

## Variabilities of water pH and temperature in Lake Biwa based on branched GDGT distribution over the last 280,000 years

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We generated a 280,000 yr record of water pH and temperature in Lake Biwa, central Japan, by analysing the methylation index (MBT<sup>\*</sup>) and cyclisation ratio (CBT) of branched tetraethers in sediments from piston and borehole cores. Our aim was to understand the responses of precipitation and air temperature in central Japan to the East Asian monsoon variability on orbital timescales. Because the water pH in Lake Biwa is determined by phosphorus and alkali cation inputs, the record of water pH should indicate the changes in precipitation and temperature in central Japan. Comparison with a pollen assemblage in a Lake Biwa core suggests that lake water pH was determined by summer temperature in the low-eccentricity period before 55 ka, while it was determined by summer precipitation in the high-eccentricity period after 55 ka. From 130 to 55 ka, the variation in lake pH (summer precipitation) lagged behind that in summer temperature by several thousand years. This perspective is consistent with the conclusions of previous studies (Igarashi and Oba, 2006; Yamamoto, 2009), in that the temperature variation preceded the precipitation variation in central Japan.

Keywords: Lake Biwa, lake sediment, lake water pH, GDGT, MBT, CBT