Geophysical Research Abstracts,
Vol. 10, EGU2008-A-05444, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-05444
EGU General Assembly 2008

Paleofluid circulation through fractured multilayer porous platform carbonates. Example from the Maltese Islands: draining fractures versus hydraulic fracturing.

Y. Missenard (1,2), A. Bertrand (2), A. Benedicto (2), M.E. Cushing (1), P. Vergély (2)

(1) Institut de Radioprotection et Sûreté Nucléaire, IRSN / DEI / SARG / BERSSIN, B.P.17 92262 Fontenay-aux-Roses Cedex, France, (Yves.Missenard@irsn.fr) (2) Université Paris XI – Orsay, Département de Sciences de la Terre, Equipe Tectonique d'Orsay, Dynamique Des Systèmes Faillés (DSF), Bât. 504, 91405 Orsay Cedex, France

In the Maltese Islands, the Mio-Pliocene calcarenite-clay-calcarenite sequence of the South Sicilian continental margin exhibits an excellent example of fluid circulation into multilayer fractured carbonates. Oxydation traces related to paleofluids circulation show four types of fluid/layer/fracture relations: vertical fluid migration through major faults, horizontal flooding through confined (between clays) calcarenite layers from major faults, vertical fluid drainage through fractures and induced hydraulic fracturing within confined layers. In this poster, we illustrate all of those cases from different outcrops of exceptional quality and analyse the spatial-temporal and genetic relationships between paleofluids circulation, fault and fractures and regional stress. We also study the efficiency of fractured clay layers as cap seals.

Main fluid circulation occurred vertically through major faults. A first set of major joints also controled fluid migration. These joints postdate the main N50˚ early faults and are compatible with the Plio-Quaternary stress orientations. The dimension of these joints is often large ($>$3 m). Some of them show oxidation traces on their edges testifying of fluid percolations upward or downward. They sometimes connect porous units separated by small clay layers and allow the fluid to propagate laterally in these initially unconnected layers.

A second set of joints is clearly related to the horizontal fluid propagation through layers from major faults. We interpret it as induced hydraulic fracturation. This set is not observed in parts of the limestones where fluids did not percolate (no oxidation traces). This fracturation probably occurred under a slight extensive stress as the N140 joint direction is very regular and also compatible with the known state of stress during Plio-Quaternary. It is therefore likely that the fluid circulation occurred at that time as both phenomenons seem synchronous. The spacing between joints is also very regular following a normal law (mean spacing $\sim$1.2 m). Joints lengths vary from a few centimetres to a few meters.

The fracturation of the Maltese Islands clays and limestones thus not only records the evolution of the Sicilian continental margin since Miocene but also constitute an excellent example of fluid/faults/joints interactions in extensional context.