Department of Soil and Environment

Independent project/ degree project

Title: Geochemistry of toxic metals in pyrite ash wastes – implications for risk assessment and remediation

Credits: 30 ECT
Level: Master
Subject: Soil Science/Environmental Science
Programme: Civilingenjörsprogrammet Miljö och vattenteknik, Soil and Water management
Start: August/September 2014

Background
Pyrite ash is a waste product from the oxidation of pyrite ore (FeS_2) to obtain sulfuric acid. In Sweden there is several hundred thousand tons of pyrite ash wastes deposited on industrial land, mainly in the surroundings of pulp mill plants. Pyrite ash wastes contain high concentrations of toxic metals like Pb, Cu, Cd and As, which might leach to nearby ground and surface waters. At the moment we know too little about the geochemistry of pyrite ashes in order to make good, reliable risk assessments and propose optimal, site specific remediation options. In particular we need to know more about the solubility control mechanisms of the toxic metals and how the sorption ability of different pyrite ashes depends on their content and composition of iron (hydr)oxides. One option to manage these sites could be to manipulate pH and add organic matter, but before testing such option in field trials, more mechanistic information on solubility control mechanisms is need.

Issues
The proposed work is part of an on-going research project at the Swedish Geotechnical Institute (SGI). Some experiments (leaching tests) will be performed at SGI's environmental lab in Linköping and some at SLU. You will be offered the possibility to visit SGI's environmental lab and take part in those experiments (an option).

You will work with samples taken from the former pulp mill plant Bergvik sulfit, Söderhamn. Three samples have been taken at different depths down to 2-3 meter in each of two soil pits, in total 6 samples.

The objective of the present work is to investigate solubility control mechanisms of Cd, Pb, Cu and As in pyrite ashes of different ages (=depths) and how the sorption ability depends on their content and composition of iron (hydr)oxides.

Performance

1) Literature review (geochemistry of pyrite ash and possible remediation options)
2) Batch experiments in which metal solubility as a function of pH is being studied (performed at SGI's lab).
3) Extractions to assess the amount and properties of iron (hydr)oxides (performed at SLU)
4) Evaluating results from batch experiments using geochemical modeling (Visual MINTEQ)
5) Writing a report
6) Oral presentation of results at SLU and at SGI.

Dr. David Bendz will be your supervisor at SGI and Dan Berggren Kleja your main supervisor at SLU. David Bendz is research director at SGI and project leader of the SGI project on pyrite ash.

Contact

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