

## Variations of soil C and N along a South-North Transect in East Central Asia: Implications for climate change

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The feedback of soil organic matter to global warming is important for modeling future climate change. No consensus, however, has been reached on this issue partly because the temperature sensitivity of soil organic carbon (SOC) is affected by a variety of factors such as water availability and the associated change in soil N contents. To elucidate the links between the C stock and environmental factors, we assessed the spatial variation of C and N content in the topsoil, and the concomitant changes of temperature, water availability and alkalinity in a mega-transect in East Central Asia, which is characterized by large environmental changes.

Totally 210 sites were sampled at 6 replicates using a corer along the transect. Soil C and N content and soil alkalinity change dramatically in the transect. SOC and soil organic nitrogen (SON) increases with water availability while decreases with temperature, both are associated so closely with each other that their molar ratio, C/N, is generally invariant about 12 except in the agro-pastoral transitional zone in north China. Soil pH increases with temperature and decreases with water availability.  $\text{NH}_4^+\text{-N}$ , which is the primary inorganic N in the soil, basically varies with SON, indicating its provenance, but is also subject to modification by soil alkalinity.  $\text{NO}_3^-\text{-N}$ , though derived primarily from nitrification of  $\text{NH}_4^+\text{-N}$ , does not follow its precursor because of precipitation leaching and re-deposition.

Statistic analyses indicate that SOC and SON contents in East Central Asia should have been influenced negatively by recent warming, which, albeit occurring primarily in the winter half year, strengthens the evaporation and enlarges the difference of wet and dry seasons, and thus reducing soil annual water availability while increasing soil alkalinity. The accelerated decomposition of SOC stock, in association with the increased soil alkalinity, enhances transformation of SON to  $\text{NH}_4^+$ . The increased N mineralization, however, may not necessarily promote net primary production because of the decreased water availability and increased soil  $\text{NH}_3$  volatilization.

## Pressure-induced insertion of xenon into a small-pore zeolite natrolite

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We report here a novel mechanism of xenon incorporation into a zeolite at moderate upper mantle PT conditions. When silver-exchanged natrolite,  $\text{Ag}_{16}\text{Al}_{16}\text{Si}_{24}\text{O}_{48} \cdot 16\text{H}_2\text{O}$ , a small pore auxetic zeolite is compressed under xenon medium to ca. 1.7 GPa and heated to ca. 250 degrees Celsius, significant amount of xenon is incorporated into the natrolite channel via desorption of water molecules and charge disproportionation of silver cations, resulting in ca.  $\text{Ar}_8\text{Al}_{16}\text{Si}_{24}\text{O}_{80} \cdot 8\text{Xe}$ . This material is recovered to ambient conditions with ca. 4% larger unit cell compared to the starting material. This process has been monitored by in situ high-pressure synchrotron XRD, and the presence of xenon and the formation of charge-disproportionated silver metal nano particles have been confirmed by XRF chemical analysis and TEM imaging from the recovered sample. Xenon incorporation under moderate pressure into Auxetic framework silicate such as natrolite is an important and overlooked confinement mechanism of heavy noble gases in geochemical environment.