

An Overview of the Porosity Classification in Carbonate Reservoirs and Their Challenges: An Example of Macro-Microporosity Classification from Offshore Miocene Carbonate in Central Luconia, Malaysia

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Abstract : Biological and chemical activities in carbonates are responsible for the complexity of the pore system. Primary porosity is generally of natural origin while secondary porosity is subject to chemical reactivity through diagenetic processes. To understand the integrated part of hydrocarbon exploration, it is necessary to understand the carbonate pore system. However, the current porosity classification scheme is limited to adequately predict the petrophysical properties of different reservoirs having various origins and depositional environments. Rock classification provides a descriptive method for explaining the lithofacies but makes no significant contribution to the application of porosity and permeability (poro-perm) correlation. The Central Luconia carbonate system (Malaysia) represents a good example of pore complexity (in terms of nature and origin) mainly related to diagenetic processes which have altered the original reservoir. For quantitative analysis, 32 high-resolution images of each thin section were taken using transmitted light microscopy. The quantification of grains, matrix, cement, and macroporosity (pore types) was achieved using a petrographic analysis of thin sections and FESEM images. The point counting technique was used to estimate the amount of macroporosity from thin section, which was then subtracted from the total porosity to derive the microporosity. The quantitative observation of thin sections revealed that the mouldic porosity (macroporosity) is the dominant porosity type present, whereas the microporosity seems to correspond to a sum of 40 to 50% of the total porosity. It has been proven that these Miocene carbonates contain a significant amount of microporosity, which significantly complicates the estimation and production of hydrocarbons. Neglecting its impact can increase uncertainty about estimating hydrocarbon reserves. Due to the diversity of geological parameters, the application of existing porosity classifications does not allow a better understanding of the poro-perm relationship. However, the classification can be improved by including the pore types and pore structures where they can be divided into macro- and microporosity. Such studies of microporosity identification/classification represent now a major concern in limestone reservoirs around the world.

Keywords : overview of porosity classification, reservoir characterization, microporosity, carbonate reservoir

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