The Dhruma Formation of Saudi Arabia: Bajocian to Bathonian Micropalaeontology and Sedimentology

Hughes, Geraint W.; Lindsay, Robert; Naji, Nassir; Jenden, Peter D.; Hooker, Nigel; Meyer, Franz O.; Toland, Christopher (1) Saudi Aramco, Dhahran, Saudi Arabia. (2) Oolithica, Gloucester, United Kingdom. (3) Carbonate Research Consulting, Conifer, CO.

The Faridah, Sharar and Lower Fadhili hydrocarbon reservoirs of subsurface Saudi Arabia represent grain-dominated terminations of a succession of shoaling-upwards depositional cycles. They are hosted within the Dhruma Formation and a recent study of outcrops and shallow cores drilled in the outcrop belt has revealed the palaeoenvironmental and lithostratigraphic locations of the reservoir facies as well as a regionally significant seismic reflector known as the Dhruma Shale. The age of the Dhruma Formation is based primarily on ammonites and nautiloids but supplemented by micropalaeontological and palynological evidence. Carbon and oxygen isotope determinations complement the biostratigraphic evidence. The Dhruma lies unconformably on the Early Jurassic (Middle to Late Toarcian) Marrat Formation and is unconformably overlain by the Middle Jurassic (Middle to Late Callovian) Tuwaiq Formation. An allostratigraphic, sequence-based reinterpretation of the originally defined Dhruma now assigns the Atash and Hisyan Members, previously of the uppermost Dhruma Formation, to the overlying Tuwaiq Mountain Formation.

The Dhruma Formation at outcrop consists sedimentologically of a thick succession of shoaling-upwards depositional cycles, each of which commences with calcareous mudstones (marls) that contain moderately deep marine foraminifera with pelagic bivalves, and terminate with clean, locally cross-bedded to hummocky cross-bedded and ooid-bearing carbonates that contain very shallow marine foraminifera and associated microfossils.

The study concludes that the Dhruma Formation was deposited as a succession of high-frequency depositional cycles. The outcrop has provided new information on the palaeoenvironment and lithostratigraphy of the Dhruma Shale, Faridah, Sharar and Lower Fadhili reservoirs and will have significant impact on further exploration activities to identify these reservoirs in the subsurface.