# The clay magnetic fabric in confrontation with quartz microtomography fabric in shales.

Charles Aubourg*[1], Hugo Saur[2], and Peter Moonen

[1]Laboratoire des Fluides Complexes et leurs Réservoirs (E2S-UPPA, Total, CNRS, LFCR-IPRA) – Université de Pau et des Pays de l'Adour [UPPA], CNRS : UMR5150, TOTAL – France
[2]Laboratoire des Fluides Complexes et leurs Réservoirs – TOTAL FINA ELF, Université de Pau et des Pays de l'Adour, Centre National de la Recherche Scientifique – France

**Résumé**

Magnetic fabric is a technique that has been tried and tested over the last 70 years. Applied in a wide range of possible environments, it has demonstrated its potential for detecting sometimes cryptic fabric. In recent years, our group has used high-resolution microtomography ($\mu$CT) to complement this magnetic approach. Here, we present results obtained in shales. These shales show a deformation gradient with the progressive appearance of pencil-to-slaty cleavage. Two sites were investigated, one in Spain (Sigues), the other in the USA (Lehigh Gap). Maximum burial temperatures are _˜180◦C at Sigues, and _˜280◦C at Lehigh Gap. At both sites, cleavage develops at a steep angle to bedding. At Sigues, the slaty cleavage almost overlies the bedding.
Moderately buried shales have the advantage of a very strong paramagnetic component. The magnetic fabric then provides access to the clay fabric (illite, chlorite). $\mu$CT provides access to the preferential orientation of the quartz. Each quartz, once segmented, is draped with an ellipsoid, whose characteristics enable us to find all the elements of a fabric. We show a remarkable homogeneity of size and shape distributions in shales, reflecting the dynamics of transport and erosion of detrital quartz.

When subjected to deformation, minerals can either rotate rigidly in the matrix, or undergo pressure solution. At Sigues, we found that quartz and clays behave rigidly and remain mainly controlled by bedding, even in highly cleaved areas. Conversely, at Lehigh Gap, clays show relatively rigid behavior, while quartz is controlled by cleavage. This observation supports the idea that quartz undergoes more pressure solution processes at _˜280◦C than at _˜180◦C. At both sites, the degree of deformation correlates with the scalar parameters of the magnetic fabric. This shows that in this temperature range of shale burial, the magnetic fabric is a good proxy for measuring deformation
This combined approach suggests a much better understanding of fabric acquisition in shales, and of the importance of pressure solution in mineral reorganization.

**Mots-Clés:** fabrique magnétique, microtomographie, shales

*Intervenant