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Paleoenvironmental evolution of an alkaline fluviogenic peatland (fen) from northern France: a 14 kyr bottom valley history between climatic and anthropogenic forcing

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Fens are common in Northwest Europe in chalky bedrock valleys (from France to Poland). The peat from the valley bottoms of the River Somme basin is a remarkable wetland characterized by a significant organic accumulation (4 to 6 m on average). This alkaline peat sequence provides outstanding archives to describe the environmental evolution of Northwestern France over the last 14,000 years. Fens are also fragile environments forming huge carbon sinks. In the current context of rapid climate change, it is important to better understand and protect this carbon accumulating ecosystem. In this context, a research initiative has been initiated to highlight the respective roles of climatic and anthropogenic forcing factors (drainage, slope soil erosion) on peat formation and degradation processes and the modification of the related fluvial environments. The study focuses on a high-resolution stratigraphic transect of the valley in Morcourt (about 600 m wide) based on more than fifty manual boreholes and mechanical corings. The reconstruction of sedimentation dynamics and palaeoenvironments evolution is based on a multiproxy approach combining sedimentology, geochemistry, palynology, and plant macro-remains identification, supplemented by thirty-five ¹⁴C dates. This work reveals that the first peat deposits were restricted to channel filling at the beginning of Lateglacial (14.6 - 14.0 ka cal. BP). This peaty event was then interrupted during the Younger Dryas by the deposition of highly calcareous overbank silts (CaCO₃ > 40%) in the whole alluvial plain. Typical peat formation with high TOC values (> 45%) then growth from the beginning of the Preboreal period around 12 ka cal. BP to the Atlantic (6.5 ka cal. BP) and rapidly extended to the entire valley bottom (0.07 cm/year). During the Subboreal, the reactivation of the river flow (climate modification and soil erosion) is then indicated by the development of a deep meandering channel progressively filled in with laminated silty-organic deposits and a slower peat accumulation rate in the alluvial plain (0.03 cm/year) due to lowering of the water table. These modifications are contemporaneous with the generalized opening of the landscape (palynology), associated with the acceleration of anthropic erosion processes on the slopes. Since the Subatlantic (2.9 ka cal. BP) peat deposits have higher mineral component originating from flood and slope erosion (carbonated: 65% of CaCO₃; silicated: up to 27% in silty-peat). Since the late Middle Ages, organic silts fed by the erosion of loessic soils have rapidly buried the peat system which, combined with drainage, is now essentially inactive and fossilized.