, while both remained at constantly low levels in all sediment layers in the core from Hajeren. The C:N molar ratio showed the same trend as nitrogen and carbon in Kongressvatn and Blokkvatn, while it was decreasing in the most recent sediment layers of Hajeren. C:N ratios were low ($<$12) throughout these cores indicating that aquatic organisms (algae) were the major source for organic matter. Our ultimate aim is to reconstruct the historic changes in atmospheric deposition, and the resulting changes in biodiversity (diatoms, productivity) in these high Arctic lakes, and to assess whether climate and nitrogen deposition together cause unprecedented ecological conditions in high Arctic lakes.