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Holocene climate of the southwest Yukon Territory, Canada, inferred from lake-level and isotope analyses of small carbonate lakes

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Abstract

Analyses of sediment cores from two small lakes in the southwest Yukon, Jellybean Lake (60.35°N, 134.80°W, 730-m a.s.l.) and Marcella Lake (60.074°N, 133.808°W, 697-m a.s.l.) provide records of Holocene changes in atmospheric circulation, hydrology and humidity from millennial time-scales up to 5–20-year resolution. An Aleutian Low mechanism for Holocene climate variability in the North Pacific sub-Arctic region is developed from the results of oxygen isotope records from these new sites. The climatic reconstruction and proposed mechanism lays the framework for evaluation of the paleoenvironmental and human response to climate changes in the region. ^ Jellybean Lake water reflects the isotope composition of mean annual precipitation and Holocene variations are inferred from the analyses of sedimentary carbonate oxygen isotopes. Recent variations correspond with changes in the North Pacific Index, a measure of the intensity and position of the Aleutian Low, the semi-permanent low-pressure system located over the Gulf of Alaska. This suggests that the Jellybean oxygen isotope record reflects changes in Aleutian Low intensity and position since ~7500 cal BP. Late Holocene changes correspond with changes in North Pacific salmon abundance and shifts in atmospheric circulation over the Beaufort Sea. ^ Marcella Lake is a small, hydrologically-closed, evaporation sensitive lake. Former water levels were driven by changes in regional effective moisture and reconstructed by multi-proxy analyses of sediment cores from a shallow-to-deep water transect. Marcella Lake water oxygen isotopes are strongly affected by evaporation allowing past humidity changes to be reconstructed from sedimentary calcite oxygen isotope ratios. The record from Jellybean Lake accounts for variations related to atmospheric circulation and ambient temperature changes allowing an estimation of

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changes in ambient humidity driven by evaporation. Results suggest that late Holocene increases in aridity in the interior regions of the southwest Yukon are the result of long-term and sustained Aleutian Low intensifications and/or eastward shifts ~1200 and 400 cal BP. ^ The following climatic patterns are emerging. The early Holocene was warm and dry. Between 9000 and 10,000 cal BP there was a rapid increase in lake level suggesting a shift in the precipitation regime. The early aridity may have prevented the establishment of spruce forest. Between 7500 and 4000 cal BP, lake levels were relatively stable 5-m below modern levels and Aleutian Low intensity was predominantly weaker and/or westward than present. Between ~4500 and 3000 cal BP the Aleutian Low intensified and/or shifted eastward before weakening and/or shifting westward further between 3000 and 2000 cal BP. (Abstract shortened by UMI.)^

Subject Area

Physical Geography|Geology|Geochemistry

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