Geophysical Research Abstracts
Vol. 21, EGU2019-12781, 2019
EGU General Assembly 2019

Characterization of coarse-grained acid sulfate soil materials in western Finland

Stefan Mattbäck (1,2), Anton Boman (2), Andreas Sandfält (1), Jaakko Auri (2), and Peter Österholm (1)

(1) Åbo Akademi University, Geology and Mineralogy, Åbo, Finland (firstname.lastname@abo.fi), (2) Geological Survey of Finland, Finland (firstname.lastname@gtk.fi)

In Finland, acid sulfate (AS) soils are regarded as a serious environmental threat towards the Baltic Sea and watersheds situated in land areas which have emerged from the sea since the last glaciation due to glacial isostasy. Because of this, a national mapping and data collection program of Finnish AS soils started in 2009. The mapping raised many questions regarding characterization and risk assessment of boreal AS soils, in particular coarse-grained (median grain size $\geq$ 63 μm) AS soils. In some cases, coarse-grained AS soils may cause severe acidity and metal problems even though their sulfide and metal content are magnitudes lower compared to fine-grained (median grain size < 63 μm) AS soils. The aim of this study is to assess the potential environmental threat of coarse-grained AS soils and criteria to be used in future risk assessment.

The hypotheses are that (1) some coarse-grained AS soils leach significantly less metals and acidity than fine-grained AS soils, thus, posing a smaller threat to the environment; and (2) coarse-grained AS soils should be considered as a subgroup separate from fine-grained AS soils. Research and sample materials used for this study is data obtained from the national AS soil mapping, additional samples collected from 12 soil profiles, and 3 sulfidic aquatic sediments. The study used an incubation based “let the soil speak for itself”-approach, which means that parameters such as pH and acidity were measured on arrays of sample aliquots before, during, and after a 16-week incubation (oxidation) period. In addition, we utilized a modified version of the standard leaching method EN 12457-2:2002 to quantify the amount of acidity and metals released from the soil materials before, during, and after incubation. General properties such as grain-size and bulk chemistry (aqua regia leachable elements) were determined as well.

Preliminary results show that some of the studied coarse-grained AS soil materials released at least one magnitude less metals and acidity, as compared to the fine-grained AS soil materials. However, one exception was iron, which was leached in greater quantities from coarse-grained AS soil materials than from fine-grained. The results also indicate that the leachate electric conductivity (EC), measured in the leachate obtained at the end of the incubation period, may be used to assess the amount of metals liberated during oxidation; if the initial EC (measured in the leachate obtained from a sample aliquot at the start of the incubation period) is known. For reduced parent materials, total sulfur (measured as aqua regia leachable sulfur) might be sufficient for a crude assessment of the amount of metals and acidity potentially released if the materials were to be oxidized. The preliminary results create an incentive to divide coarse-grained AS soils into subgroups based on their acidity and metal leaching potential; as some coarse-grained AS soil material’s leaching capabilities are indeed equivalent to those of “traditional” fine-grained AS soils, and some coarse-grained AS soil materials do not seem to leach more than non-AS soil materials.