Risk assessment and remediation of historical mine waste – experiences from Sweden

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During the 17th century Sweden was the largest producer of copper in the world. The remaining waste legacy is thus substantial and there are several thousand mining related contaminated sites in need of risk assessment and possibly also reclamation. This presentation focus on 20-30 years of Swedish experience with regards to investigations, risk assessments and remediations of historical mine waste (waste rock, tailings and jig tailings).

Investigation and risk assessment recommendations for contaminated sites are in Sweden provided by the environmental protection agency. During the first part of the risk assessment process focus are on total amounts of contamination, contaminant concentrations and presence of objects at risk (both humans and environment). At the second part of the risk assessment focus is more on availability and mobility of the present contamination. Since the developed method is for all types of contaminated sites analysis of acid/base behaviour might be added for historical mine sites since future behaviour of the contaminated sites must be understood.

Generally, it has been found that waste rock is seldom a problem from a health perspective unless arsenic is present. Waste rock might, however, be an environmental problem due to low pH from the oxidation of sulphidic minerals (primarily pyrite) and trace element leaching. The trace elements concentrations might be high in historical waste rock but it is generally not available for humans.

Jig tailings are more often a health problem due to higher availability of the trace elements present (primarily arsenic but also lead). From an environmental perspective copper is a great problem threatening both aquatic systems as well as plants.

Due to the weathering and high content of oxidized iron covering of historical mine waste using conventional cover systems can lead to sustained pyrite oxidation through autocatalytic oxidation. Instead there is a need to increase pH in weathered mine waste in order to decrease trace element mobilization. Innovative methods for oxidized waste are also included in the presentation; injection of alkaline by-products, reactive barriers, water covering after additions of alkaline materials.

Experiences from several performed remediations at historical mine sites are also discussed.