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Interactions between soil, vegetation and fire in the formation of a bog

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The need to understand interactions between lands and ocean or atmosphere is increasing in the context of global change. In particular, key climate drivers act on several components of an ecosystem, such as soil moisture availability and environmental disturbances like fires.
To study interactions between soil and vegetation, the distribution of indurated layers in podzolic soils (ortstein) was described along a 800-meter transect from forest to bog on the North Shore of the St-Lawrence estuary (Quebec, Canada). Ortstein decreases towards the bog developed on a post-glacial delta. The basal layers of peat sediments have been collected at five locations, at the forest edge (450 meters) and then at 100 meters intervals until the bog at 800 meters.
The analysis of size particles in organic and basal peat layers shows a signature of past glacial and fluvioglacial conditions. Size particles distribution from one site measurement to the other showed temporal and spatial gradients useful for the paleoecological interpretations.
The identification of plant species was based on macroremains, pollen and charcoal fragments. Because of the possible transportation before charcoal deposition and because of the standard quantity of charcoal for AMS dating and wood identification, charcoal having a weight higher than 5 mg were selected.
Reconstruction of the ecological conditions since 5595 cal yr B.P. (basal organic layer at 800 meters) indicates that the bog was initiated from forest paludification, with the influence of soil and paleofires. The origin of ortstein is linked to humid and cold climatic conditions on flat areas where the hydrology and geochemistry of soils have been modified, particularly after fire, which also can remove organic matter by erosion. Peat accumulation differed between the five peat monoliths but was lower than values reported in literature, with a mean of 0.11 mm/year.
An initial forest was confirmed with Picea cf. mariana (first macroremain record at 4110 cal yr B.P.), Pinus banksiana (identified and radiocarbon-dated charcoal) and more regionally Abies balsamea and Larix laricina (first pollen records at 3360 and 3055 cal yr B.P., respectively). Five paleofires occurred at 2265, 2205-2215, 2090, 1905-1940 and 1800 cal yr B.P.