Qualitative and Quantitative Use of Partial Stacks in Seismic Interpretation: Case Studies from West Africa

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Abstract

Conventional seismic interpretation involves picking and tracking laterally consistent seismic reflectors, so as to map subsurface geologic structures, stratigraphy, and reservoir architecture, with the aim of predicting hydrocarbon accumulations, delineate their extent, and calculate their volumes. Thus seismic interpretation is the process of deriving simple, plausible geological models that are compatible and consistent with all observed data. As such models are non-unique, it is necessary to use every piece of information/data that is available, when formulating an interpretation approach.

Considering the fact that the seismic data which is usually available to the "conventional" seismic interpreter is some form of a stack data, this paper presents an example to show that seismic interpreters (especially in frontier exploration) could miss identifying potential prospects if their interpretation results are based only on full stack data. We show that seismic interpretation would be greatly enhanced if interpreters include partial stacks in their interpretation. Qualitative attribute analysis of the partial stacks, showed geological features that could not be seen on the full stack data. This "qualitative analysis" was used in the absence of well data. When well data became available, a quantitative analysis of the data was carried out. Quantitative seismic interpretation (QI) utilizes seismic amplitudes and rock physics models to make predictions about lithology and fluid distributions far away from well locations. Based on well and seismic data availability (exploration, appraisal or development), different approaches or workflows could be applied. In this study, we use an approach of QI to quantify the seismic responses associated with the lithologies using the concept of extended elastic impedance (EEI). This study contains the examples of applying rock physics analysis from well logs and EEI from seismic angle stacks. It is always preferred to make well tie on the near stack rather than the full stack to avoid the AVO effects. In the case of west Africa deep water Cretaceous stratigraphic prospects, the extended elastic impedance (EEI) computed from seismic angle stacks was found to be of great value in interpreting lithology, identifying the reservoir zones, and estimating the depth shifts between log and seismic data as well as to better estimates.