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The Use of Forward Modelling as an aid to Reservoir Characterization and Modelling of Deep-Marine Sedimentary Systems: an Example from the Permian Tanqua Karoo Turbidites, South Africa

The deepwater sandstone fan-complex of the Permian Skoorsteenberg Formation, Tanqua Karoo Basin, South Africa has been identified as analogous to North Sea and offshore West African deep-marine oil reservoirs. This system is currently the principal focus of detailed reservoir modeling efforts using industry recognized reservoir modeling applications such as Schlumberger's PETREL and Roxar's IRAP RMS. To help constrain the distribution of typical deepwater architectural elements in those areas of the models where measured data is absent, research has been carried out using novel software, the Geological Process Modeler (GPM) from Schlumberger. This new, in-house software allows a fully three-dimensional approach to forward modeling of clastic depositional systems with control over numerous primary input parameters such as e.g. basin topography, temporal flow control, sediment composition of gravity flows, flow concentration and syn-sedimentary seabed deformation. For comparison with the outcrop systems, GPM has been successfully used by members of NOMAD to forward-model deep-marine, basin-floor fan sedimentary systems. Features observed from these GPM models are closely analogous to those observed in the Skoorsteenberg Formation outcrops (e.g. fan geometry and dimensions, fan grain-size profiles, time of deposition, distribution of channel and sheets), giving confidence in the use of these forward modeling techniques. In addition, GPM has allowed testing of geometry and dimensions of features not preserved in the outcrop belt, such as the up-dip regions of the basin-floor fans plus feeder slope systems. Finally, a complete workflow from geological modeling based on physical processes, to synthetic seismic modeling and seismic attribute analysis has been successfully tested.