

Object-based modeling for systematic risk analysis in hydrocarbon exploration, an example from western Sverdrup Basin, Canada

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ABSTRACT

Two fundamental facts affect an exploration drilling decision: the size of potential hydrocarbon accumulation and the uncertainty of turning a prospect into an economic discovery. In this paper, we propose the use of object-based stochastic simulation of undiscovered hydrocarbon accumulations to evaluate the uncertainty of the presence of commercial accumulation for exploration decision-making. This simulation procedure simultaneously considers information, such as the basic geological requirements for forming petroleum pools, spatial correlation among the pools in the region of interest, and the economic exploitation of these accumulations. The risk associated with the presence of a commercial accumulation at a specific location, expressed as the occurrence probability, is derived from hundreds of thousands of equal-probable combinations of petroleum accumulations. Such a risk map reflects the uncertainty inherited from the data as well as our understanding of the spatial characteristics of petroleum deposits, and provides a consistent basis for prospect ranking. The application of the object-based simulation for exploration risk analysis is illustrated by an example from the western Sverdrup Basin of Arctic Canada.