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Changes in Terrestrial Organic Carbon Delivery to the Colville River Delta and Adjacent Simpson's Lagoon Over the Late Holocene

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The Colville River in Alaska is the largest river in North America that drains only continuously permafrosted tundra, and as such provides a unique signal of historical changes in one of the world's most vulnerable areas to climate changes. Additionally, the Colville flows into Simpson's Lagoon, a shallow area of the Alaskan Beaufort coast protected by a barrier island chain, lessening the impacts of Arctic storms and ice grounding on sediment mixing. Cores collected from the Colville river delta in August of 2010 were found to be composed of muddy, organic-rich, well-laminated sediments. The 2.5 to 3 meter length of each core spans about one to two thousand years of Holocene history, including the entire Anthropocene and much of the late Holocene. Three cores were sampled for this data set, arranged latitudinally from the mouth of the Colville River east into Simpson's Lagoon. Samples were taken every 2 cm for the entire length of all cores. Bulk analyses including percent organic carbon, percent nitrogen, and stable carbon isotopic analysis were performed, and compound specific analyses including lignin-phenol and algal pigment analyses were performed.

These analyses showed significant changes in carbon storage over the past one to two thousand years. There were also significant spatial differences in organic carbon inputs across the $\sim$20km distance between the Colville mouth and the easternmost core. Lignin-phenol concentrations in surface sediments nearest to the river mouth correlated positively with reconstructed Alaskan North Slope temperatures, suggesting more terrestrial organic matter was delivered during higher temperature regimes. Molar C:N ratios and plant pigments correlated negatively and positively, respectively, with reconstructed Alaskan North Slope moisture regime, indicating greater algal inputs during wetter time periods. These data may in part be consistent with observed woody shrub encroachment and increasing expanse of permafrost lakes on the North Slope. Bulk isotope data of the same core showed extremely depleted (up to -34‰ excursions in the top third (i.e. over the past 800 years), and corresponded with increased input of more highly degraded lignin-phenols (as indicated by higher (Ad:Al)v ratios). Alternatively, sediments from the most distal core from the river mouth indicate the majority of organic carbon input to this area of the lagoon was not connected with Colville River outflow, and likely originated from either coastal retreat or was potentially carried into the lagoon from farther east by the Beaufort Gyre. Over the past millennium, the organic carbon input has consistently become more enriched in 13C and less lignin-phenol rich, likely indicating increased input of algal carbon. This data provides the first fine-scale, late Holocene record for this region of the Arctic.