Constraints on Deformation Mechanisms During Folding by Combined Analyses of Anisotropy of Magnetic Susceptibility (AMS), Calcite Twins and Fractures. Example of Sheep Mountain Anticline (Wyoming, USA)

Khalid Amrouch[1,2], Philippe Robion[3], Jean-Paul Callot[2], Olivier Lacombe[3], Nicolas Bellahsen[1], and Jean-Marc Daniel[2]

[1] Université Pierre et Marie Curie, Paris, France
[2] Institut Français du Pétrole, Rueil-Malmaison, France
[3] Université de Cergy-Pontoise, Cergy, France

On the basis of the analyses of AMS data, calcite twins and fractures, we discuss the relationship between stress, strain and fold evolution in a folded-fractured reservoir analogue, the Sheep Mountain Anticline (Wyoming, USA). The NW-SE trending fold is asymmetric, basement-cored, and formed during the Laramide orogeny. AMS results reveal three different directions of K1 (maximum susceptibility axis), parallel, perpendicular and oblique (E-W) to the fold axis, respectively. These results also show the variability of the orientation of the 'strain' ellipsoid through the anticline, the AMS fabrics being less developed in the forelimb than in the backlimb. Five main fracture sets are observed in the field. Among those, a NE trending joint set that formed just prior to, and during initial anticline growth is only present in the hinge and the backlimb, which supports, like ASM, that the backlimb was more deformed than the forelimb during early fold evolution. Computerized inversion of calcite twin data from veins and rock matrix provide information about the evolution of the stress tensor through time and space. The results especially document a layer-parallel maximum compressive stress secondarily tilted during folding. These complementary approaches reveal a powerful tool to constrain both internal rock deformation, vein chronology and kinematics, and fold evolution.

Key-words : calcite twins, rock magnetism, fracture, folded-fractured reservoir.