Arsenic background values and its risk assessment to human and crops in the Sendai Plain, Northeast Japan.

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The background concentration of hazardous substances in sediments is an important factor for evaluating the origin of contamination, because natural origin heavy metal is widely distributed in Japan. Large-scale civil engineering, such as tunnel, railroad, or expressway construction, has a risk to digging out ore bed, in addition to artificial mining activity. The cognition of heavy metal background level of surface soil and geological formation avoid the spread of contamination.

Heavy metal concentrations of surface soils are not exactly agree with chemical composition of host rocks differently form major elements, which were found to agree well with average value for gneisses rocks. In this study, we target on the heavy metal contents, especially arsenic in surface soil from 5 to 50 cm depth level and their host rock in the Sendai Plain. The upper sampling level of soils was flexibly changed for removing the corrosion. Collected soil samples were air-dried and crashed and sieved to 2mm under, and removed the roots and leafs of plants. Rock samples also collected from out cops and crushed and sieved to 1 to 2mm grain. Using these pre-treating samples we estimate the heavy metal total content and dissolution level in neutral water and acidic water. The eluate were measured by ICP-MS and XRF were also used for evaluation of heavy metal content in soils

Fundamental rock formation is composed from Neogene (Miocene and Pliocene) and Quaternary Systems. Miocene formation was deposited in the age of marine transgression to regression with volcanic eruption. Pliocene formation was also deposited during two times of marine transgression. Sendai Plain is almost covered with alluvium and landslide deposits in Neogene period. The surface geology of hilly zone is consolidicated and half-consolidicated sediment, and continues to unconsolidated diluvial terrace to alluvial low land region.

The main arsenic included part in soils from Natori, Hirose and Sunaoshi river-basin sewerage were mainly involved in grey, gray lowland or muck soils, which are distributed in alluvial soil and seashore sediment. The arsenic distributions basically depend on watersheds of main river, and arsenic obviously migrate from host rock and accumulate in particular region.

Several percentages of soils in the Sendai Plain are over the environmental quality standard of As in Japan in water elution test. High arsenic contents regions were limitted to some specific river, such as Naruse, Tsuruta, Sunaoshi, Natori and Abukuma River. Additionally, one lowland part of river, Shiroishi, Yoshida, hazama and Eai River, locally include As in Soils. These high arsenic regions are obviously related with upstream part of host rock composition and limited to Quaternary volcanic non-alkali Mg-Fe rich layer or marine or non-marine sediments.

Based on leached arsenic species and bulk contents from soils, the arsenic risk level for human or plant were calculated by the accumulation from some exposure process in soil. The exposure scenario of risk analysis of heavy metals is set four pathways: exposure from crops, direct intake, inhalation particles, and direct intake of well water. The human health risk is evaluated by TDI (tolerable daily intake). TDI of arsenic is $2.1*10\text{-}6$ g/kg/day.

As compared with the estimation of environmental criteria, this calculation shows the arsenic human health risk. Considering form the actual concentration of arsenic of pore water and extracted speciation from soil, it was suggested that arsenic transfer from soils to plants was safety level for human health. Soil inhalation and ingestion may become important pathway of human exposure. Risk analysis is important to know the actual dangerous level of contaminant, not only sticking to environmental Quality standard. We must know accurate distribution and take it into account for the land use plan or ground water use.