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PS Carbonate Facies and Depositional Environments of the Marrat Formation (Lower Jurassic), North Kuwait*

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Abstract

Unlike the Gulf of Mexico region and most of the Atlantic continental margins, where stratigraphic successions of Lower Jurassic age are thin or absent, the presence of the Lower Jurassic Marrat Formation in the outcrop region of western Saudi Arabia and in the subsurface of the Arabian Gulf has been known for many years. These strata were thought to be non-prospective until quite recently with limited well penetrations in the northern part of Kuwait. Recent discovery of six independent gas and oil condensate fields in deeper Jurassic reservoirs in this area stimulated an active exploratory drilling and coring program covering an area of about 2000 sq km in North Kuwait. Thirty deep, high-temperature and high-pressure wells have been drilled in the North Kuwait area to date with production mainly from the middle portion of the Marrat. Typical production rates per well is in the range of 2500 to 5,500 BOPD/BCPD and 7 to 15 MMSCFPD. Detailed study of approximately 3,500 feet of core from 22 wells has allowed identification of lithofacies and depositional environments in the middle and upper Marrat Formation. No reefs or large carbonate buildups have been found in these cores, although there is a wide variety of algal and cryptalgal features and thin biostromal algal accumulations. Oolites and mixed high-energy grainstone facies accumulated in aggrading and prograding shoreface/shoal environments, separating a lagoon, tidal flats and sabkha from an open shelf. The shelf can be divided into inner and outer shelf. Limited penetrations of probable slope and basinal strata have also been seen in cores. Reservoir-quality rocks have been found in high-energy shoreface and island/shoal

facies but are most often developed in burrowed mudstones, dolomitized by seepage refluxion. The dolomites that have been seen in association with the sabkha environment were syngenetic and mimic original depositional texture. They are very fine-grained and not of reservoir quality. The Marrat, which has a total thickness of approximately 2,000 feet, has been informally divided into lower, middle and upper units, separated by maximum flooding surfaces (MFS). These flooding surfaces have been correlated to the sequence stratigraphic framework for the Arabian Plate.

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