

Cenozoic Depositional History of the Northeastern Arabian Plate

Po C. Tai¹, George J. Grabowski², Marek Czernuszenko¹, Chengjie Liu²

¹Business Development, ExxonMobil Exploration Company, Spring, Texas, UNITED STATES

²Asia Pacific Middle East, ExxonMobil Exploration Company, Spring, Texas, UNITED STATES

ABSTRACT

The Cenozoic strata of the Arabian Plate contain significant reservoirs, source rocks, and seals, and they recorded the basin-filling history of the Zagros Foreland Basin. The Cenozoic era is also one of the most important time periods in terms of hydrocarbon generation, maturation, migration, and trap formation for the Middle East region. This study illustrates the depositional history of the sedimentary rocks of the Arabian Plate through the Cenozoic with a focus on the Zagros Foreland Basin, including intervals of erosion and of no-deposition, progressive erosion and onlap, and paleobathymetry. It represents part of our current understanding of the Phanerozoic depositional history of the Arabian Plate.

We have compiled twenty four composite Cenozoic paleoenvironment maps summarizing the major facies tracts and environment of deposition. These maps are not palinspastically restored and thus display depositional features in their present-day locations. Each map is a compilation and synthesis of facies tracts and environments of deposition most representative of the time slice with an average of 1-4 million years duration. These maps show transgressions and regressions of the sea, directions of margin progradation, areas of enhanced subsidence and uplift, and regional tilt of the plate. They also are the maps of source, reservoir, and seal facies.

Early flexural basins first developed in the northeastern and eastern Arabian Plate from Late Cretaceous to Eocene by ophiolite loading to the northeast and to the east, respectively. The onset of Arabia-Eurasia collision and the establishment of an initial orogenic wedge probably took place by Late Eocene. At the onset of collision, a distal foreland basin system was established in the central Arabian region. Two margins developed along the foreland basin and prograded toward each other as the basin center narrowed and filled with deep-water calcareous muds, aggradational to progradational carbonates, fluvial-deltaic to shallow-marine sands, and basin-center evaporites from Paleocene to Early Miocene. An abrupt increase in subsidence at ~19 Ma indicated the arrival of the Zagros

Foredeep, which then was quickly filled by mixed Neogene clastics, carbonates, and evaporites that have been considered as foredeep and wedge-top deposits. This transition from the Paleogene marine deposits to the Neogene continental deposits suggests an evolution from an underfilled- to an overfilled-foreland basin.