Abstract

Magnetic susceptibility (Ms) measurements were carried out in the cores of six wells distributed throughout the study area of tight sand oil of the Hamra quartzites reservoir, southwest of the Hassi Messaoud oil field. With steps of 2. cm, 8760 Ms values were taken from a total core length of 174. m. In most of the intervals, the contrasts in Ms coincide with high fracture density and high shale content (increase of gamma ray in this interval). The analysis of the hysteresis loops, isothermal remanent magnetizations to saturation (IRMs) and thermomagnetic curves for samples taken from some high interval of Ms shows that magnetite and pyrrhotite are the main magnetic minerals. It demonstrates that fractures can be considered as precipitation environments of the magnetic minerals in the reservoir, which is a good indicator for mineralized fractures. The application of principal component analysis (PCA) to the entire reservoir shows low linear correlation between Ms and the main petrophysical parameters (gamma ray, neutron porosity, density, and saturation of oil). Meanwhile, the application of fuzzy ranking and artificial neural network (ANN) evidenced non-linear relations between these parameters. It is justified by the prediction of the Ms from the petrophysical parameters with an acceptable degree of accuracy. The results obtained using an ANN structure of 25 neurons in a hidden layer show the performance in the test stage with mean square error (MSE), mean relative error (MRE) and correlation coefficient (R) equal to 0.0142, 0.0743 and 0.907, respectively