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## The Upper Shale Reservoir, Zubair Formation, Rumaila Field, Southeast Iraq: Integrated Subsurface Description in Support of Field Production & Development

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### SUMMARY

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The Early Cretaceous (Aptian) Upper Shale Member is the uppermost part of the Zubair Formation: the principal producing interval in the supergiant Rumaila Field in south-eastern Iraq. Historically, the Upper Shale has not been the primary focus for Zubair Formation development and production: first oil from the Upper Shale occurred in 1962 and since then the reservoir has been developed through natural depletion. Critical to enabling the effective management of current production and the planning of further development of the Upper Shale is a robust, fit-for-purpose, field-wide reservoir description which appropriately characterises important heterogeneities.

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The Upper Shale forms an overall transgressive succession recording the transition from clastic deltaic deposition in the Zubair Formation to carbonate deposition in the overlying Shuaiba Formation. Within the Upper Shale a higher-frequency regressive-transgressive cycle occurs which records the last significant advance and retreat of the Zubair Delta into the Rumaila Field area. The Upper Shale Member has been sub-divided into seven zones that are bounded by field-scale, laterally-extensive, shale-prone, biostratigraphically significant, flooding surfaces which are associated with significant (>100psi) pressure breaks. These zones control the distribution of reservoir fluids and pressure; hence their recognition is critical for effective reservoir management and development planning.

Within individual reservoir zones the integration of core, palynology and wire line log data, including image log data, has facilitated the recognition of a wide-range of near shore deltaic depositional environments, including: laterally amalgamated channels, single-storey delta distributary channels, mouthbars, sand-flats, mud-flats, pro-delta and low-energy shoreline deposits. The best quality reservoir sandstones (~20% porosity, ~500+ mD permeability) are associated with channel and proximal mouthbar deposits, whilst poorer quality sandstones (~15% Porosity ~50-200 mD permeability) are associated with distal mouthbar, sand-flat and low energy shoreline deposits.

Field-wide Reservoir Depositional Element maps describe the frequent juxtaposition of different reservoir architectures and reservoir quality. This geological complexity impacts production as within reservoir zones there is evidence for the presence of pressure baffles and complex sweep. Higher-frequency stratigraphic cycles are recognised within individual reservoir zones. Some of these are associated with the development of thick (c. 20m) 3-5 km wide multi-storey amalgamated sand bodies which cross-cut the field from W/SW to E/NE and are interpreted to record Incised Valley Fill successions. These IVF sandstones are associated with higher well production rates.