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Constraints on Regional-Scale Stratigraphic Forward Modelling in the Upper Sarvak Formation, Lurestan, Iran

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SUMMARY

Forward numerical stratigraphic modelling is the simulation of sedimentary processes through time. The DIONISOSTM software, developed as a research consortium by the Institut Français du Pétrole, is used in this work to constrain a range of controls on the Upper Sarvak hydrocarbon-bearing carbonate platform-basin deposits at the regional scale (Lurestan Province). This technique is used to better predict stratigraphic geometries and facies distribution through time, with focus on understanding reservoir facies distribution, volume and connectivity. The model simulates Cenomanian – Turonian carbonate sedimentation (Upper Sarvak Formation) in an area of 70500 km2. The simulation is based on three main parameters: accommodation (tectonic subsidence and eustasy), sediment supply (in situ production for carbonates) and transport (mainly gravity-driven diffusion).

To date a combination of 42 wells and outcrop sections have been correlated into a sequence stratigraphic framework, and 13 facies maps and 11 isochore maps have been prepared. The sequence stratigraphic framework is then used to produce a 4-D "static" DIONISOSTM geomodel that is matched to the wells, surface sections and stratigraphic architecture. The geomodel allows the geologist to verify the geologic database and interpretation. Once quality control of the "static" geomodel is complete, tectonic subsidence maps are computed for each interval, using (1) the interval thickness map, (2) its initial and final bathymetries, and (3) eustatic sea-level (i.e. Gradstein, 2004). This tectonic subsidence history is used as an input parameter for the forward stratigraphic modelling. The last step of the forward stratigraphic modelling workflow consists of constraining the the dynamics of a sedimentary system in response to different parameters, such as carbonate productivity, sediment transport, wave energy or clastic input. This is achieved through sensitivity testing. 4-D stratigraphic modelling that incorporates physical processes to forward model the stratigraphic architecture is revolutionizing the way we predict reservoir facies distribution and quantify uncertainties around this prediction. This technique allows:

- A better understanding of the parameters controlling the stratigraphic architecture, such as tectonic or the external controls,
- Improvements in prediction of platform-basin facies length scales,
- Highlighting of the important changes in reservoir facies and architecture/stacking associated with ocean facing, intra-shelf and isolated platform margins.
- A thorough understanding of reservoir facies distribution and connectivity that can be used as a template to aid model building of early phase fields where well data is sparse.
- A depositional/facies template that can be further utilised for regional-scale diagenetic and seismic modelling studies.