Records of climate change and atmospheric lead depositions since the Early Bronze Age in archeologically dated buried soils

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The aim of our study was to track climatic change and global environment pollution by lead since the Early Bronze Age in the Low Volga region of Russia. We used a comparative analysis of the organic matter, soluble salts, gypsum, carbonates, stable lead isotopes (of the total and mobile fractions of lead) profile distribution in the modern soils and paleosols buried under the burial mounds and dated using archaeological methods.

Results demonstrated that 3500 years ago climate was warmer and drier than nowadays. Drought epoch had maximum between 2000 BC and 3000 BC. The most moist climate conditions were found in XII-XIV centuries AD.

There was a difference in lead isotopic composition between deeper and upper horizons both in the modern and buried soils, due to atmospheric lead deposition. Since the Bronze Age till nowadays we observed an increase of the mobile lead fraction and shift of its isotopic composition towards “anthropogenic” Pb (gasoline-Pb, and lead of the Russian aerosols and ores). However no shift of the total lead content or isotopic composition was found in the soil chronological sequence.

The relative contribution of atmospheric and geogenic sources to mobile Pb was calculated using a two-component mixing model. For the upper horizons atmospheric fraction increased since the Bronze age from (on average) 40% till 70%, and even deep horizons of the modern soil were enriched with airborne mobile lead (40%).

The regression analysis showed a correlation between mobile lead and carbonates in the soil profile. Climate cooling since the Bronze Age and the increase of the amount of precipitation resulted in a leaching of carbonates and mobile lead to the deeper soil horizons.

Work is supported by the RFBR-CNRS project 09-05-91058

The characteristics of the selenium-bearing minerals in the Tamusu sandstone-type uranium deposit, Inner Mongolia, China

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The Tamusu uranium deposit is a typical sandstone-type uranium deposit which was discovered in recent year in Inner Mongolia, China. High Se content (more than 1000 ppm) was detected in uranium ore, meanwhile five selenium-bearing minerals such as clausthalite (PbSe), ferroselite ($FeSe_2$), penroseite [$(Ni,Co,Cu)Se_2$], klockmannite (CuSe) and athabascaite (Cu_5Se_4) were discovered based on study of EPMA in the uranium ore. These selenium-bearing minerals distribute in the edge or cranny of pyrite, quartz and feldspar. The selenium-bearing minerals such as Clausthalite and Ferroselite are formed under mid- or lower temperature hydrothermal system, so we infer that the Tamusu uranium deposit was reformed under mid- or lower temperature hydrothermal condition.

This study was fund by NSFC (No. 40872072)