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Integrated 3-D Geocellular Model—A Strategic Deep-Water Reservoir Management Tool: Cmac Reservoirs, Allegheny Field, Green Canyon Area, Gulf of Mexico, USA

The Allegheny field, located offshore in Green Canyon Gulf of Mexico, was discovered in 1991 in 3,200 feet of water depth. The field has been producing since 1999 from multiple Plio-Pleistocene channel systems enclosed in stratigraphically complex and fault compartmentalized reservoirs. These middle to upper bathyal turbidite sands were deposited during mid-to-late lowstand slope fan complexes within (salt) tectonically active minibasin in the Gulf of Mexico.

Due to the complex nature of the channel systems, a comprehensive 3-D geocellular model was built to aid in the development and management of the condensate and gas of the Cmac reservoirs. An accurate and robust static reservoir model was developed for field simulation — one that used a) appropriate cell resolution, b) direct/indirect data calibrations, c) multiple uncertainty scenarios and d) minimum number of realizations to define the final dynamic model.

The construction of the field 3-D geocellular model helped determine volumes in place, the impact of the reservoir drive mechanisms, and allowed prediction of reservoir performance and recovery efficiency under different well and dynamic reservoir conditions. The static model embraced the use of multiple technologies, such as a) chronostratigraphic sequence analysis to define the framework of the field, b) object reservoir modeling to constrain facies variations, c) uncertainty scenarios and statistical analysis of petrophysical properties, d) stochastic facies-composite modeling and e) probabilistic ranges for volumetric distributions.

The team took a holistic approach in building a static model. Once completed, the model was successfully initialized and upscaled to a dynamic model. The model was also used to identify additional drilling opportunities employing forward-prediction models that helped formulate and rank production scenarios.