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

Eva Moreno*[1,2], Catherine Homberg[1], Johann Schnyder[1], Alain Person[1], Arthur Du Peloux[3,2], and Pierre Dick[3]

[1]Institut des Sciences de la Terre de Paris (ISTeP) – Université Pierre et Marie Curie [UPMC] - Paris VI, CNRS : UMR7193 – 4, Place Jussieu 75252 PARIS Cedex 05, France

[2]Muséum national d'histoire naturelle (MNHN) – Ministère de l'Ecologie, du Développement Durable et de l'Energie, Ministère de l'Enseignement Supérieur et de la Recherche, Muséum National d'Histoire Naturelle (MNHN) – 57, rue Cuvier - 75231 Paris Cedex 05, France

[3]Institut de radioprotection et de sûreté nucléaire (IRSN) – Ministère de l'écologie de l'Energie, du Développement durable et de l'Aménagement du territoire, Ministère de la santé, Ministère de la Défense, Ministère de l'Enseignement Supérieur et de la Recherche Scientifique, Ministère de l'économie, de l'industrie et de l'emploi – BP17 F-92262 Fontenay-aux-Roses, France

Résumé

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 indicates that the anisotropy of magnetic susceptibility (AMS) 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 [Mattei et al., 1997; Teh-Quei et al., 1990] We report here a study based on AMS, structural analysis and magnetic 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).

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.

The AMS fabrics and structural analysis showed a different responses in cores ASM1 and TF1 and point out the great heterogeneity of the fault. The AMS shape parameters showed a higher increase in lineation, a change in the shape parameter T from oblate (T_˜1) to neutral (T_˜0) and the identification of a weak cleavage fabric in the damaged and core fault zones of core TF1. These changes were not observed in core ASM1 whose fabric remained oblate along the core. The differences observed in the ASM fabrics were in agreement with the structural analysis study which showed a more complex architecture in core TF1.

Finally, the magnetic mineralogical study performed in core TF1 based on low T measurements showed that the undeformed host rock was dominated by pyrrhotite. A neo-formation of SD magnetite at the expense of pyrrhotite was observed in the damaged zone.

Réferences

*Intervenant

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