

## **The Lower Devonian Jauf Formation, Eastern Saudi Arabia: Sequence Stratigraphic Analysis and Implications for Predicting Facies Architecture.**

Nawaf Al Dosari<sup>1</sup>, Hamza Tourqui<sup>1</sup>, Pierre Breuer<sup>1</sup>, Elizabeth C. Lacsamana<sup>1</sup>, Abdulla Ghazi<sup>1</sup>

<sup>1</sup>Saudi Aramco, Dhahran, SAUDI ARABIA

### **ABSTRACT**

The Lower Devonian Jauf Formation of Saudi Arabia is a widespread siliciclastic succession composed of tidal and shoreface deposits. The outcrop section in northern Saudi Arabia also contains carbonates. The Jauf Formation is a proven hydrocarbon reservoir and to define and predict sandstone reservoir architectures, a sequence stratigraphic analysis has been applied using mainly cores, well log data and outcrop observations. The current study presents a new and refined interpretation, integrating ichnology, biostratigraphy and chemostratigraphy, and their relationship to diagenesis. Three main transgressive-regressive cycles are identified from cores and outcrop, and maximum flooding surfaces can be correlated at the regional scale. Depositional environments are mainly tide- influenced, fluvio-deltaic during regression and estuarine/shoreface systems during transgression. Ichnofabrics observed in cores offer more reliable interpretation of key stratigraphic surfaces, as substrate controlled ichnofacies were used to help interpretation of depositional environments. Palynological results provide late Pragian to late Emsian ages and show a relationship between bio-events and sedimentary cycles. The distinctive spore marker species associated with leiospheres typify the D3B Palynosubzone in eastern Saudi Arabia, which corresponds to a maximum flooding surface. This allows precise correlation between the outcrop and subsurface. Sedimentary facies integrated with petrophysics data reveals that the best sandstone reservoirs occur during the early transgressive system tract and the late highstand system tract. Common patchy concretions of ferroan dolomite are observed in the sandstones below the D3B maximum flooding surface and appear to indicate a close relationship between diagenetic processes and sea level fluctuation.