

High Ni and Mn concentrations in human hair and slightly lower Ca in blood serum in sulphur-rich black shale areas: impact and mechanisms

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The incidence of coronary heart disease is higher in eastern and northern Finland compared with other parts of the country. We studied if one of the reasons is related to the occurrence of sulphur-rich black shales which are more abundant in eastern and northern Finland.

Migration of Ni, Mn and Hg from S-rich bedrock to aquatic ecosystem and local residents was studied in two pristine areas with no local anthropogenic contamination at that time. Altogether 225 residents from these sparsely populated regions participated voluntarily by providing hair and blood samples. Drinking water samples were collected from the households [1]. In addition, we collected samples of bedrock and glacial till, stream and lake water, and organic stream and lake sediments (Fig. 1). The geochemistry of soil, waters and sediments reflected the geochemistry of the bedrock [2-4].

Calcium concentration in human blood serum was slightly lower in the areas with black shale bedrock (median value 91.4 mg/l) than in the adjacent sulphur-poor bedrock (median value 93.6 mg/l). The concentrations of Ni and Mn in human hair correlated with those in drinking water. The highest Ni and Mn concentrations in human hair samples were 12.3 mg/kg and 36.44 mg/kg, and the highest concentrations in drinking water samples were 51 µg/l and 1620 µg/l, respectively. [1]

The total Hg concentrations in human hair varied between 0.04 and 12.1 µg/g. The consumption of local fish was the strongest determinant for Hg in hair. However, the use of spring water or private dug well water slightly increased Hg in hair, as did the consumption of local mushrooms and potatoes. [2]

Extensive black shales are encountered globally, also in highly populated countries[5]. In Finland and in other Nordic countries, 90% of households currently enjoy municipal water supply with monitored drinking water quality.

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