The Influence of Salt Diapirism in Outlining Petroleum Traps: Conjugating Tectonics, Sedimentation, and Surface Expositions—Cardenas Field, Mexico

Pedro Ernesto Villaseñor Rojas

Instituto Mexicano del Petróleo, Eje Central Lázaro Cárdenas 152,
Colonia San Bartolo Atepehuacan, C.P. 07730, México D.F.

ABSTRACT

The onshore Cardenas Field produces oil, is located south of the Gulf of Mexico in the Chiapas-Tabasco Basin, and was discovered in 1980. Hydrocarbon production comes from two Lower Cretaceous carbonate reservoirs tectonically fractured in the vicinity of major faults. The field is hosted on the western sector of a southeast-northwest trending pop-up anticline structure formed by Middle Miocene times.

Stratigraphic cross-section correlations show thickness variations at the Cardenas Field, thinner in the central part and gradually thicker to the northeast and southwest; several angular unconformities also are shown.

A detailed log analysis by means of electrofacies modeling, cores description, cathodoluminiscence analysis, and production data, allowed for the identification of several bodies of dolomitized sedimentary breccias in different stratigraphic levels through the reservoirs. In plain view, these bodies are separated by a non-dolomitized carbonated barrier in the central part of the field, creating two different Lower Cretaceous reservoirs: the northeastern reservoir (KiNE) and the southwestern reservoir (KiSW).

Vertically, these stratified reservoirs were outlined into three main units: KiA, KiB, and KiC. The origin of brecciation is attributed to early bathymetric uplifts of the area, related to diapiric pulses of the underlying Jurassic salt, inducing the coeval deposition of rock avalanches and debris flow in adjacent basinal depocenters. These reworked carbonates were subsequentially affected by dissolution and dolomitization, that gave place to an excellent vuggy and channel network which controls permeability and connectivity of the reservoirs. The Cardenas Field model is compared with outcrops of the El Papalote Diapir, from La Popa Basin in northeast Mexico. La Popa Diapir is an exhumed salt stock, elliptical in plain view, composed of gypsum and anhydrite, presumably derived from the underlying Jurassic Minas Viejas Formation. The diapir is surrounded by Maastrichtian to Eocene rocks deformed during both diapirism events as well as minor Laramide shortening.

Passive diapirism triggered marine to nonmarine thin siliciclastic strata toward the diapir, as well as interbedded carbonate breccias lentil-shaped bodies that rimmed and covered the bathymetric high. Adjacent packages of lentils and associated siliciclastic wedges were folded to vertical to completely overturned, before being truncated by angular faults.

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