Contaminant load and transport at mega-cities in Asia: current conditions and problems

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The large quantity of mass generally converges on the mega-city. As a result, a part of consumed mass had been leached into river, groundwater and ocean. The most of mega-cities in the world exist in Asia, and the most of them are located on the coastal area. Growing Asian mega-cities have the some severe pollution problems such as those in Tokyo or London about 30 years ago. To prevent the expansion of these problems, it is necessary to find the relationship between water pollution characteristics and growing stage of mega-city, and to propose the possible problems in future and the measure to them for Asian mega-cities intensive growing.

The objective of this research is to confirm the current conditions of the water pollution in mega-cities, and to select the reasonable methodology for reconstructing of contaminant history and confirming of the relationship between water pollution and growing stage of mega-city in our project.

The case examples of the water pollution problem in Japan and England include some cautions to new growing mega-cities. In 1950s and 60s, some pollutions and damages by them had begun to recognize in the local scale. This period is the first stage of water pollution with accelerated economic growth in the mega-city process. In this stage, the main contaminant is composed of the dissolved nitrogen in domestic and agricultural waste and heavy metal originated in industrial activity. In 1970s, Japanese mega-cities had an experience of the most severe contamination in river and seawater by human sewage and industrial waste. This period is the second stage with largest growth of cities. In the over 10 years later, we faced with the groundwater and soil contamination by nitrate, heavy metal and organic compound, while the river contamination had been begun to improve by the development of sewage system. This period is third stage. The subsurface contamination generally appears with delay because of the difficulty of its detection and long transport time. On the other hand, the properties are useful to reconstruct the contamination history, such as the history of fertilizer application and industrial waste. Especially, the stable isotopic and gas component of nitrogen would be effective for the reconstruction. In the following third stage, we detected the nitrate increment of river water in the forest catchment around the mega-city. This trend indicates the accumulation and saturation of nitrate in soil layer by atmospheric deposit. The distribution of trace metal content in the sediment in various Asian mega-cities by some previous studies indicated the change of pollution properties with the growing stage like from the direct leaching to atmospheric deposit. In addition, it also suggests the trace metal discharge with delay in future. For determining the source of pollutants and sedimentation age, we also need to analyze the isotopic ratio of trace metal in sediment as well as the contents. In the coastal mega-cities in Japan, not only the water pollution but also the seawater intrusion or decline of groundwater level occurred. Therefore, we also have to consider the effect of them on the subsurface contamination.