EAG Distinguished Lecture Program 2017
Lecture Abstracts

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Lecture 1: Arsenic contamination of groundwaters

Natural contamination of aquifers with arsenic (As) affects over 150 million people around the globe. Most severely affected regions are located in South and Southeast Asia but also areas in Europe (e.g., the Pannonian Basin) are affected. Exposure to elevated levels of arsenic occurs through drinking contaminated water but also via eating food prepared with arsenic-enriched water, among other exposure routes. Long-term exposure to arsenic can lead to chronic arsenic poisoning, referred to as arsenicosis, which leads to serious health effects (e.g., skin lesions and cancers) and eventually to death. This talk will focus on the biogeochemical factors controlling the release of arsenic in groundwaters. It will also show how human actions, such as extensive groundwater pumping in areas affected by natural arsenic contamination, can lead to contamination of previously uncontaminated aquifers. Finally, methods of removing arsenic from groundwater will be discussed.

Lecture 2: Global biogeochemical cycling of selenium

Selenium (Se) is an important micronutrient for humans and animals as it is a key component of selenoproteins that serve a wide range of biological functions. Understanding selenium cycling in the environment is complex as selenium is a redox sensitive element that can occur in many chemical forms (i.e., species) in all Earth's spheres (i.e., lithosphere, biosphere, hydrosphere and atmosphere). Since the environmental distribution and chemical speciation of selenium is closely related to environmental health issues, it is of major importance to better understand the factors that control its distribution and biogeochemical cycling, from the molecular to global scale. Climate plays a key role in global selenium cycling, firstly by controlling soil properties and thus selenium retention in soils and secondly, the atmosphere itself is an important reservoir of selenium and thus a potential source of selenium to terrestrial ecosystems and agricultural soils. Climatic processes and atmospheric cycling can thus affect selenium status of soils and finally of food crops. However, the effect of climate on terrestrial selenium distributions as well as atmospheric cycling of selenium and deposition to the surface is still largely unknown. This talk will give new insights in the atmospheric sources, sinks and fluxes of selenium and how these are linked. Furthermore, it will be shown how various geochemical techniques can be used to analyse selenium speciation and concentrations in a wide range of environmental matrices.

<u>Lecture 3:</u> Predicting broad-scale environmental distributions of trace elements

Many trace elements are important for human health as they function as essential micronutrients, however, these elements are often only required in a narrow range of concentrations: too low dietary intakes can lead to deficiency and too high intakes to toxicity. Other elements are toxic at all dietary intake levels. Many health issues related to unsafe levels of trace elements are related to the environmental concentrations and distributions of these elements (e.g., in soils, crops and groundwater). However, in many locations in the world, these distributions are still largely unknown as analysis of trace elements can be expensive and time-consuming. In order to pinpoint areas where further studies are required, it is important to have the ability to predict areas at risk of occurrences of unsafe levels of trace elements. In this talk it will be shown how systematic broad-scale surveys of trace elements can be used, in combination with environmental factors, to predict concentrations of trace elements in soils and groundwaters in regions where this information is not available. Examples will include predictions of soil selenium concentrations on a global scale and regional scale predictions of arsenic in groundwater. Furthermore, it will be discussed how future climate projections can be used to predict future changes in trace element distributions.