Integrating Structural Uncertainty into the Reservoir Simulation Process

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Currently the majority of reservoir simulation models tend to over-estimate fault throw. This is a function of the typical reservoir modeling procedure. The data immediately adjacent to the faults is commonly ignored due to seismic imaging limitations in this region and horizons subsequently back-projected into the faults to develop a clean horizon-fault intersection. This process assumes that the throw indicated in the seismic data away from the faults is a good representation of the throw on the main slip plane where no appreciable strain is distributed in the wall rocks to the fault and that no pre-existing flexure was present in the vicinity of the fault. This assumption is counter to outcrop and core scale observations as well as our general understanding of faulting processes. Structures are often not discrete offsets; strain may be accommodated via folding and minor faulting immediately adjacent to the fault presenting a more complex problem. Detailed analysis of outcrop datasets suggests that cross-fault juxtapositions may be better honored by reducing the throw in geocellular models. In order to better model the likely flow in reservoirs we have developed a tool in PetrelTM that allows fully populated geocellular models to be modified adjacent to the faults enabling the throw on those faults to be altered.

Application of this process has shown that significant changes in water breakthrough time and residual hydrocarbon distributions result from these modifications. Tightly integrating this structural uncertainty process into the reservoir modeling and simulation workflow should allow for the realistic range in likely simulation responses to be better defined.