The study of the ferruterous mineral water in Kareliya by isotopic and chemical tracers.

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From 1979 to 2012 the ferruterous mineral water in Karelia (northwest of Russia) was studied by monitoring the isotope and chemical tracers.

In 1979-1980 stable isotopes (^{2}H, ^{18}O) had fractionated composition (on the plot $\delta^{2}H$ vs. $\delta^{18}O$ the points shifted right from the meteoric line), which was caused by cryogenic metamorphism at partial freezing of water in the last glacial period. The composition of stable isotopes has strongly changed for the last 25 years (the points fit on the global meteoric line now). Other isotope tracers ($\delta^{13}C$, ^{3}He, ^{4}He, ^{20}Ne, $^{234}U/^{238}U$, ^{3}H) also have changed and become closer to the recharge water. So the isotope data show that the water of the studied area in 1979-1980 was formed by mixing “old” and “young” components. But now we observe the rapid penetration of the atmospheric precipitation and gradually disappearance of the "old" component.

Though the seasonal variations are detected, the average chemical composition of the mineral water (major components and microelements) has not changed for the last decades in contrast to the isotope tracers. Probably the relative constancy of the chemical composition indicates that iron accumulation in the water is due to melanterite ($Fe[SO_4]\cdot 7H_2O$) dissolution. Melanterite has formed from pyrite during the last glaciations and filled cracks and pores. The reserves of this mineral are not known and because of the rapid changes in the isotopic characteristics we can talk about the over-exploitation of the mineral water deposit. Data suggests the need for strict sanitary control of water quality.

Selenium distribution linked to monsoon climate in the Chinese Loess Plateau

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Selenium (Se) is a vital trace element for human health with a narrow range between deficiency and toxicity. Diets deficient in Se have been linked with various diseases, while those with an excess can lead to toxicity. Predicting where Se deficiency/toxicity occurs is challenging due to the heterogeneous terrestrial distribution of Se and limited knowledge on what controls this heterogeneity. It has been proposed that the largest natural flux of Se to the terrestrial environment is via wet deposition from the atmosphere.

Our research uses the loess-paleosol and red clay deposits on the Chinese Loess Plateau (CLP), the largest area of windblown sediments on Earth and one of the best available records of climate change, to elucidate how atmospheric deposition of Se relates to its terrestrial distribution. We present a 6.8Ma record of variation in the Se concentration in the Lingtai section from Central CLP. In interglacial climatic periods from 2.31-1.56Ma and 1.6-1.3Ma, we find very strong positive correlations (R^2=0.97 and 0.85 respectively) between Se concentration and summer monsoon index, a proxy for effective precipitation. In later interglacial periods from 1.26-0.83Ma and 0.78-0.16Ma, the strong positive correlation with precipitation is absent or there is a negative correlation (R^2=0.21 and 0.50, respectively) and we find dust input plays a greater role. As both precipitation and dust inputs are determined by the strength of the East Asian Monsoon, we are able to show that Se deposition in the CLP (at the Lingtai section), is directly related to past changes in the monsoon climate system.

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