10 000 years of hydrological changes in Yellowstone Lake (USA) based on the analysis of oxygen isotopes in diatoms

Rosine Cartier*[1], Daniel Conley[1], Melanie Leng[2], Jack Lacey[2], Petra Zahajská[1], Sabrina Brown[3], Christopher Schiller[4], Cathy Whitlock[4], and Sherilyn Fritz[3]

[1]Department of Geology, Lund University – Sölvegatan 12, SE-223 62 Lund, Suède
[2]British Geological Survey, Nottingham – Royaume-Uni
[3]Department of Earth and Atmospheric Sciences and School of Biological Sciences, University of Nebraska–Lincoln – États-Unis
[4]Institute on Ecosystems and Department of Earth Sciences - Montana State University – Bozeman, MT, États-Unis

Résumé

Northern Yellowstone Lake is on the southeast edge of the 631-ka Yellowstone caldera and is an area with high heat flow, high seismicity, and an abundance of active hydrothermal features and structures. Several large hydrothermal explosions since the last glacial recession formed craters of more than 100 m in diameter. These large craters raise the question on how climate and hydrological changes have affected the hydrothermal system and the lake ecosystem at millennial timescales.
This study focuses on an 11.6-m-long core collected in 2016 in the Lake Hotel graben covering the last 9,900 cal years according to radiocarbon ages. Past hydrological changes were inferred from oxygen isotopes values of biogenic silica that comprises the cell wall of the diatoms. d18O values reflect silica-lake water fractionation during diatom growth. Currently, precipitation occurs mainly as winter snow from weather systems originating in the Pacific. Periods of high d18O in diatoms occur from the base of the record 9900 to ca. 7500 cal years BP, from 4500 to 3000 cal years BP and ca. 1000 cal years BP. These isotopic enrichments have been interpreted as to be mostly the result of increased water evaporation and/or reduced snowmelt flowing into the lake from tributaries. The base of the record also is characterized by lower abundance of *Pinus* pollen suggesting a more open *Pinus contorta* forest until 5800 cal years BP, with more-frequent fire than today. Additionally, a long-term decrease in d18Odiatom in the record and a progressive increase in the duration of spring water mixing shown by diatom assemblages (i.e. higher *A. subarctica/S. minutulus*ratio) are associated with decreased summer insolation during the Holocene. These results compare well with other paleoclimatic records from the Yellowstone region that show a transition to cool, wet conditions in the late Holocene.

*Intervenant