

## Redefining feldspar-water interfaces

C. ZHU

Geological Sciences, Indiana University, Bloomington, IN  
47405, USA, (chenzhu@indiana.edu).

Currently prevailing theory or hypothesis on kinetics is that feldspar dissolution is controlled by surface reactions. However, recent atomic scale electron microscopy studies of naturally weathered K-feldspars in the Navajo sandstone, Arizona (Zhu *et al.*, 2006), labradorite dissolved in pH 1 solutions in the laboratory at room temperature (Hellmann *et al.*, 2003), and alkali-feldspars dissolved at 200 °C and 300 bars (our unpublished) show that there is an amorphous layer on the dissolving feldspar surfaces. Furthermore, K-feldspars from the Navajo sandstone show tightly adhered coating of kaolinite and a 3-5 micron thick smectite (Zhu *et al.*, 2006). We believe the amorphous layer and secondary coating layers are important characteristics that bear significances on the feldspar dissolution kinetics. We advance two hypotheses for explaining the field-lab discrepancy. First, the secondary minerals rinding on feldspars are not at local equilibrium with groundwater, as traditionally assumed, but their slower precipitation rates can raise the groundwater saturation state with respect to feldspars to very close to equilibrium, and thus retard the feldspar dissolution rates. Feldspar dissolution reaction in aquifers is within a complex web of reactions, in which secondary clay precipitation plays a key role. Second, a thin (~ 10 nm) amorphous layer, possibly leached in origin, is found on feldspars that we examined. The presence of the amorphous layer on naturally weathered feldspars requires re-consideration of the details of surface reaction controlled mechanism.

## Stable sulfur isotopic composition of H<sub>2</sub>S and its TSR origin in Sichuan basin, China

G.Y. ZHU, S.C. ZHANG, J.X. DAI AND Y.B. LIANG

PetroChina Research Institute of Petroleum Exploration and  
Development, Beijing (zhuguangyou@Petrochina.com.cn)

The natural gas has widely some H<sub>2</sub>S in Sichuan basin; the contents are from minim to 18.6 percents. The high H<sub>2</sub>S-bearing natural gas lies in the Feixianguan Formation, Leikoupo Formation and Jialingjiang Formation of Triassic; the Sinian, Carboniferous and Permian reservoir have lower contents H<sub>2</sub>S, Xujiache Formation of Triassic and Jurassic have micro or free sulfur in natural gas reservoir. The research shows that the gypsiferous rock of Feixianguan Formation, Leikoupo Formation and Jialingjiang Formation of Triassic, Sinian and Carboniferous reservoirs provide the physical matter for TSR; the Permian lower H<sub>2</sub>S-bearing natural gas is mainly from the pyrolysis of organic sulfur source rock. The stable isotopic composition of sulfur show that the sulfur isotope of H<sub>2</sub>S-bearing gas has a short at 7~11‰ of the reservoirs sulfate, and that the sulfur isotopes of lower H<sub>2</sub>S-bearing have widely distributing and about 15‰ short of most data. The stable isotopes of sulfur have a wide distribution extent and step change in the gypsiferous rock of Triassic, which are similar to the H<sub>2</sub>S in the distributed law (Fig.1), the data indicate that the sulfur comes from the sulfate in the H<sub>2</sub>S and TSR occurs in the respective reservoirs. Otherwise, the temperature conditions are similar as the TSR occurs, which means that the H<sub>2</sub>S generates in the similar temperature condition and the fractional process of sulfur isotopes have no concern with the sulfur isotopes of sulfate, the temperature and extent of reaction are the key factors in the TSR process.

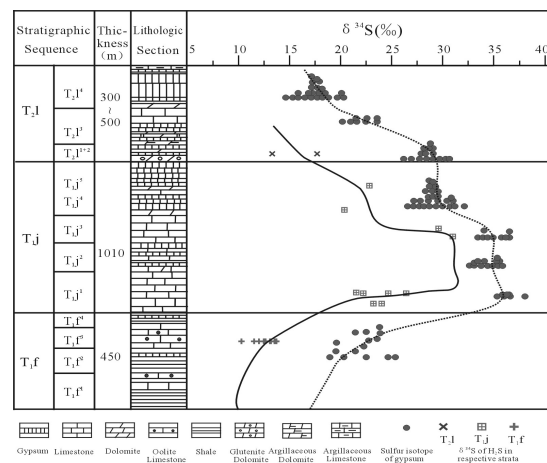


Fig 1.  $\delta^{34}\text{S}$  of H<sub>2</sub>S and gypsum of Sichuan basin

### References

- Claypool G.E., *et al.*(1980), *Chem Geolo.***28**:199-260.  
Zhu G, Zhang S,*et al.*(2005), *Sci China.* **48**(11):1960-1971.  
Worden R.H., *et al.*(1995), *AAPG Bull.***79**(6):854-863.  
Machel H.G.,*et al.*(1995), *Appl Geochem.***10**(4):373-389