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15 This file includes:

16 Description of experimental setup

17 Supplementary Figure S1 to S5

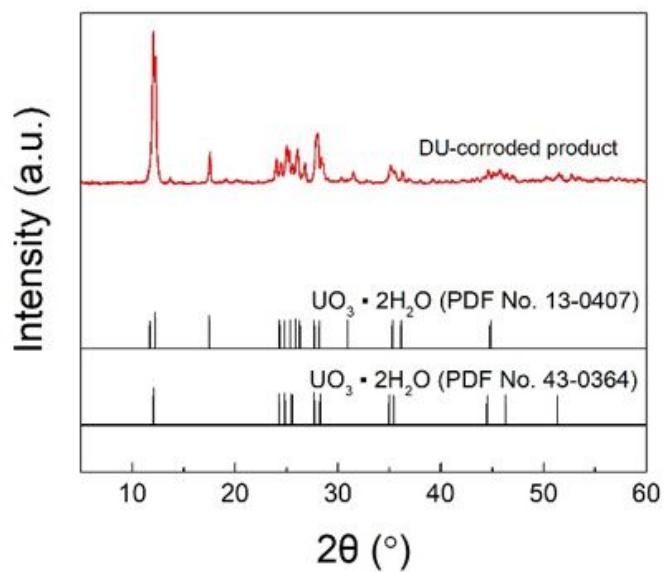
18 **Metaschoepite dissolution and transformation in the water system**

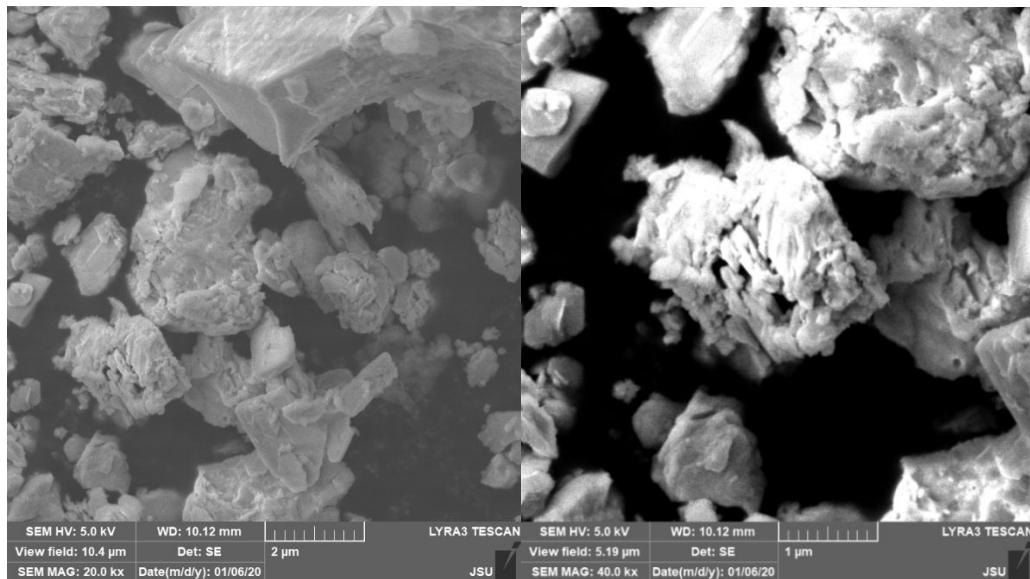
19 To explore the effects of different water regimes on the dissolution and transformation of
20 metaschoepite in water system, an incubation experiment was setup. The same water regimes of
21 water as soil incubation experiment was set (i.e. saturation and flooding), which formed a 3-cm
22 and a 5-cm water layer covering the 15 g metaschoepite. Portions of metaschoepite (1 g, dry weight
23 basis) were collected during the incubation period at 1, 30, 90, 270 d. The samples were freeze-
24 dried, and the releasing behavior of U and Mn and the dynamic transformation of metaschoepite
25 in water were investigated. Also, at the end of incubation (270 d), sub-metaschoepites were
26 sampled for the U species detection.



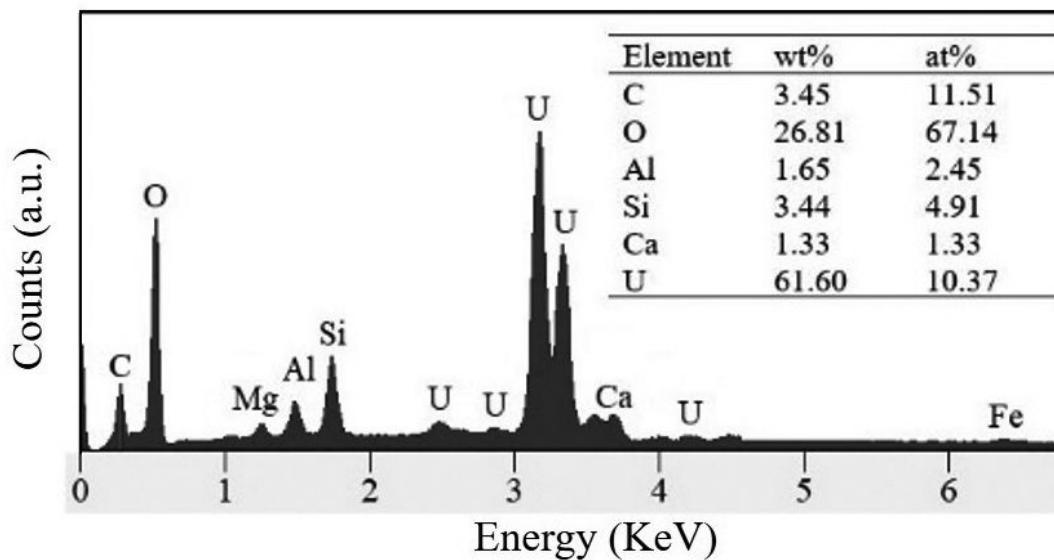
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28 **Fig S1.** The corrosion product of penetrators (bright yellow) in the soil samples collected from
29 the Yuma Proving Ground and the XRD pattern of the corroded product (metaschoepite).



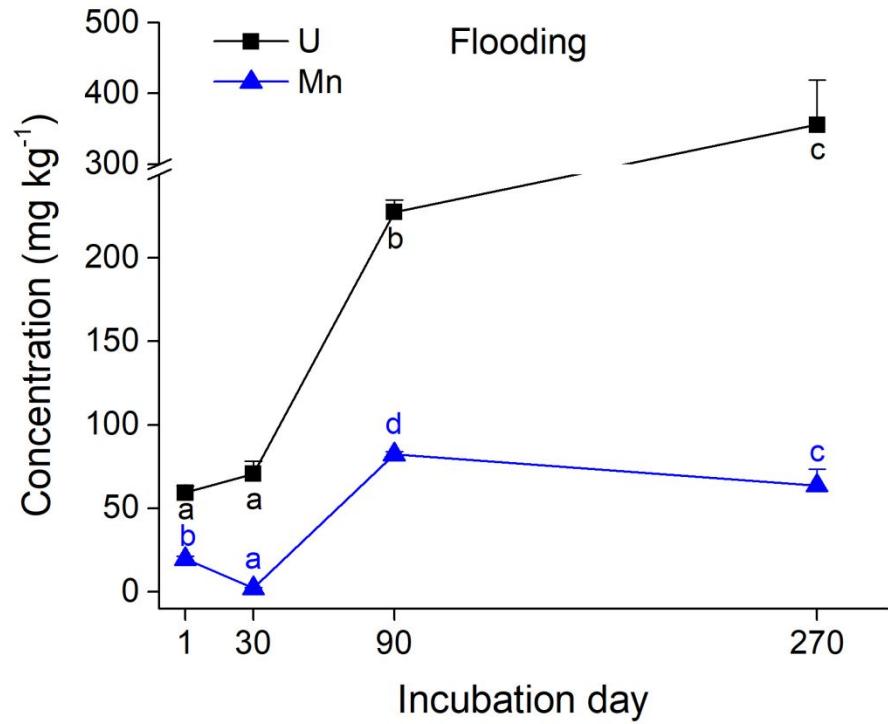
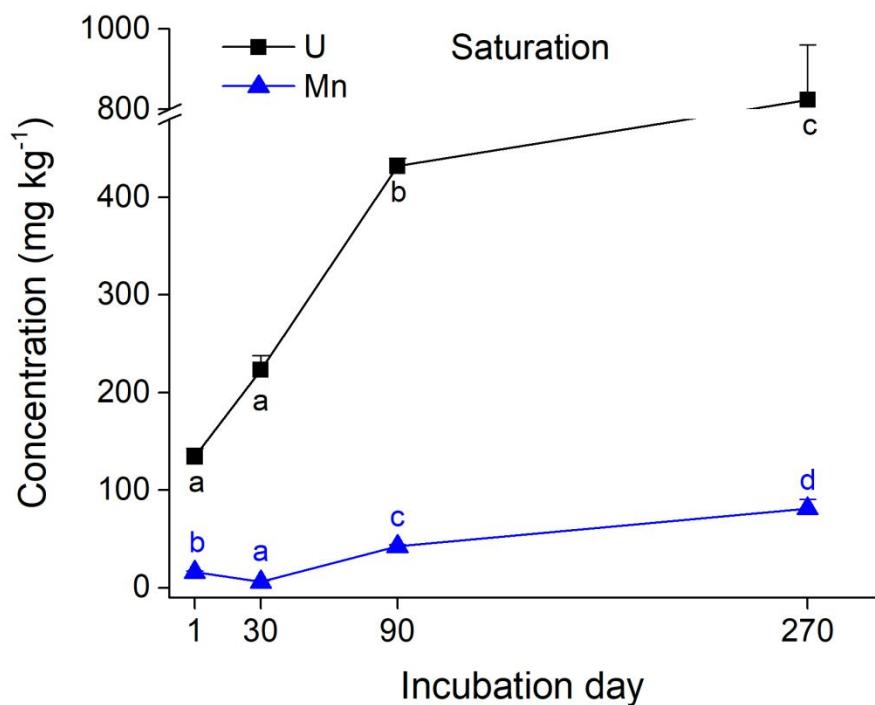


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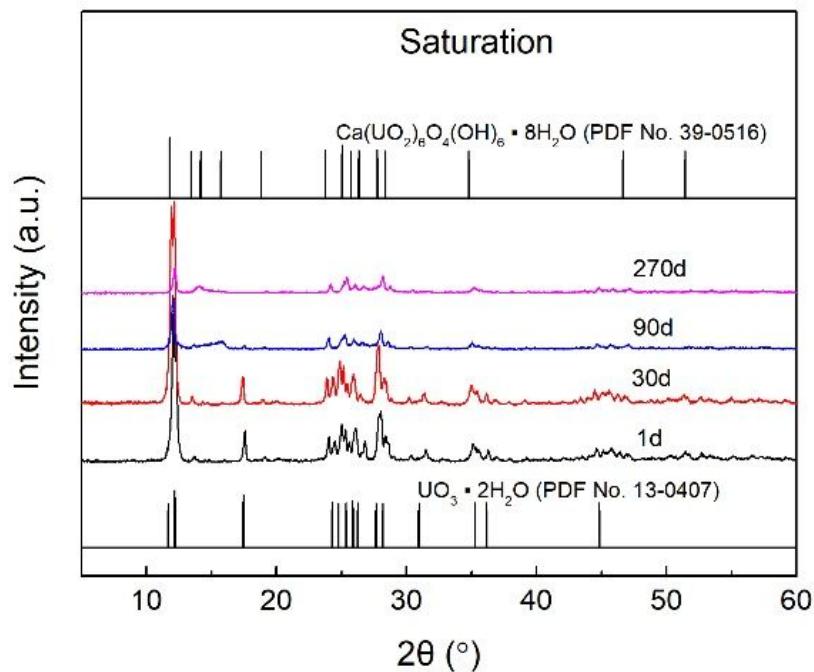
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32 **Fig S2.** The SEM-EDS spectrum of the used DU-corroded product (metaschoepite).

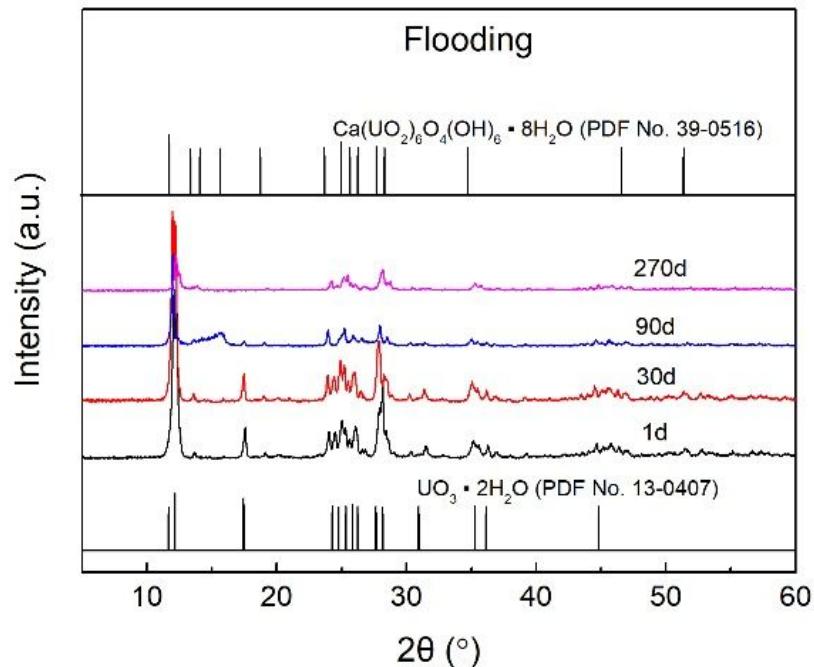


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36 **Fig S3.** Dynamic releasing behavior of U and Mn of metaschoepite under saturation and flooding regimes in water system.



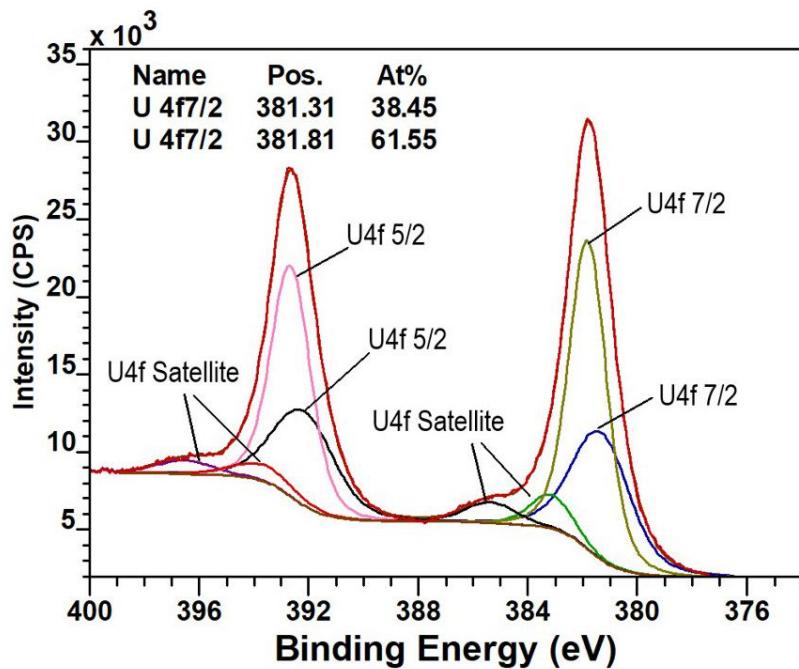
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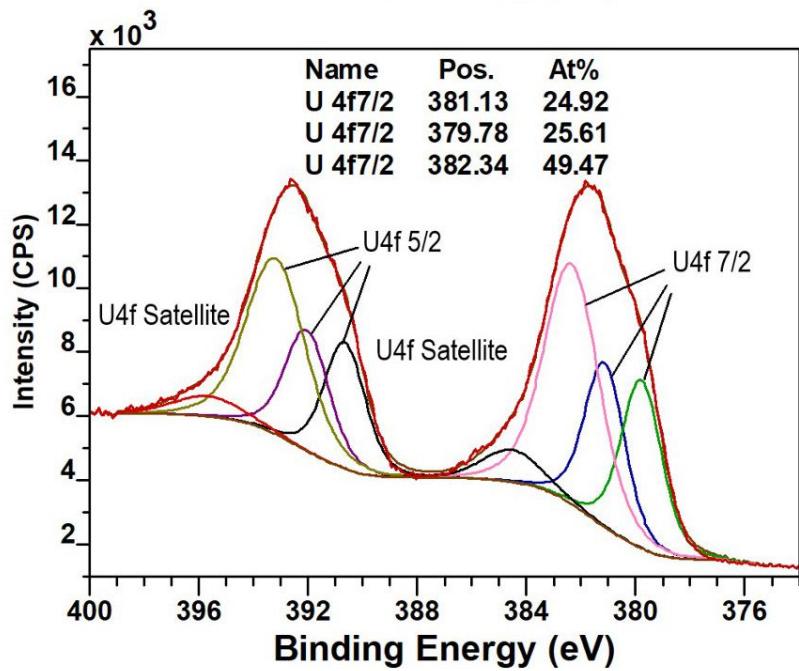
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39 **Fig S4.** Dynamic changes of the XRD patterns of metaschoepite under saturation and flooding
40 regimes in water system.

Saturation



Flooding



41

42 **Fig S5.** XPS spectra of U of metaschoepite after 270 d incubation under saturation and flooding
43 regimes in water system.