Preface

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Over the last few decades, public awareness of metal toxicity has increased enormously. Researchers have already long since realized that metals like lead, mercury, arsenic, aluminium, and cadmium are highly toxic to many organisms, and the limited capacity of the environment to immobilize these metals in non-toxic form has also been recognized. Consequently, it is now generally accepted, for example, that lead cannot be used in gasoline, that the industry has to clean wastewater before discharging it, and that the mining industry has to neutralize acidic mine drainage. This awakening has given rise to new legislation and guidelines that, in turn, have resulted in a decrease in the discharge and dispersion of toxic metals in many regions and industrial areas. Unfortunately, there are a number of exceptions, and one of these is constituted by acid sulphate soils. These soils are developed in natural sulphur-rich sediments as a result of human activities such as intensive artificial drainage. A recently published study shows that much larger quantities of nickel, cadmium, cobalt, zinc, etc. are discharged into Finnish waters from acid sulphate soils than by the entire industry of the country. In other countries where these soils exist abundantly, such as Australia, Vietnam, and Indonesia, corresponding comparisons have not been made, but it is likely that the situation is in many respects similar, i.e. the leakage from acid sulphate soil is massive. This is a serious problem that, in the long term, may threaten aquatic ecosystems in sensitive areas such as the Gulf of Bothnia and the Great Barrier Reef. A global awakening to the environmental impact of these soils is thus urgently needed.

In Europe, the largest acid sulphate soil areas are found in Finland and Sweden. While the environmental impact of these soils seems to be larger in Finland, the countries have in common that the acid sulphate soil problem receives relatively little attention. The main reasons for this are that (1) the acid sulphate soil leaching has a diffuse character, i.e., the discharge occurs via hundreds of thousands of small, mostly unidentified ditches in coastal areas (mainly in Pohjanmaa (Ostrobothnia), Västerbotten, Norrbotten, and south-western Finland), (2) the acid sulphate soil leaching is complex, i.e., the source of the acids and metals consists of natural sediments, but the mechanisms mobilizing these compounds are triggered by human activities, (3) the leaching from acid sulphate soils is mainly from agricultural fields, i.e., it is farmland drainage that results in acid sulphate soil development and since agriculture is already experiencing economic problems, there are political difficulties associated with attempts to highlight the problem. It is however important to realize that the acids and metals discharging from the acid sulphate soils are in a chemical form at least as harmful and toxic as the corresponding compounds dispersed, for example, by industry, traffic, and energy production. Considering the modern and useful environmental legislation regulating these activities, it is obvious that the acid sulphate soil problem is not being managed in a way to be expected today.

Because the leakage of acids and metals from acid sulphate soils is large throughout Finland and is by far the dominating source in a number of watercourses (e.g. most watercourses in Pohjanmaa), extensive and high-quality research is needed to produce precise and detailed information for the environmental authorities, politicians, and land owners. The authorities and politicians, in turn, are responsible for initiating measures that will result in a decrease of the leaching of solutes from these soils to a level acceptable from a hydrochemical and hydroecological point of view and in accordance with the European Water Framework Directive (2000/60/EC). This special issue highlights current research concerning, in particular, the Finnish acid sulphate soils, with a focus on characterization, environmental loading, identification, and management. Specific and novel issues presented include biogeochemical identification methods, remedial techniques such as controlled lime-filter drainage and successive alkalinity producing systems, multielement analysis of affected rivers in Pohjanmaa, methods for identifying and quantifying sulphur species and isotopes, the historical development of pH levels, and the characterization of different forms of nitrogen. Taken together, the papers of this special issue give a good insight into current research and knowledge about Finnish (boreal) acid sulphate soils.