

Water Quality in a Black Shale Mining Area - Effects of pH and Natural Organic Acids on Weathering and Subsequent Metal Releases

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Abstract Mining of black shale (alum shale) of Late Cambrium age for the extraction of alum started in the early 17th century in Sweden, and in the late 19th century there was an extensive use of shale, with its high content of organic carbon, as fuel in lime-burning processes. Full-scale recovery of hydrocarbons from shale took place in Kvarntorp during 1942-66, and recovery of uranium in Ranstad during 1965-76. Remains from the historic mining and processing of black shale are some 50 major deposits with processed and unprocessed shale residues, as well as water-filled pits, at the former mining sites. There are also large areas covered with crushed shale, e.g. as road filling material. Studies of the weathering of shale due to exposure to the atmosphere and water with pH within the natural range indicate a high leachability of cationic elements at low pH, as well as anionic elements at high pH. The presence of organic complexing acids of natural origin (microbial exudates and humic acids) may give an enhanced leaching, particularly at pH above 8, when hydroxy-groups would constitute active metal binding sites. Results from studies of weathering and leaching of processed and unprocessed black shale are presented, as well as the effects on the water quality observed at former mining sites and related environmental impact.

Keywords black shale, leachability, organic complexing acids