A reactive transport model of CO_2 injection in basaltic rocks

Juan J. Hidalgo (1,2), Caroline de Dieuleveult (3), Pierre Agrinier (4), and Vincent Lagneau (3)

(1) MIT, Cambridge, MA, United States (jhidalgo@mit.edu), (2) IDAEA-CSIC, Barcelona, Spain, (3) Mines Paristech, Paris, France, (4) IPGP, Paris, France

A CO_2 injection was carried out at the Lamont-Doherty Earth Observatory site (Palisades, New York, USA) to assess the basalt neutralization capacity [1]. The essay consisted of a single-well push-pull test in which an CO_2-rich solution was injected in the aquifer and pumped after a 24 days incubation period. Chloride was added as a inert tracer and ^{18}O was measured as a second conservative tracer.

We present a reactive transport model of the push-pull test made with HYTEC code [2]. Flow and transport parameters were calibrated using data from pumping and recovery tests and by fitting the chloride breakthrough curve. $\delta^{18}O$ was used to validate the calibrated parameters. The model shows that conservative tracers arrival is mainly controlled by the product of porosity times longitudinal dispersion. Chemical processes were identified using the reactive transport model. Results show that the interaction between CO_2 and the basaltic host rock is governed by the kinetic dissolution of carbonate minerals and plagioclase. An estimation of the mineral dissolution rates was obtained by fitting the arrival curves of the major ions.

References

[1] N. Assayag, J. Matter, M. Ader, D. Goldberg, and P. Agrinier. Water-rock interactions during a CO_2 injection field-test: Implications on host rock dissolution and alteration effects. *Chemical Geology*, 265(1-2):227–235, 2009.

[2] J. van der Lee, L. De Windt, V. Lagneau, and P. Goblet. Module-oriented modeling of reactive transport with HYTEC. *Computers & Geosciences*, 29(3):265–275, 2003.