Simulating foam transport in the vadose zone at the continuum scale

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The nuclear wastes residing in the deep vadose zone at the Hanford Site near Richland, WA, USA, threaten the underlying groundwater [1]. To immobilize the contaminants, aqueous and/or gaseous amendments may be carried by foam and injected into the contamination region. Foam is an emulsion-like, two-phase system in which gases are dispersed in a liquid and separated by thin liquid films. Foam has a very low density and a very high apparent viscosity. The transport of foam in the vadose zone is complex in that the number of lamellae present governs foam flow characteristics such as viscosity, relative permeability, and interactions between injected and residential fluids. We have developed a simulation capability into the STOMP numerical simulator [2] to model the transport of foam and the amendments contained in foam. Bench-scale lab experiments were conducted by injecting pre-generated foam into an initially unsaturated system containing one or more types of sediments. Soil water content and foam pressure were measured with time at multiple locations. The Figure below shows the simulated moisture-content distribution during the injection of foam into a two-dimensional flow cell. Further work is warranted for better understanding the foam transport mechanism in the vadose zone and parameterizing the model.

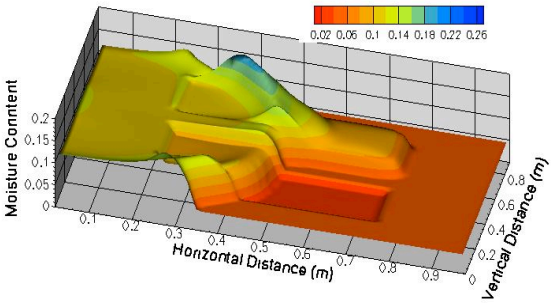

Figure 1: Simulated moisture content distribution during the injection of foam.

[1] United States Department of Energy (2010), DOE/RL-2010-89, Revision 0. [2] White and Oostrom (2006), PNNL-15782, Pacific Northwest National Laboratory.

The significance of Cenozoic magmatism from the Eastern margin of the Eastern Himalayan syntaxis

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Previous studies show that the adakitic rocks have magma crystallization ages between 10~18 Ma in central Gangdese belt (west of 92°E) and 22~26 Ma in eastern Gangdese (east of ~ 94°E) [1,2,3,4]. It seems that the magma crystallization ages for the Gangdese adakitic magmatism tend to an increased variation from west to east. However, whether this variational trend extend to far eastern Gangdese is uncertain because previous work on the far eastern Gangdese adakitic magmatism lacks high-precision geochronological data. If the age variational trend for the adakitic magmatism is true, an interesting issue is what continental dynamic process taken place along the Gangdese belt.

We carried out an integrated study of U-Pb zircon dating, geochemistry and Sr-Nd-Hf isotopes for two granitoid intrusions in Motou area, the eastern margin of the eastern Himalayan syntaxis. U-Pb zircon dating shows their magma crystallization ages of ~28 Ma. These granitoids have adakitic geochemical signatures. Our result further confirms the age variation of the adakitic magmatism along the Gangdese belt. We suggest that the adakitic magmatism resulted from break-off of the subducted Indian continental slab and a westward propagation model for the slab break-off can account for the age variation and magma generation.

[1] Chung *et al*., 2009. *Tectonophysics*, v. **477**, p. 36-48. [2] Ji *et al*., 2009. *Chemical Geology*, v. **262**, p. 229-245. [3] Xu *et al*., 2010. *Lithos*, v. **114**, p. 293-306. [4] Zhang *et al*., 2010, *Contributions to Mineralogy and Petrology*, v. **160**, p. 83-98.