

Structural Control on Occurrence and Distribution of Late Jurassic Gotnia Evaporite Sequences in North Kuwait Area

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Abstract

Discovery of hydrocarbons in carbonate layers interbedded with anhydrite units of Late Jurassic Gotnia and Hith formations in North Kuwait endorsed presence of new play in evaporite sequences of Gotnia Basin in the State of Kuwait. Basin configuration during Late Jurassic had played a controlling role in distribution of Gotnia salt-anhydrite units and development of limestone reservoirs within anhydrites. Structural analysis of Gotnia Formation performed in Jurassic wells located west, central and eastern parts of North Kuwait brought out the basin configuration during the deposition of each successive salt and anhydrite units over the area. Well correlation flattened at different evaporite units signified the direction of thickness variation of an individual unit indicating structural disposition of older unit that controlled deposition of subsequent sediment unit. Correlation flattened at the top of Gotnia 4th Salt, the oldest salt unit deposited over thin Gotnia 4th Anhydrite unit showed gradual thinning of this unit in southwest to northeast direction and finally its absence at northeast. Seismic reflector corresponding to Gotnia 4th Salt also thins from southwest to northeast and onlaps on to older Najmah Formation indicating possible subaerial exposure of northeastern part of Kuwait during deposition of Gotnia 4th cycle. Similar thinning of Gotnia 3rd Salt in southwest to northeast direction is noticed in well correlation indicating continued creation of active accommodation space towards southwest. Gotnia 2nd Salt though thins in same direction; the variation in thickness from southwest to northeast is very less suggesting availability of almost equal accommodation space in entire North Kuwait at this time. This implies creation of high accommodation space towards southwest during deposition of older 4th and 3rd Gotnia cycles, which is continuously filled with salts through periods of restricted circulation and by anhydrite-carbonate units during subsequent transgressive events deposited on flat salt surfaces in sabkha and very shallow water conditions. Limestone layers developed within anhydrites are probably associated with flooding and highstand times. Log analysis also indicates organic matter richness and fair porosities in these limestone layers. Reduced thicknesses of 3rd and 2nd anhydrite-carbonate units deposited above thick 4th and 3rd salt units respectively indicate long periods of basin isolation interspersed with brief fresh marine incursions.