Studies on As contaminated groundwaters –an example of international scientific activity against environmental problems

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Decreasing water resources threaten the human beings, and degradation of water quality is one of those problems widely occurring in the world. Geogenic arsenic contaminated groundwater is a unique but the most serious problems among the quality problems of groundwater resources. Arsenic is known as a highly toxic element, and WHO gives the limited standard value 0.01 mg/L for drinking water. However, people have to use the waters including >0.05 mg/L As, and it has caused fatal disease to millions of people, especially living in the developing countries, for more than three decades. Here, the distribution and formation mechanisms of As contaminated groundwaters and international collaboration activities we concerned are documented as an example of scientific activities for the mitigation of natural environmental hazards.

Arsenic contaminated groundwaters appear mostly in the Holocene aquifer, in which the host phases of As are reactive. Many researchers suggested that the As-adsorbing Fe-oxyhydroxides are the sources of As in most of the contaminated Holocene aquifers, and that the As was released into the groundwater via desorption from and/or decomposition of Fe-oxyhydroxides during biochemical reduction of the aquifer environment. One of our important results was that chlorite was a primary source of As in an aquifer of Bangladesh. Chemical weathering of As-bearing chlorite promoted by infiltrating oxic water must the primary reaction to release As into the studied aquifer and the desorption of As and reduction-dissolution of As-adsorbing Fe-oxyhydroxides would be the secondary reaction, which is important to control the As concentration. The Fe-oxyhydroxides precipitation and As adsorption via chemical weathering of primary As-bearing sulfides and/or silicates must occur in situ. The multi-stages of reactions would be generalized the As contamination mechanisms in the other areas.

Many international teams of scientists from modern and affected countries have been collaborating to cover the lack of finance, facilities and human resources. After accumulating the experiences of collaborations throughout the case studies, more than fifty scientists had a meeting in Hanoi in 2011, and an international team was organized to apply an ICDP project. The team, including the geochemists and hydrogeologists from 8 modern countries and 5 As-affected countries, has been working to realize the drilling of the biologically uncontaminated groundwater aquifer sediments since then. Microbial activities were known to be important for the As cycle, and its importance in the groundwater aquifers is focused on this project. This project is principally a part of natural science and not directly connecting to the mitigation, although many scientists concerning this project are working for the mitigation in various countries. The drilling is still on the schedule and has not been completed yet, however, we have constructed the interconnection not only for the collaboration but also for the education of young researchers throughout the projects. It must be a good example of the organization of scientist group to contribute the mitigation and education against the environmental problems.

