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Integration of conventional open hole logs and borehole images for lithofacies interpretation and porosity partitioning in the upper Jurassic Arab Formation, Saudi Arabia

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ABSTRACT

The upper Jurassic Arab formation of Eastern Saudi Arabia consists of shallow marine carbonates and evaporates. The carbonates portion of the Arab A, B, C and D members form the most prolific Jurassic reservoirs within Saudi Arabia. The intervening Arab and overlying Hith evaporates provide excellent field to regional scale seals. The reservoir carbonates are often composed of highly porous grainstones and packstones, locally enhanced by natural fracturing and vuggy zones.

Borehole image logs can provide critical geological information; e.g., bedding dip changes, rock texture change, and fault or fracture zones to aid characterization of the reservoirs. Integration of conventional open hole logs with borehole images, enables identification of image based textural lithofacies and vuggy porosity partitioning. Traditionally, this type of interpretation has been applied to conventional open hole wireline image logs. In this study. the methodology is extended to LWD resistivity image logs and our focus is the comparison of results — obtained from interpretation of high resolution LWD datasets — with those from conventional wireline resistivity images from the same wellbore sections.

Sixteen different lithofacies were interpreted in the Arab Formation, and vuggy porosity partitioning was applied to vuggy zones identified from the images. The image interpretation from both types of image log was calibrated to the available core, to ensure the accuracy of the interpretation results. The good match between the two sets of image results gives us confidence when extrapolating the interpretation into un-cored sections. This study shows that the images generated from the new generation of high-resolution LWD resistivity image tools have sufficient azimuthal and along-hole resolution, to offer an alternate to the conventional wireline images for lithofacies interpretation and vuggy porosity partitioning.

Although technically the highest resolution LWD and conventional wireline imagers produce resistivity images with similar applicability, factors outside of the scope of this paper, such as tool availability, hole-size, well-profile, drilling fluids, and the economics of the overall logging suite, will ultimately control the choice of the technology.