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Organic carbon accumulation and reactivity in central Swedish lakes during the Holocene

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Sedimentation and burial of particulate organic carbon (POC), received from terrestrial sources and from lake internal primary production, are responsible for the progressive accumulation and long-term storage of organic matter in lake basins. For lakes in the boreal zone of central Sweden it can be presumed, that the onset of POC accumulation occurred during the early Holocene ($\sim$8000 BP.) after the retreat of the Scandinavian ice sheet.
In this study we investigated carbon mass accumulation rates (CMARs), as well as sources and reactivity of deposited organic material, for seven lakes in central Sweden (60°N, 15°E), in order to obtain a detailed temporal resolution of carbon burial and preservation in boreal lakes. Sediment long-cores were sampled in March 2011 from the ice, and CMARs were calculated from water contents, dry bulk densities, carbon contents and radiocarbon (14C) ages of the depth profiles. To indicate the sources of the organic material and characterize its diagenetic state, we determined carbon-nitrogen ratios (C/N) as well as amounts and compositions of lignin phenols.
The transitions from organic rich sediment layers to glacial till deposits were found to be in sediment depths of $\sim$3 m in each lake. POC contents were on average highest (25-34 wt. % C), in small lakes ($\leq$ 0.07 km2) and lowest (10-18 wt. % C) in the larger lakes ($\geq$ 165 km2). The CMARs over the Holocene showed significant variations and were on average lower in the early Holocene, compared to recent accumulation rates. C/N values and the composition of lignin phenols further provided indications of important changes in organic matter source and reactivity over the Holocene. In summary, our data suggest that boreal lake sediments were a significantly stronger sink for organic carbon during the last $\sim$150 years than during earlier periods of the Holocene.