Geophysical Research Abstracts
Vol. 17, EGU2015-9838, 2015
EGU General Assembly 2015

3D modeling of carbonates petro-acoustic heterogeneities

Dawin Baden (1), Yves Guglielmi (1), Ginette Saracco (2), Lionel Marié (1), and Sophie Viseur (1)
(1) CEREGE, Aix-Marseille University, Marseille, France (baden@cerege.fr), (2) CEREGE, Aix-en-Provence, France

Characterizing carbonate reservoirs heterogeneity is a challenging issue for Oil & Gas Industry, CO_2 sequestration and all kinds of fluid manipulations in natural reservoirs, due to the significant impact of heterogeneities on fluid flow and storage within the reservoir. Although large scale (> meter) heterogeneities such as layers petrophysical contrasts are well addressed by computing facies-based models, low scale (< meter) heterogeneities are often poorly constrained because of the complexity in predicting their spatial arrangement.

In this study, we conducted petro-acoustic measurements on cores of different size and diameter (Ø = 1", 1.5" and 5") in order to evaluate anisotropy or heterogeneity in carbonates at different laboratory scales. Different types of heterogeneities which generally occur in carbonate reservoir units (e.g. petrographic, diagenetic, and tectonic related) were sampled. Dry / wet samples were investigated with different ultrasonic apparatus and using different sensors allowing acoustic characterization through a bandwidth varying from 50 to 500 kHz. Comprehensive measurements realized on each samples allowed statistical analyses of petro-acoustic properties such as attenuation, shear and longitudinal wave velocity. The cores properties (geological and acoustic facies) were modeled in 3D using photogrammetry and GOCAD geo-modeler.

This method successfully allowed detecting and imaging in three dimensions differential diagenesis effects characterized by the occurrence of decimeter-scale diagenetic horizons in samples assumed to be homogeneous and/or different diagenetic sequences between shells filling and the packing matrix. We then discuss how small interfaces such as cracks, stylolithes and laminations which are also imaged may have guided these differential effects, considering that understanding the processes may be taken as an analogue to actual fluid drainage complexity in deep carbonate reservoir.