

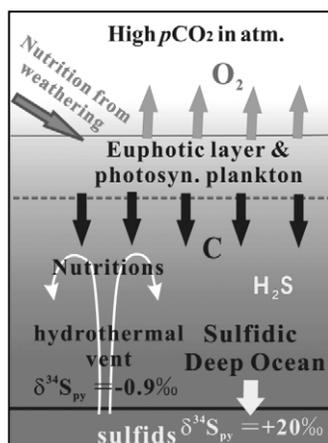
## Sedimentary environments of lower Cambrian black shale in S. China

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The  $\delta^{34}\text{S}_{\text{py}}$  of sedimentary pyrite from the Lower Cambrian black shale in NW Hunan of China have been determined. Except one sample with a  $\delta^{34}\text{S}_{\text{py}}$  value of  $-0.97\text{‰}$  from the Ni-Mo mineralized bed at the bottom Cambrian, total other 16 pyrite samples are all in the range from  $+10\text{‰}$  to  $+28\text{‰}$  with an mean value  $+20\text{‰}$ , obviously different from those in modern oceanic sediment ( $-20\text{‰}$  to  $-10\text{‰}$ ). If  $\delta^{34}\text{S}$  of the seawater sulphate was identical with the world seawater at the early Cambrian, about  $+34\text{‰}$ , there was a small fractionation only  $14\text{‰}$  during sedimentation of the black shale. The high  $\delta^{34}\text{S}_{\text{py}}$  value in the black shale should be caused by small fractionation between seawater sulphate and biogenic sedimentary pyrite in an anoxic sulfidic ocean in which the availability of sulphate is limited. Combining the data of  $\delta^{13}\text{C}_{\text{org}}$ ,  $\delta^{13}\text{C}_{\text{carb}}$  and trace elements of the black shale and related paleo-atmosphere and -ocean models, we propose a preliminary idea of paleoenvironments of the Lower Cambrian black shale in NW Hunan as follows.

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### References

- Canfield D.E., (1998) *Nature*, 396. 450-453.  
 Berner R.A. and Kothavala Z., (2001), *Am. J. Sci.* 301. 182-204.  
 Veizer J., D. Ala, K. Azmy et al., (1999), *Chem. Geol.* 16. 59-88.

## Hyperalkaline leachate-rock interaction and radionuclide transport in a fractured rock

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### Introduction

The HPF project (hyperalkaline plume in fractured rock) at the Grimsel Test Site (Switzerland) comprises an underground field experiment including radionuclide transport in a shear zone, laboratory core infiltration experiments, reactive transport modelling, structural / mineralogical characterization, and studies on radionuclide stability. The aim is to quantify processes relevant for geologic disposal of nuclear waste in a cementitious environment. HPF is funded by ANDRA (F), JNC (J), NAGRA (CH), SKB (S), DoE (US).

### Experimental results and modelling

Injection of K-Na-Ca-OH fluid (pH 13.4) into a natural shear zone in granodiorite induces marked changes to the flow field over two years, as recorded by hydraulic parameters and repeat dipole testing with radioactive tracers (Br, I, Na, Sr). The 3-D chemical evolution of the test zone is observed in 28 packed-off intervals in 10 boreholes. The overall transmissivity within the dipole is gradually decreasing while focusing of flow results in faster breakthrough times. Similar processes are observed in laboratory core infiltration experiments where formation of Ca-Si-hydrates is observed.

1-D reactive transport modelling of lab experiments is in good agreement with the measured chemical and hydraulic evolution. 2-D transport modelling (heterogeneous porous medium or discrete fractures) of tracer experiments in-situ is more difficult in an evolving natural system.

### Discussion and conclusions

HPF offers challenges to experimental methods and reactive transport models, and created a unique hydraulic and geochemical data set of an evolving flow field controlled by rock-water interaction in a shear zone.

### References

- Pfingsten, W. and Soler, J.M. (2003). *J. Contam. Hydrol.*, 61, 387-403.  
 Soler, J.M. and Mäder, U (2003). *Nuc. Sci. Tech.* (in press).