Contamination of Kristianstad biosphere reservoir by metal bound sediments

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Introduction: Acid sulfate soils (ASS) may release sulfuric acid owing to the oxidation of sulphidic phases [1], causing metal leaching and transport to drainage channels and surface water resources. Åström et al. 1997 and Nordmyr et al. 2006 report high concentrations of trace metals such as Fe, Zn and Ni and low concentrations of rare earth elements (REE) such as La and Sc from leached ASS within Finish coastline (Table 1). However, the metal concentrations in the sediments and the transports are not entirely understood in southern Sweden.

***Table 1**. Reference median values for Sediments associated with ASS Studied in Finland and Kristianstad values.*

Element	Reference	Kristianstad
Fe (%)	3.5**-3.8*	10.6
Zn (ppm)	85**-90*	191.8
Ni (ppm)	31**-31*	15.2
La (ppm)	34**-38*	304.2
Sc (ppm)	6.7**	9.8

* Åström at el. 1997
** Nordmyr at el. 2006

In the past century with high agricultural demands, farmers have lowered the ground water to enable cultivation, causing oxidation of sulfidic sediments in many coastal regions [1]. In Kristianstad Vattenrike (Kingdom of Water), southern Sweden soils are drained resulting in the formation of ASS.

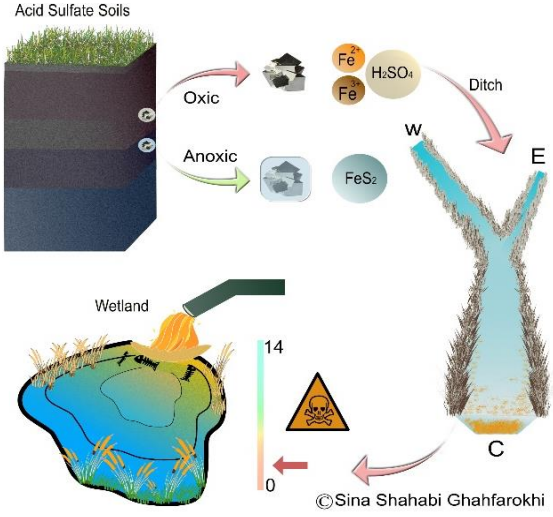

***Figure 1**: Conceptual model for Kristianstad Case study.*

The drained water containing precipitated and coprecipiates is collected through a ditch and then pumped onto a wetland (Figure 1). This study aims to understand the type and extend of elements that are transported to the wetland through the ditch system.

Methods: Sediment samples were taken from 5 points of the ditch using one-meter long (Ø63x57mm) PVC tube corer. Sediment cores were sliced every 2.5 cm and dried in oven (30°). Samples were then grinded with agate mortar and pestle. In total, 71 samples are prepared for analysis.
To analyse the element concentrations a 4-step digestion (near-total digestion) is chosen. Measures are then taken by ICP and ICP/MS (Activation Laboratories Ltd. | 41 Bittern Street, Ancaster, Ontario, L9G 4V5, Canada).

Results: From the 71 samples, median concentrations of Fe show 2.8 folds higher Iron concentration (Table 2.) when compared to values obtained from Table 1. From trace metal concentrations, Zn shows 2.1 folds higher concentration and Ni lower concentration as much as 0.5 folds (Table 2.). La and Sc, REE, illustrate 8 and 1.5 folds increase, respectively (Table 2.).

Discussion and conclusions: Considering expected elements with high leaching fates from ASS [1], trace elements have unusual concentrations. On one hand, Ni shows high concentrations. On the other hand Zn and Fe are present with higher concentrations. Existing low concentrations of elements might be detected with high concentration on the receiving end of the ditch (biosphere). Therefore, further studies of the present sediments and soils in the biosphere will help to understand this complex phenomenon. In contrast, REEs occur in high concentrations; considerably higher than previous sites under influence of ASS which have previously been studied.
Our recent findings show the importance of the geochemical processes influencing the Kristianstad biosphere. Future remediation options and strategies to manage the contaminated sediments is proposed by a continuation of the same project in the group of Environmental Geochemistry of Linnause Unversity, Kalmar.

References: [1] Åström et al. (1997) *Environmental Geochemistry and Health (1997), 19, 155-164*. [2] SedNet et al. (2006) Boreal Environmental Research, 11 (4), 261-273 [3] http://www.actlabs.com