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Mapping Paleozoic Siliciclastic Channel Using Deterministic Post-Stack Inversion

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ABSTRACT

A number of exploratory wells have been drilled in Eastern Saudi Arabia targeting Paleozoic siliciclastic formations that contains poorly sorted low porosity sandstones with sub-angular to angular grains. However, within this formation there are incised channels (Paleo-Valleys) that have better developed porosity ranging from 8 to 15 percent. In theory, an increase in porosity will lower the density, and will slow wave propagation, hence affecting the acoustic impedance of the interval. Therefore, an effective method to map these incised channels would be inverting for acoustic impedance and setting certain cutoffs to highlight them. Before starting the post-stack inversion process, a feasibility study must be carried out to ensure that there is in fact a relationship between the acoustic impedance (AI) and the porosity within the target zone. If this link is poorly developed or non-existent, the pre-stack inversion must be initiated. Once a relationship is confirmed and acceptable, the 3D seismic volume covering the field is used as an input for the inversion, along with a wavelet and a low frequency model built using the available wells. Relative and absolute AI volumes are produced from this inversion process. In this study, one well displayed good porosity zone ranging from 8 to 15 percent. These values are translated to acoustic impedance cutoffs using a Porosity-AI crossplot. Using the body-checking function and inputting the proper cutoffs for acoustic impedance, a channel-like geobody that has reservoir qualities was extracted. This kind of geobody is expected to be found within this target formation due to its depositional environment and paleo geography. To further quality check our findings, the body-checking process was done in both absolute and relative acoustic impedance and both yielded the same results. One of the wells was drilled at the edge of that geobody and displayed no significant hydrocarbon presence, except for the background mud gas that was primarily C1 “methane.” However; finding this geobody and the detailed analysis can definitely help optimizing future well placement and deployment.