GEOLOGY POSTER 13

CALIBRATING CARBONATE CORE DATA TO WIRELINE DATA: SEARCHING FOR A RELATIONSHIP BETWEEN PETROPHYSICAL PROPERTIES AND MAPPABLE DEPOSITIONAL TRENDS

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A common carbonate formation evaluation objective is to define a relationship between petrophysical properties and mappable depositional trends. If such a relationship exists, reservoir simulations and full field development plans are easier to formulate because we can infer petrophysical properties beyond the borehole using the depositional maps as a proxy.

This poster focuses on describing the heuristic process of calibrating wireline logs from an offshore Borneo well that cored carbonate rocks. The process describes the different blind, but necessary, avenues followed to arrive at an optimal facies and petrophysical relationship. One lesson learned in this case study is that multiple methods of inquiry and the integration of different datasets and disciplines are paramount for a more effective understanding of results and the best way forward.

A comprehensive data set was acquired including cores, NMR, full waveform acoustics, borehole images logs, and pressure tests. After data acquisition, a first-pass analysis of reservoir productivity was undertaken using methods outlined in Altunbay, et al (2007). These initial results provided a dataset for work by reservoir engineers. Concurrently, cores are described, plugged for porosity and permeability measurements, acquisition of mini-permeametry data, special core analysis, and thin sections are described.

Borehole image logs suggest there are widely varying facies despite the core being largely uniform skeletal packestone (Figure 1). The resistivity image was unitized according to motif, for example predominately massive conductive or massive resistive, layered, or convoluted (Figure 2). The acoustic image logs were similarly unitized into facies largely reflecting acoustic impedance (Figure 3). Variations in resistivity and acoustic fabrics were expected to relate to vuggy porosity distribution in the core. These image facies were later compared with core facies, logging petrophysical parameters, and when available, the core petrophysical parameters. Surprisingly, resistivity image variation did not reflect vuggy porosity distribution. Acoustic images reflected variations in permeability.

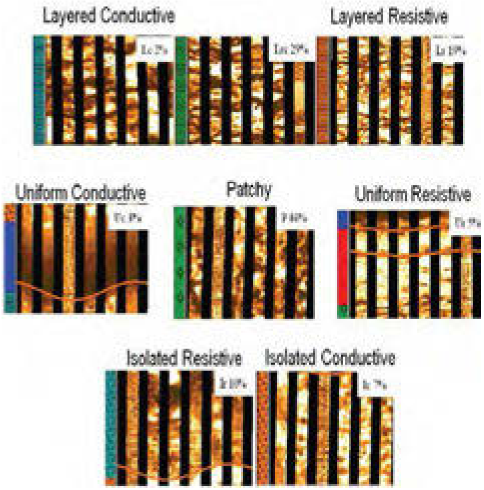

Figure 2: Distribution of resistivity fabrics. Horizontal axis ranges from conductive to resistive. Vertical axis ranges from isolated through to layered fabrics. Percentage quantifies relative proportion in image.

The core was mostly packestone with little variation. Thin section work showed that there was a heavy diagenetic overprint. Consequently, core petrophysical properties largely followed diagenetic trends rather than depositional trends. Ultimately, the first-pass analysis proved to be the best way forward. This is not to say that searching for mappable units is invalid. Ideally, we need mappable units to determine the 3D geometry of the reservoir and must search for these possibilities is a necessary requirement.

REFERENCES

MEHMET ALTUNBAY, KO KO KYI, ADRIAAN BAL, SELIM BELHAOUAS, NORSHUHADA SHAHARUDDIN, AND SONGHUA CHEN, 2007: Porosity Typing And Productivity Analysis By Modified-Timur-Coates Permeability Model For Carbonates Using Nmr And Conventional Log Data. The 13th Formation Evaluation Symposium Of Japan, September 27-28, 2007

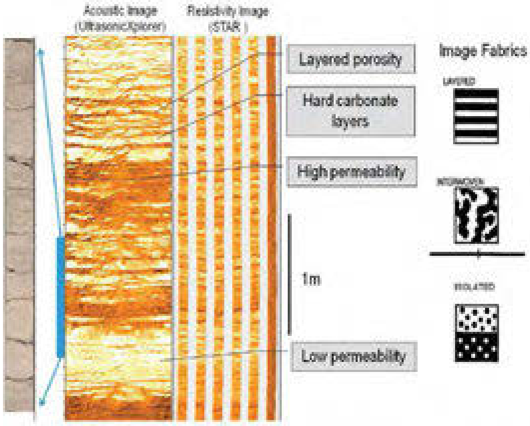

Figure 1: Alonghole view of static image logs showing predominantly layered image fabrics. Corresponding core shows no apparent variation in lithofacies (100% skeletal packestone). Variation in image response relates to changes in permeability and porosity that is not visually apparent in the core.

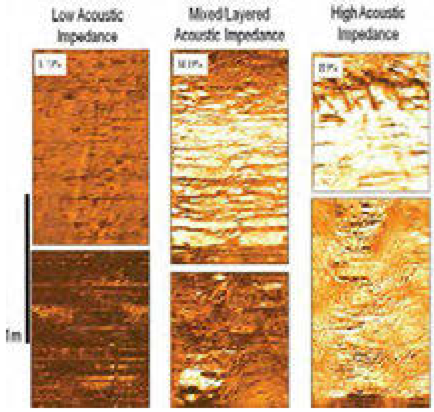

Figure 3: Distribution of acoustic image fabrics. Percentage quantifies relative proportion in image.

Warta Geologi (Newsletter of the Geological Society of Malaysia), Vol. 37, No. 1, January-March 2011