

ASSESSMENT OF ENVIRONMENTAL RISKS IN A BLACK SHALE AREA, CENTRAL SWEDEN

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Abstract

Black shales of marine origin are common in Europe. Cambrian shales are found in S Sweden and along the Caledonian mountains. They are enriched in trace metals like U, Mo, V, Ni and Zn. They have been utilized for extraction of alum, as energy sources and for the extraction of uranium. This study aims at assessing the environmental risks of trace metals in the Viken area in Central Sweden. The tectonic forces have created a “loaf”, 200 m thick, about 4 km wide with a length of a few km containing about 400 000 tons of U.

The situation has been studied by sampling soils, plants and water. Soils are rich in trace metals, however a variable percentage has been lost in soil formation as compared to the black shale. Only As is of similar levels in soils and shale and has been adsorbed on site onto ferric oxyhydroxides in soils. Mo is taken up in common forage plants like red clover, risking molybdenosis, secondary Cu-deficiency in cattle. However, farmers buy concentrate enriched in Cu which seems to avoid this. Water is rich in U (> 100 µg/l), however calculations with Visual MINTEQ show that U is in the form of Ca-uranyl-complexes (97-99 %) not toxic or uptakeable.

While the current situation does not seem to be of serious concern, there are plans for mining 700 M tons of shale over a 30 year period. This would leave almost the same amount of finely ground waste with 15-25 % of the trace metals left after microbial leaching. The deposition of this waste is crucial as U and Mo would leach under oxidizing conditions while arsenic would do so under reducing conditions. The distance to lake Storsjön, a water source for about 50 000 people, is less than 2 km.

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