Rare earth element geochemistry of marine carbonate reservoir in northeast Sichuan, China

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Abstract

Samples were collected from marine carbonate reservoir of northeast of Sichuan province, China. And REE of those samples were analyzed to statement ΣREE, LREE, HREE, δEu and δCe geochemical characteristics. Using the mechanism of REE migration, enrichment and fractionation, the nature of fluid and diagenesis environment were distinguished. The impact of deep fluid was also analyzed to study the formation of carbonate rock geochemistry and the diagenesis environment.

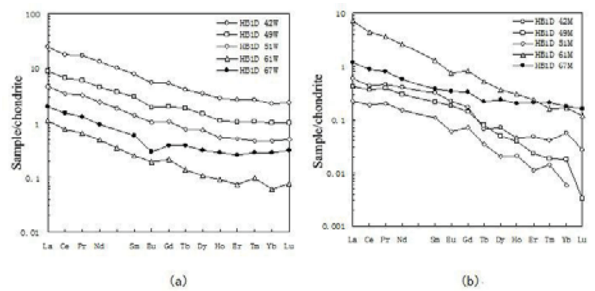

Figure 1. The REE partitioning patterns for (a) wall rock, and (b) veins

Results and Conclusion

The results show that during the diagenesis process of the original marine limestone, REE in protolith has been constantly depleted and manifested similar ΣREE values between wall rock and the veins. The δEu value of samples from wells Heba1 and Ma2 are greater than zero and less than 1, which indicates an open oxidizing environment. The δEu values of other drilling samples are greater than 1, which suggests an effect of high temperature hydrothermal fluids with Eu anomalies and hot water dissolution. Comparing with the veins and the Earth REE patterns, there're similar REE patterns between veins and the original mantle, which could be related to the activities of the mantle fluids.

[1] Huang J. Chu X. L., Chang H. J., Feng L. J. (2009) *Chinese Science Bulletin*, **54(2)**, 3498-3506.

A new pore-scale model of diffusion and advection of reactant in a dissolving porous media

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We have developed a new model of pore-scale reactive transport based on the lattice Boltzmann method (LBM). LBM has already been successfully applied to reactive transport by Kang and co-workers [1 & 2]. Our model offers a natural approach to handle porosity changes in the solid matrix during dissolution and precipitation. It also uses an iterative solver for the coupling of the reactant transport with surface reactions which allows us to explore a wide range of reaction rates and non-linear heterogeneous reactions. In a first application, we present the results of calculations aiming at investigating the effect of matrix dissolution during multiphase flow (e.g. CO_2 injection into an aquifer). We find that although dissolution processes and multiphase flows in porous media generally lead to channelization, i.e. wormhole structure and capillary instabilities respectively, dissolution during multiphase flows stabilizes the reactive front leading yielding a homogeneous distribution of CO_2 in the pore space (see Fig. 1) [3]. In a second application, we incorporate subgrid-scale roughness at the solid-fluid interface in a single phase reactive transport model. The presence of surface roughness can significantly increase the reactive surface area at the pore-scale. We propose some simple laws for the development and evolution of a time-dependent local surface roughness as function of reaction rates and local chemical disequilibrium and investigate its effect on the development of flow and reactive patterns at the mesoscale (~100 pores/physical dimension).

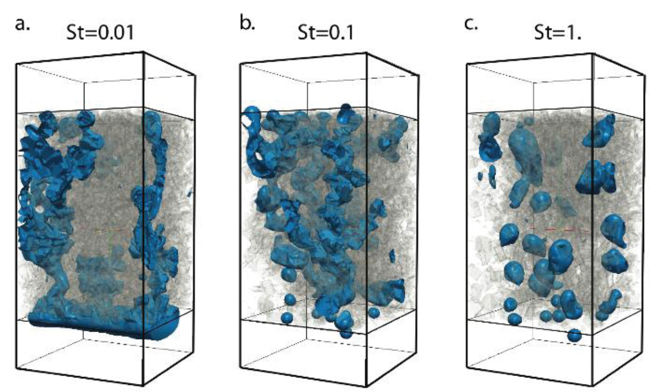

Figure 1: Snapshots of volatile (CO2) transport (blue) in a dissolving porous media with dissolution rates increasing from left to right.

[1] Kang, Zhang and Chen (2003) *PRE* **65**. [2] Kang, Lichtner and Zhang (2006) *JGR* **111**. [3] Parmigiani *et al.* (2011) *JFM* **686**, 40-76.