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Holocene paleohydrology and carbon accumulation in the ombrotrophic peatlands of the North Shore of the Gulf of Saint-Lawrence, Northeastern Canada

Gabriel Magnan and Michelle Garneau
UQÀM, Montreal, Canada (garneau.michelle@uqam.ca)

The peatlands cover about 12% of the land area in Canada. The amount of carbon (C) stored in these ecosystems is the equivalent of one third of the C content in soils (i.e. $\pm$ 135 Gt). Ombrotrophic peatlands (bogs) are very abundant on the North Shore of the Gulf of St-Lawrence in Northeastern Canada. These peatlands have developed in two main geomorphologic contexts: over the deltaic formations from 7500 yr cal. BP and above the marine sediments after a marine transgression from 4200 yr cal. BP. This study provides the first detailed reconstruction of the past hydroclimatic conditions and related carbon dynamics in these peatlands during the Holocene. We present the long-term rates of C accumulation (LORCA) of 8 coastal bogs along a climatic gradient from the St-Lawrence estuary to the Gulf of St-Lawrence. A paleohydrological reconstruction (depth to water table) based on testate ameobae analysis have been conducted on 3 peat profiles covering the past 7500 years. We show the influence of paleohydroclimatic conditions and vegetation successions on the long-term variations of carbon accumulation. The LORCA values range from 22.14 to 67.38 g C m^{-2} yr^{-1} with a mean value of 42.9 g C m^{-2} yr^{-1}. The mean LORCA were higher in the bogs that initially developed in a marine environment (55.15 g C m^{-2} yr^{-1}) compared to 30.8 g C m^{-2} yr^{-1} for those that developed over the well-drained sites on the deltaic formations. The mean LORCA were significantly higher in the southwest part of the study area (Baie-Comeau) (60.6 g C m^{-2} yr^{-1}) compared to 32 g C m^{-2} yr^{-1}in the northeastern area (Havre St-Pierre). This difference in the LORCA values could be explained by the contrasting paleohydrological conditions throughout the Holocene. In the southwestern peatlands, carbon accumulation has been favored by the maintenance of near-surface water tables throughout the Holocene whereas the northeastern peatlands were characterized by prolonged periods of dry surface conditions that slowed down peat accumulation. It seems to reflect a pervasive climatic influence on carbon accumulation along this south-north gradient. Our results suggest that the paleohydrological conditions and the related vegetation successions have played a major role on the long-term carbon dynamics in these peatlands.