

## Humic substances in deep sedimentary groundwater

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Humic substances (HSs) are ubiquitous in various environments and play important roles for the fate of nutrients and pollutants. Deep underground environment is not an exception, although the properties of HSs there are largely unknown due to their limited availability. Recently, we reported the physicochemical and ion-binding properties of HSs extracted from sedimentary groundwater at -250 m below ground surface of the Horonobe underground research center operated by the Japan Atomic Energy Agency. The Horonobe HSs (HHSs) consist of relatively small organic molecules rich in aliphatic carbon and reduced sulfur. The densities of acidic functional groups such as carboxylic groups are relatively high for HHSs, and they are chemically homogenous. Nevertheless, the binding of  $\text{Cu}^{2+}$  to HHSs are smaller than that to surface HSs, suggesting the presence of different coordination environments for  $\text{Cu}^{2+}$  in HHSs. Cadmium, a thiophilic metal, tends to form  $\text{CdS(s)}$  nano-particles with HHSs likely due to the high concentrations of reduced sulfur. In this talk, the particularity of the HHSs will be discussed, comparing their properties with those of their counterparts in surface environments.

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