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Sulfide bearing soil materials in peat extraction areas in Finland

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Sulfidic sediments that may form acid sulfate (AS) soils (pH < 4) upon oxidation, typically due to disturbance by draining, cover over 17 million ha worldwide. They are typically sediments of marine origin, located in coastal environments where they have emerged from the sea due to sea level change and/or due to postglacial land uplift and preserved in anaerobic conditions by peat and a high groundwater. In Finland more than 3000 km2 Holocene sulfidic sediments have emerged up to 100 m above the current sea level. In addition, regional Paleoproterozoic black schist areas have resulted in sulfide bearing till deposits within their immediate glacial dispersal area.

There are extensive studies on farmland AS soils with intensive drainage, exposing the upper 1-2 meters of sediment for oxidation and mobilizing extreme amounts of acidity and metals to recipient streams. Studies on AS soils in peat lands, where the peat or underlying sediment commonly contains significant loads of sulfides, are, on the contrary, scarce, because they have been of less economic importance. Worldwide peat lands cover an estimated area of 400 million ha, mainly located in the northern hemisphere (350 million ha). In Finland, where about 30% (i.e. about 10 million ha) of the land surface is covered by peat land, peat extraction has become an important industry during the last decades.
The aim of this study is to characterize the mineral soils in peat extraction sites in northern and northwestern Finland where sulfide related problems were expected to occur.

Sulfide-bearing marine/lacustrine sediments were commonly found right below the peat layer in former marine areas. Some sulfide-bearing soil materials, both in the mineral soil material and in the peat, were also found in high altitude non-marine black schist areas. Sulfur in the mineral soil occurred almost solely as sulfides, mainly as pyrite (up to 3.5 %) that was occasionally mixed with metastable iron sulfides (FeS). The sulfidic mineral soil layer was relatively thin, especially in the case of the high altitude marine sediments, and the contents of sulfides in the mineral soil material were highest close to the peat layer. The potential acidity was remarkably high, but despite peat extraction very little oxidation had occurred in the mineral soil; limited to riparian zones and to the upper mineral soil in areas where little peat was left. Consequently, in terms of acidity and metal leaching, after-care is most crucial for peat extraction sites. Leaving a thick enough protective peat layer on top of the mineral soil and minimizing drainage may prevent significant oxidation from occurring in this climate. Where sulfidic sediments occur, drainage after peat extraction, e.g. for farmlands, would mobilize the acidity pool.

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