Geophysical Research Abstracts
Vol. 16, EGU2014-15479, 2014
EGU General Assembly 2014

Fault imprint in clay units: magnetic fabric, structural and mineralogical signature

Eva Moreno (1,2), Catherine Homberg (2), Johann Schnyder (2), Alain Person (2), Arthur du Peloux1 (1,3), and Pierre Dick (3)

(1) Muséum national d'Histoire naturelle, Département d'Histoire de la Terre, Paris, France, (2) Université Pierre et Marie Curie ISTeP (Institut des Sciences de la Terre de Paris)/UMR UPM-CNRS 7193 4 place Jussieu 75252 Paris Cedex 05, France, (3) IRSN/PRP-DGE/SRTG Laboratoire d'Etude et de recherche sur les Transferts et les Interactions dans les Sols BP17 92262 Fontenay-aux-Roses Cedex

Fault-induced deformations in clay units can be difficult to decipher because strain markers are not always visible at outcrop scale or using geophysical methods. Previous studies have indicated that the anisotropy of magnetic susceptibility (ASM) provides a powerful and rapid technique to investigate tectonic deformation in clay units even when they appear quite homogenous and undeformed at the outcrop scale (Lee et al. 1990, Mattei et al. 1997).
We report here a study based on ASM, structural analysis and magnetic and clay mineralogy from two boreholes (TF1 and ASM1)drilled horizontally in the Experimental Station of Tournemire of the Institute for Radiological Protection and Nuclear Safety (IRSN) in Aveyron (France). The boreholes intersect a N-S trending strike-slip fault from west to east. The ASM study indicates the evolution of the magnetic fabric from the undeformed host rock to the fault core. Also, all the fractures cutting the studied interval of the core have been measured as well as the slip vectors which are generally well preserved. In the two boreholes, the undeformed sediments outside the fault zone are characterized by an oblate fabric, a sub-vertical minimum susceptibility axis (k3) perpendicular to the bedding plane and without magnetic lineation. Within the fault zone, a tilt in the bedding plane has been observed in two boreholes TF1 and ASM1. In addition, in the TF1 core, the fault area presents a tectonic fabric characterized by a triaxial AMS ellipsoid. Moreover, the magnetic lineation increases and k3 switches from a vertical to a sub-horizontal plane. This kind of fabric has not been observed in borehole ASM1.
The structural analysis of the individual fractures making the fault zone indicates a complex tectonic history with different imprint in the two fault segments cut by the two boreholes. The large majority of fractures correspond to dextral strike-slip faults but normal and reverse movements were observed and are more or less frequent depending on the borehole. Notably, many fractures are low angle faults (dip<45°) and may bear both strike-slip or normal striae.
The mineralogical study based on X-ray diffraction analysis, have pointed out some variations in clay minerals associations nearby the deformed zones that may be the result of fluid circulation along the fault system which is in agreement with the presence of goethite determined by low magnetic temperature measurements.
This multi-proxi study, combining ASM, petrostructural and mineralogical approaches has highlighted the heterogeneity of the fault, but also its past role as a drain to fluid circulation.