Study on uranium speciation in the water of a river near phosphate mining area

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Uranium is a toxic and radioactive element for human health. Previous research has revealed that those people who lived in the phosphate mining affected zone, had higher concentration of uranium in blood than those who lived in urban area. Based on the investigation of uranium concentration in a river which flowed through phosphate mining affected zone, the speciation of uranium in the water was discussed in detail.

In this paper, the potential, temperature and pH value were in situ analysed. The concentrations of uranium, other cations and anions were respectively determined by ICP-MS, ICP-OES and IC. According to the above experimental data, the uranium speciation model was constructed. The results show that:

In nearly-neutral pH value range, the uranium speciation distribution in water was mainly controlled by the phosphate concentration of the water. The MUS (major uranium speciation) of the river near the phosphate mining affected zone was $UO_2(HPO_4)_2^{2-}$, while the MUS were $UO_2(CO_3)_2^{2-}$and $UO_2(CO_3)_3^{4-}$in water which near the cement factories. When the river flowed through a farmland where the phosphate fertilizer was being used, the MUS in the water was $UO_2(HPO_4)_2^{2-}$. But after that site, the MUS of the river changed into $UO_2(CO_3)_2^{2-}$ and $UO_2(CO_3)_3^{4-}$ because of the increase of pH value and phosphate concentration. In this process, We found the use of phosphate fertilizer would lead to a significant increase of the phosphate concentration in the river. Moreover, the increasing of the phosphate concentration resulted in the hydrolysis of the anion and led to the raise of pH value of the river. Some studies about the relationship between the uranium toxicity and its speciation revealed that, because of the biological preference of element Phosphorus, the speciation of uranyl phosphate had stronger cytotoxicity (bioavailability) than the common speciation of uranyl carbonate.

Holocene changes in fire frequency in the Daihai Lake region (north-central China): Indications and implications for an important role of human activity

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Black carbon (BC) content in a sediment core from Daihai Lake, Inner Mongolia, was analyzed to reconstruct a high-resolution history of fires occurring in northern China during the Holocene and to examine the impacts of natural changes and human activities on the fire regime. The black carbon mass sedimentation rate (BCMSR) was disintegrated into two components: the background BCMSR and the BCMSR peak, with the BCMSR peak representing the frequency of fire episodes. Both the background BCMSR and the magnitude of the BCMSR peak display a close relation with the percentage of tree pollen from the same sediment core, suggesting that regional vegetation type would be a factor controlling the intensity of fires. The inferred fire-episode frequency for the Holocene exhibits two phases of obvious increases, i.e., the first increase from <5 to ~10 episodes/1000 yrs occurring at 8200 cal. yrs BP when the vegetation of the lake basin shifted from grasses to forests and the climate changed from warm/dry to warm/humid condition, and the further increase to a maximum frequency of 13 episodes/1000 yrs occurring at 2800 cal. yrs BP when herbs and shrubs replaced the forests in the lake basin and the climate became cool/dry. Both increases in the fire frequency contradict the previous interpretation that fires occurred frequently in the monsoon region of northern China when steppe developed under the cold/dry climate. We thus suggest that human activities would be responsible for the increased frequencies of fires in the Daihai Lake region in terms that the appearance of early agriculture and the expansion of human land use were considered to take place in northern China at ca 8000 and 3000 cal. yrs BP, respectively.

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