Geophysical Research Abstracts
Vol. 14, EGU2012-6065-1, 2012
EGU General Assembly 2012


# Evolution of flow properties in homogeneously altered limestone specimens

L. Zinsmeister (1), J. Dautriat (1), A. Dimanov (2), J. Raphanel (2), M. Bornert (3), and N. Gland (1)

(1) IFPEN, Rueil Malmaison, France (Louis.zinsmeister@IFPEN.fr), (2) Laboratoire de mécanique des solides, Palaiseau, France (jean.raphanel@mines-paristech.fr), (3) Laboratoire Navier, Champs sur Marne, France (michel.bornert@enpc.fr)

$CO_2$ storage in deep saline aquifers is a way to limit the anthropogenic part of the greenhouse effect. The injection of supercritical $CO_2$ in aquifer leads to geochemical reactions with the host rock, resulting for instance in dissolution and precipitation processes. These phenomena impact the flow properties of the porous network. To study this impact, we make use of thermally activated retarded acid. This treatment allows us to realize an homogeneous alteration. The materiel is an oolitic limestone from the Lavoux quarry in the Paris basin.
We analyse the evolution of flow properties using porosity and permeability measurements in connection with the micro-structural evolution, studied with mercury porosimetry, NMR, medical scanner, laser diffraction, SEM and thin section analyses. A particular attention has been paid to the permeability evolution and the distribution of fines.
Intact samples show a bimodal porosity distribution, with a micro-porosity ranging from 0.5$\mu$m to 3$\mu$m, a macro-porosity ranging from 10$\mu$m to 100$\mu$m, and a total porosity exceeding 20%. Permeability is about 100mD. Porosity increases by 0.4% per alteration cycle together with the proportion of micro pore throats and the size of the macro pore throat, as evidenced by mercury porosimetry.
The permeability is measured using a differential pressure sensor before and after alteration, back and forth in the axis direction of the plug. The results show that while the alteration in general results in an increase of the permeability, some complex non monotoneous behaviour can be observed. We infer that fines are mobilized in the porous network, clogging some pore throats. We also analyse the outgoing fluids after alteration with laser diffraction. A familly of particles ranging from 3$\mu$m to 10$\mu$m is detected, suggesting that bigger fines remain stuck in the porosity. These larger particles can be observed using comparative $\mu$-CT imaging. Thin sections and SEM analyses do not show any evidence of precipitation at our laboratory conditions.
Our measurements and observations suggest that the evolution of permeability relates to two major phenomena: (i) the evolution of the pore network (including enhancement of large pore throats and increadsed network branching), and (ii) the appearence and migration of fines.