An Evaluation of Existing Carbonate Pore System Classifications and Rock-Typing Approaches

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Restrictions on the most commonly used porosity classification schemes for carbonate reservoirs stem from poorly-defined relationships between porosity and permeability. The rock fabric method of Lucia (1995, 1999) and the more elaborate pore classification scheme of Lonoy (2006) represent attempts to overcome this problem. Although these approaches provide a considerable improvement on more traditional classifications, there have been few independent attempts to evaluate the relative merits of each. The aim of this study is to evaluate the two carbonate porosity classification schemes using a well-constrained dataset from the Upper Cretaceous of offshore Tunisia.

The methodology employed for this study involved the examination of thin sections and the integration of routine core analysis data. Following pore classification using each scheme, permeability was calculated and compared to measured values. Neither classification scheme worked particularly well for the dataset in this study. Only one pore-type class yielded the porosity-permeability trends anticipated according to Lonoy (2006), and none of Lucia's (1995, 1999) rock-fabric classes adhered to the trends expected. Furthermore, permeability calculated using Lonoy's (2006) scheme resulted in better correlation with measured values than when using Lucia's (1995, 1999) scheme, although neither scheme resulted in well-matched values. The inability of both schemes to adequately characterise porosity-permeability relationships is due to pore-type diversity. With Lucia's (1995, 1999) classification scheme, the presence of large amounts of separate-vug porosity poses problems when calculating interparticle porosity. Lonoy's (2006) classification scheme is based on dominant pore type and size, therefore the presence of several pore types and sizes in a sample reduced the correlation between matrix-related porosity and permeability. Recommendations for improving the applicability of both approaches are presented in this study.