THEME 2:
THE DYNAMIC INTERFACE

Session 2.5:

Processes near geochemical fronts: making space and filling space

CONVENED BY:

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This session focuses on the coupling between transport, deformation and dissolution-precipitation reactions that generate geochemical fronts. We invite field-, modelling- and/or experimental studies of geochemical fronts on scales ranging from the micro-scale of individual mineral grains to the kilometer-scale fluid flow pathways near the Earth's surface. Examples of pertinent topics could be: Mineral replacement processes, vein-formation, volatilization or devolatilization fronts in metamorphic rocks, mantle-metasomatism, fronts connected to ore-deposition, weathering fronts, redox fronts, migration of contaminant plumes at undersaturated or saturated conditions. Studies of geochemical fronts arising near the interface between the geo- and biosphere are welcome.

2.5.11

Front propagation in fracture-assisted reactive transport

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Reactive transport in the Earth's crust can be strongly linked to deformation through the formation of fractures that enhance fluid transport. Fracturing is probably the most important porosity and permeability producing mechanism in the lithospehre. Coupled transport processes that includes fluid transport through fractures, with associated reactive transport into the matrix from the fractures, can lead to efficient transport even through initially practically impermeable rocks through fracture-assisted processes. For example, the stress perturbations caused by nonisochoric reactions may lead to deformation and fracturing that generates permeability for further fluid tranport. We have introduced a model for fracture-assisted transport [1]. Here, we demonstrate that reaction fronts described by this model can be described using a formalism similar to Bickle [2], and we show how the Damkohler number is related to fundamental properties of the reaction system. In addition, we discuss the cross-over to anomalous diffusion as transport throught the generated fracture network becomes important. An illustration of a typical reaction front with assosciated fractures is shown in Figure 1.

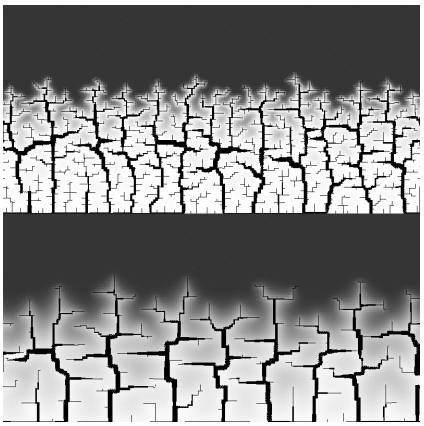

Figure 1. Illustration of the width of the reaction front for two simulations of fracture-assisted reactive transport. The ratio of diffusion and reaction rates is different in the two simulations.

References

[1] Jamtveit, B, Austrheim, H. and Malthe-Sørenssen, A. (2000) *Nature* **408**, 75-78.

[2] Bickle, M. J. (1992) *American Journal of Science* **292,** 289-316.