



Processes and fluxes during the initial stage of acid sulfate soil formation

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Acid sulfate soils occur over a wide range of climatic zones, mainly in coastal landscapes. In these soils, the release of sulfuric acid by the oxidation of pyrite generates a very acidic environment (e.g., DENT and PONS, 1995, PONS, 1973). Two major types of acid sulfate soils can be distinguished: In actual acid sulfate soils, the initially contained pyrite was at least partly oxidized. This resulted in a severe acidification of the soil. Potential acid sulfate soils are generally unoxidized and contain large amounts of pyrite. Upon oxidation, these soils will turn into actual acid sulfate soils. By excavation or lowering of the groundwater table, potential acid sulfate soils can be exposed to atmospheric oxygen. During oxidation the pH drops sharply to values below pH 4. This acidification promotes the release of various metals, e.g., alumina, iron and heavy metals. Additionally, large quantities of sulfate are released.

In order to assess the effects of disturbances of potential acid sulfate soils, for example by excavations during construction works, several large scale column experiments were conducted with various types of potential acid sulfate soils from Northern Germany. In these experiments, the oxidation and initial profile development of pyritic fen peats and thionic fluvisols were studied over a period of 14 months. The study focused on leaching and the translocation of various metals in the soil profile. To study mobilization processes, element fluxes and the progress of acidification, soil water and leachate were analyzed for total element concentrations. Furthermore, several redox-sensitive parameters, e.g., Fe^{2+} and sulfide, were measured and changes to the initial solid phase composition were analyzed. Chemical equilibria calculations of the soil water were used to gain insights into precipitation processes of secondary products of pyrite oxidation and leaching products. The results of this study will support the assessment of risks deriving from acid sulfate soils. Furthermore, these experiments can serve as a model for the initial stage of naturally occurring acid sulfate soil formation. Thus, the results will provide a base for the interpretation of element distribution in the solid phase of natural acid sulfate soil profiles.

References

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