

Triassic to Upper Jurassic Depositional Settings Evolution in the Northern Arabian Platform: Integration of Cores, Logs, and 3D Seismic (Northern Iraq)

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Abstract

A regional sedimentological study was conducted within an area of about 6,000 sqkm in the Northern part of Kurdistan Region (Iraq) in a sector lying between the High folded and foothill zones of the Zagros thrust-and fold belt. The analysis focuses on the sedimentological and stratigraphic analysis of Jurassic (Gotnia/Barsarin, Naokelekan/Najmah, Sargelu, Alan, Mus, Adaiyah, Sarki/Butmah) and Triassic (Baluti, Kura Chine A, B and C members) Formations by using data at different scale (from cm to km).

Specifically, the sedimentological (facies analysis, depositional model, geometry of reservoirs bodies, understanding of diagenetic/post-diagenetic processes and their localizations) and stratigraphic study (detailed correlation guidelines, sequence stratigraphic framework) of these reservoirs' sequences allowed to perform a better reservoir characterization on a micro- and macro-scales thus to reducing drilling risks and uncertainties for the future exploration program.

The final objective of the study was to generate an integrated comprehensive regional sedimentological model based on core (500 m) and thin sections description (530), logs (26 wells), petrophysical and 3D seismic data interpretation, in order to understand sweet spots for appraisal and production wells.

The analysis and calibration of cores, thin sections, wireline logs (petrophysical analysis) and image logs served to determine main sedimentological and stratigraphic aspects: lithology and texture, internal organisation, structural features, porosity, lithofacies, depositional facies and environment and sequence boundaries within the Triassic and Jurassic successions. The integration of the data aided by well correlation panels resulted in twenty-seven facies, where predominant lithologies are: dolomite, limestone, evaporites, terrigenous and rubble zones, additionally subdivided according to their petrophysical characteristics (porous, low-porous or tight) and internal organisation (massive, poorly bedded, well-bedded, vuggy, fractured/brecciated). The synthesis of findings culminated in establishing sequence stratigraphic boundaries up to the 4th/5th order and categorising depositional environments.

The calculation of seismic attributes on 3D cubes (among all, the RMS amplitude attribute) and comparison with the well correlation panels and facies subdivision, allowed to extend the lithofacies associations and related depositional environments at the regional scale through GDE maps and cross sections. The maps and cross sections were used to carry out a more accurate petroleum prospectivity assessment based on the

distribution of reservoir units, their thickness and porosity properties variability according to the environment of deposition (mainly sabkha to lagoonal environments).