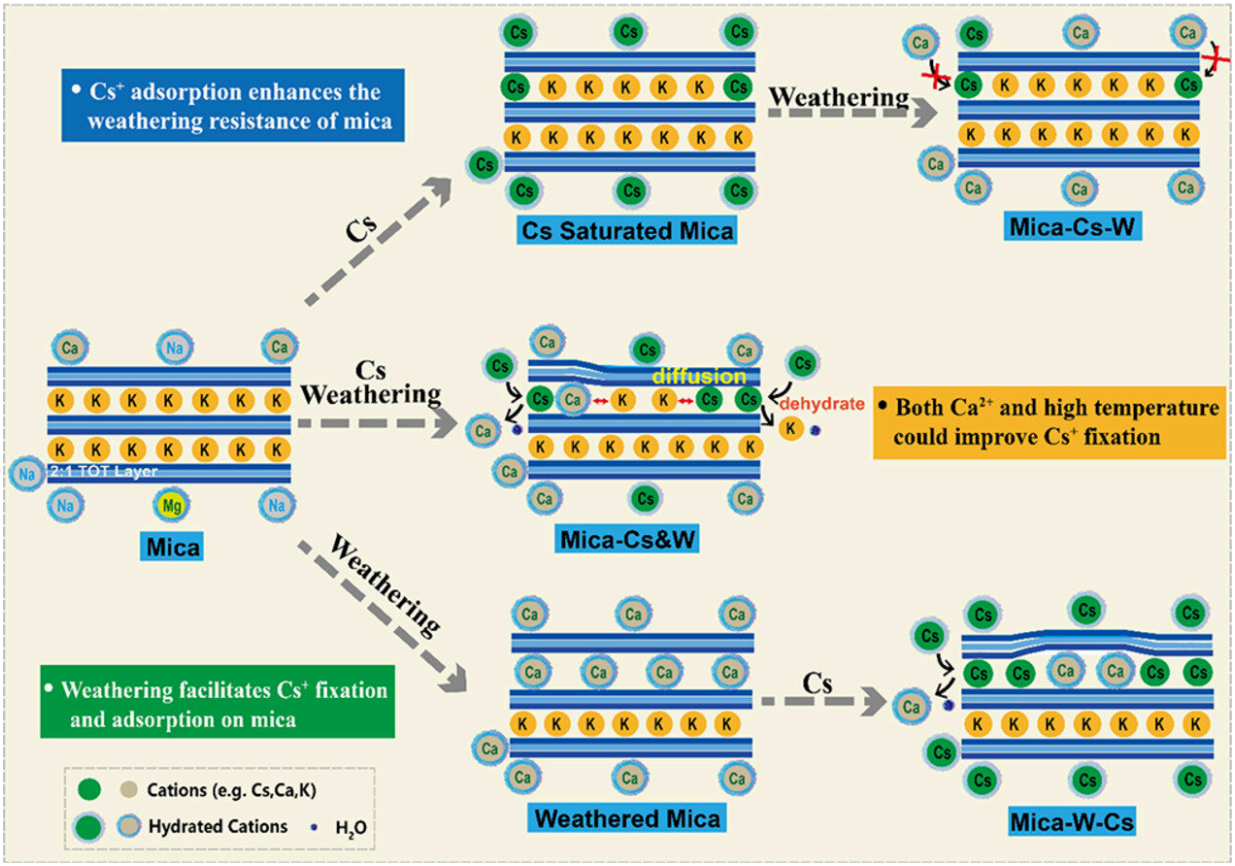
Researchers reveal interactions between micaceous minerals weathering and cesium adsorption

May 17 2023, by Li Yuan



Graphical abstract. Credit: *Water Research* (2023). DOI: 10.1016/j.watres.2023.119918

Radiocesium (RCs) has long half-life, strong radioactive toxicity, and high bioavailability. The migration and transformation of RCs in the environment have aroused much attention.

The environmental behavior of RCs is mainly regulated by the combination of clay minerals and natural weathering processes in soil or sediment. But the interaction of Cs adsorption and micaceous minerals weathering may further enhance the difficulty of interpreting and predicting the environmental behavior of RCs.

Based on real environmental scenarios, a research team led by Prof. Fan Qiaohui from the Northwest Institute of Eco-Environment and Resources (NIEER) of the Chinese Academy of Sciences systematically investigated interactions between weathering of micaceous minerals and adsorption of RCs to understand the fate of RCs in ecosystem. The study was published in *Water Research* on March 28.

They designed a research strategy consisting of three reaction sequences between the weathering of micaceous minerals and Cs^+ adsorption, and analyzed changes in the micaceous mineral structure and Cs^+ adsorption species on minerals to reveal the interaction mechanisms between the structural stability of micaceous minerals and the adsorption behavior of Cs^+.

Results showed that the sequence of reactions between the weathering of micaceous minerals and Cs^+ adsorption significantly affected the adsorption species of Cs^+ and the structural stability of micaceous minerals.

Weathering could expand the interlayer structure of micaceous minerals, generating more strong affinity sites and decreasing the exchangeability and mobility of Cs^+ in the interlayer of micaceous minerals. Besides, the Cs diffused into the interlayers would collapse the interlayers, impeding

the ion exchange and improving the weathering resistance of micaceous minerals.

High temperature and cations with large hydration radii (such as Ca^{2+}) in the environment would accelerate the ion-exchange reaction between interlayers, which is conducive to the adsorption and fixation of Cs^{+} in micaceous mineral interlayers.

"The above findings suggest that the decontamination work for soil RCs should be carried out as soon as the RCs enter the soil environment," said Prof. Fan. "Otherwise, with the prolongation of weathering time, RCs will stabilize in the soil and enhance the difficulty and cost of subsequent decontamination."

More information: Wei Wang et al, Interactions between micaceous minerals weathering and cesium adsorption, *Water Research* (2023). DOI: 10.1016/j.watres.2023.119918

Provided by Chinese Academy of Sciences