

From X-rays to Biogeochemistry to Beethoven

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Understanding the fate and transport of heavy metal and radionuclide contaminants in soils, sediments, and groundwater, through the food chain, and human physiological responses to contaminant exposure are fundamentally important in the development and evaluation of risk assessment and effective remediation and sequestration strategies. In addition to the physical and chemical process at the mineral surface, bacteria and the extracellular material associated with them are thought to play a key role in determining a contaminant's speciation and thus its mobility in the environment. Increasing our understanding of the role of bacteria in determining the fate of heavy metals and radionuclides in the environment requires the integration of many different scientific disciplines including physics, geology, chemistry, and (micro)biology. Similarly, an increased understanding of the movement of metals and radionuclides through the human body upon exposure to these contaminants is needed to better understand their toxicity. This presentation will provide a general overview of the field of Environmental Science and Geomicrobiology, present forensic studies of hair and bone relics used to identify causes of Ludwig van Beethoven's documented maladies and death, illustrate the importance of integrating multiple scientific disciplines to address key questions in these fields, and demonstrate how novel uses of synchrotron-based x-ray absorption spectroscopy and x-ray microscopy, coupled with electron microscopy, have provided key insights to some of these questions.

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