CENTRAL ASIAN CLIMATE VARIABILITY DURING THE PAST 13,500 YEARS: THE ORGANIC GEOCHEMICAL RECORD OF LAKE ISSYK-KUL, KYRGYZSTAN

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As Earth continues to warm, it is of considerable interest to develop general circulation models (GCMs) capable of accurately predicting future conditions (e.g. temperature, droughts, and floods). Studies of past climate provide essential data to ground truth GCMs, including information on the mechanisms driving Earth's climate and on spatial and temporal patterns of climate variability. The Arctic has been the focus of numerous paleoclimate investigations due to the early recognition that the North Atlantic region plays a particularly important role in driving global ocean circulation and influencing Earth's climate. In contrast, the mid-latitudes have received much less research attention and therefore represent a gap in our understanding of past climate dynamics (Oberhansli & Molnar, 2012).

Lake Issyk-Kul (42-43°N) is a unique but presently understudied paleoclimate archive from mid-latitude continental Asia. Issyk-Kul (42-43°N) is a large (6236 km^2) and deep (668 m) lake occupying a basin in the Tian Shan Mountains of eastern Kyrgyzstan (central Asia). Paleoclimate studies of continental Asia have long recognized ties to the North Atlantic region although the mechanism(s) responsible are debated. A complicating factor is that many of the previously studied sites are heavily influenced by the Asian Monsoon so the direct influence of the North Atlantic cannot be isolated. Issyk-Kul provides a unique location to examine mid-latitude atmospheric circulation since its placement in the continental interior falls outside of the influence of the monsoons to the south or southwest (Ricketts et al., 2001).

To expand the paleoclimate history of Issuk-Kul the organic geochemistry of piston core IP97-5P, spanning the past ~14,000 years, is investigated. Previously, Ricketts et al. (2001) examined the oxygen isotope and trace metal composition of ostracods and documented Holocene fluctuations between an open, freshwater, and well-mixed lake to a closed, more saline, and less well-mixed lake. Romanovsky et al. (2013) examined the Issyk-Kul modern water balance, lake level, and thermal regime and documented the impacts of recent global warming. Initial results of the organic geochemical analyses provide further support for Issyk-Kul being highly sensitive to global climate variability. The TEX_{86} paleothermometer reveals a significant temperature change of ~12°C during the transition from the Bølling-Allerød warm period to the Younger Dryas cold period (Figure 1). Plant leaf waxes also indicate a strong response during the transition from the Bølling-Allerød to the Younger Dryas, with average chain length values dropping dramatically at the onset of the YD (Figure 1).

Leaf wax deuterium isotopes (δ^2H) will be measured to examine shifts in the dominant moisture source to Lake Issyk-Kul. Here, moisture derives from North Atlantic or Mediterranean sources with the Siberian High and the Southwest Asian Low) being the major pressure cells influencing the region. Changes in the location or intensity of these pressure cells should be readily apparent in the δ^2H record as these moisture sources are isotopically distinct. The Holocene portion of the core is presently being extracted and it is expected that the organic geochemical results will provide further support for the large temperature and precipitation changes during the Holocene previously recognized by Ricketts et al. (2001).

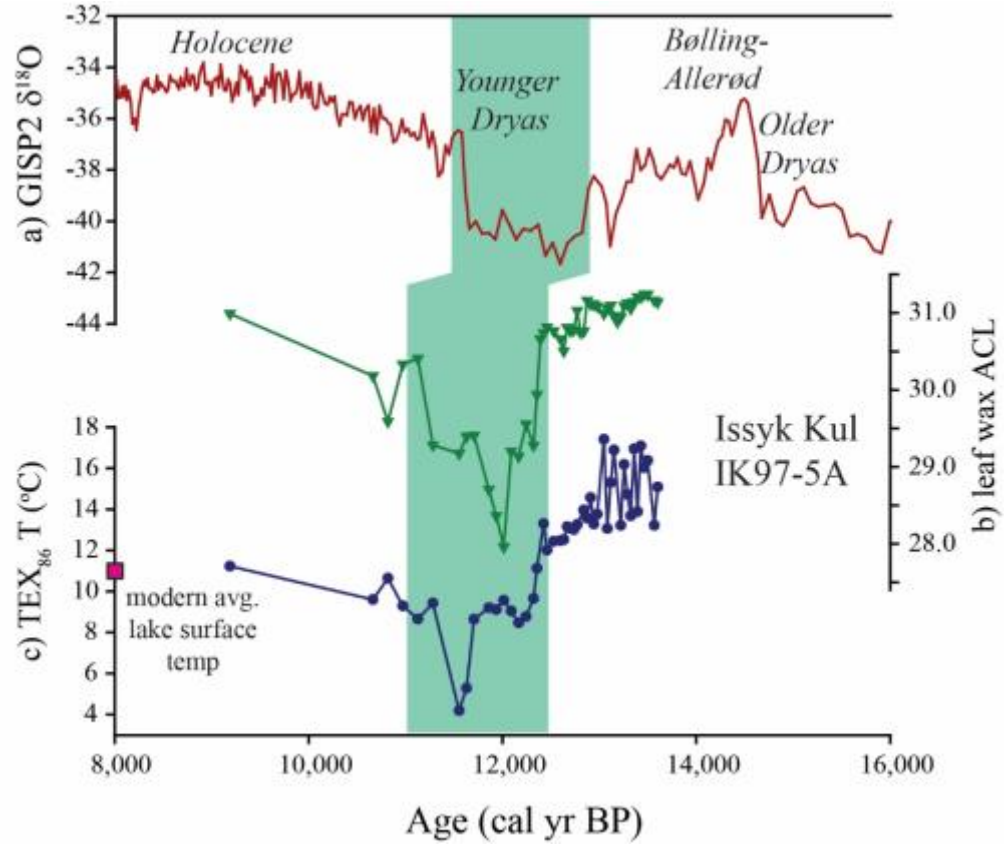

Figure 1 Preliminary data from Issyk-Kul core IK97-5A. a) The GISP2 oxygen isotope record from Greenland; the Younger Dryas cold period and Bølling Allerød warm period are indicated (Grootes & Stuiver, 1997). b) Plant leaf wax (n-alkane) average chain length (ACL). c) TEX_{86} lake surface temperature reconstruction, plotted using the calibration of Castañeda & Schouten, 2011). The pink square indicates the modern lake surface temperature.

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