

Interactive Rock Physics in Multi-Well Studies

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The prediction and sensitivity analyses of rock properties are a fundamental phase in exploration, appraisal, and production cases. It allows us to understand reservoir heterogeneity and possible facies scenarios due to changes in the elastic and electrical domains. By perturbing the rocks using a suitable rock physics model, explorationists can interpret key changes that may relate to a specific geophysical response. This process requires identifying a rock model accurate enough to represent rock type and its microstructure, and it may include empirical, theoretical, or other modeling techniques. It also assumes that well log data has been properly corrected for the reservoir of interest and encasing sediments within the window where the geophysical analysis will be performed. An interactive rock physics approach is presented as a way to emphasize the usefulness and value of rock physics diagnostics (RPD) supported models, and their application when dealing with multi-well studies or large areas including multiple well control points.

An example of this approach was applied to the Great-White well in the Gulf of Mexico. Figure 1 highlights wells included in the Alaminos Canyon deep water protraction area where the interactive rock physics modeling study was performed. The workflow consisted of (a) geophysical well log conditioning and rock physics diagnostics. In this step, a rock model or combination of models were identified for reservoir quality rocks. This model was then used as a proxy for perturbational purposes (b) fluid, porosity, mineralogy, seismic and/or electromagnetic modeling (c) interactive modeling using a real time visualization tool. Given the nature of these rocks, the base type of modeling was fluid substitution followed by the calculation of the resulting equivalent synthetic seismic signatures. Interactive rock physics enabled geoscientists to, for example, understand AVO anomaly changes from Class III to II as a function of sand facies change in the field, using rock models wrapped into the workflow. Simultaneous changes included API gravity, dissolved gas and water salinity. Modeling was also utilized to build a template so that numerous rock property scenarios were modeled when interpreting geophysical data.

For the multi-well studies, as in this GOM case, it can be built upon the existing modeling conducted as part of a regional rock physics atlas for a specific location. This interactive methodology simplifies many modeling combinations that are presented to geoscientists while keeping the rock model fundamentals untouched. The concept can be applied to any size project, and it proves to be extremely convenient in regional studies by providing an intuitive access solution to common rock physics practices.

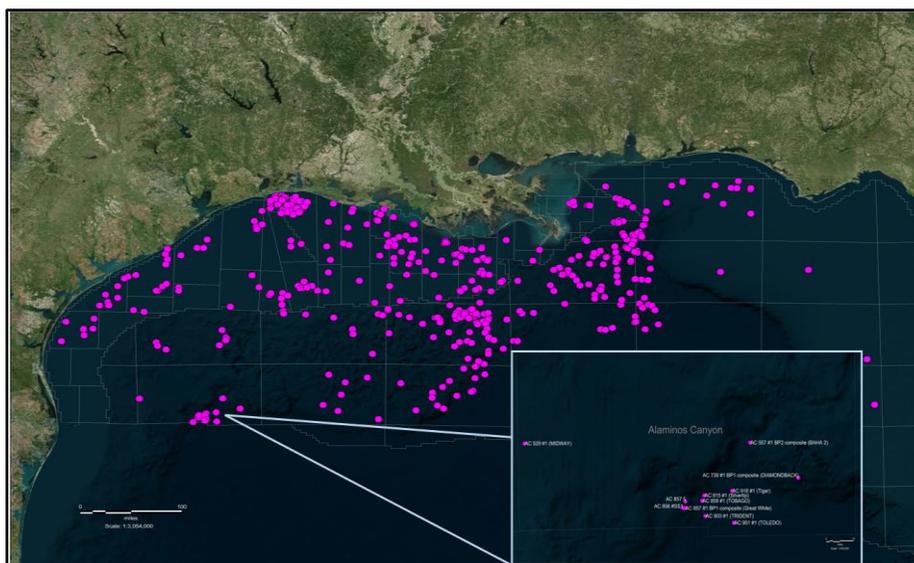


Figure 1. Map of the Gulf Mexico highlighting the Alaminos Canyon protraction area where the interactive rock physics modeling approach was applied.