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Covariation of diatoms' oxygen and silicon isotopic signatures in a Holocene Lake Baikal sedimentary record

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Here we present the first dataset to couple oxygen and silicon isotopes determined on diatom silica from a lake sedimentary profile. Samples have been extracted from a sediment core spanning most of the Holocene (∼9500 years) collected in the southern basin of Lake Baikal, the oldest and deepest freshwater lake in the world. After a sequence of oxidative and acid leaching, sieving and gravity settling, the cleaned opaline samples comprising more than 90% diatoms have been analysed by fluorination - IRMS for oxygen isotopes. An additional NaOH leaching step followed by co-precipitation was carried out prior to the Si isotopic analyses by MC-ICP-MS. Oxygen isotopic compositions of Lake Baikal diatoms have been found to be linked to prevailing climatic conditions and resulting balance between southern summer precipitation and northern snowmelt. Diatom silicon isotopic compositions in such a large lake as Baikal are expected to be mostly controlled by the diatoms Si relative utilisation of the nutrient pool.

We observe a co-variation between the two proxies with heavier isotopic compositions during the late and early Holocene while diatoms exhibit lighter Si and O isotopic compositions between 8500 and 6500 yr B.P. Such light d18O along with other paleo-proxies from Lake Baikal suggest a cooler period which could have reduced the duration of the lake's summer stratification, hence reducing the relative Si utilisation by

diatoms, in agreement with lighter Si isotopic signatures. The inverse process would have occurred for warmer periods. Although attractive, these interpretations must be examined with caution. For example, particular attention must be paid in order to rule out properly any contamination effect by clays and silt, as they could shift the isotopic compositions of both silicon and oxygen toward lighter signatures. Moreover, the influence of spring diatom blooms under the ice must be investigated as well as the role of the Selenga river to the isotopic signals. Indeed preliminary results of silicon isotope from this river, which has a major control on the southern's lake biogeochemistry, indicates variable signatures.

These features will be thoroughly discussed in order to test for the first time the use of combined Si and O isotopic sedimentary opaline records as paleo-environmental proxies.