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Characterizing Subsalt Prospect Structural Uncertainty, Deepwater Gulf of Mexico

Quantification of prospect geologic risk involves assessment of risk elements for maturation, migration, reservoir, source and trap. Structural interpretation of sub-salt seismic data is typically approached deterministically even though numerous valid solutions can be generated from the same seismic data set. The end product of seismic interpretation, when approached in this manner, is a prospect structure map illustrating the trap and potential area under closure.

Sub-salt exploration involves substantial trap risk due to variable seismic image quality related to complex salt geometry and sub-salt illumination issues. To help characterize structural uncertainty and quantify related trap risk a seismic image quality index was developed and then used to generate a series of structural realizations for sub-salt prospects in the Deepwater Gulf of Mexico. We integrate illumination model results and seismic image quality measures to provide a limited test of structure map uncertainty.

We have successfully applied this methodology to quantify sub-salt trap risk associated with prospects in southern Mississippi Canyon. Initial results show that seismic image quality can be quantified and combined with illumination data to characterize the imaging uncertainty of a mapped horizon. By generating prospect target surfaces with variable amounts of interpretation filtered as a function of image quality, we objectively build a series of structural realizations. These realizations have been used to quantify trap uncertainty by evaluating the range of potential structural forms. Incorporating these structural realizations into a probabilistic geologic risk assessment of these prospects has provided a more quantitative and realistic evaluation of ultimate trap risk.