

Miocene Compressional Tectonics in the Campeche Salt Basin SE Mexico

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The Campeche Salt Basin is interpreted to have been deposited in Bajocian times, at the end of the main extensional rift phase, with the base salt being a fairly continuous flat surface across most of the deepwater salt basin. However, rifting continued around the shallow edges of the basin up to the end of the Kimmeridgian (ca. 150 Ma) with growth strata clearly visible in the hangingwalls of faults. The main extension direction is still not clearly defined but is expected to be approximately NW-SE from plate tectonic reconstructions; and the overall present day basin tilt is also towards the NW.

The salt basin and the sedimentary cover have been compressed since the Mid-Miocene (ca. 20 Ma) up to the present day by Chiapaneco NE-SW directed shortening associated with formation of the Cocos Spreading Ridge and subduction of the ridge below Mexico. Mid-Miocene compression produced intense squeezing of pre-existing diapirs leading to extrusion of a vast allochthonous salt canopy in mid to late Miocene times in the onshore and shallower offshore area of the salt basin. These salt sheets have been continually deformed to the present day by subduction-related stresses and became folded, producing attractive sub-salt anticlinal traps. However, the folding at the top of the salt sheets is discordant with the folding below the salt sheet making seismic imaging difficult. In areas where the salt was deeply buried, Miocene compression produced salt-cored anticlines, and caused the folding and overthrusting of Mesozoic carbonate slabs which were uplifted several kilometres and laterally displaced up to 20 km. Some of the overthrust carbonate slabs became exposed at the seabed soon after the onset of the Mid-Miocene compression. Fracturing and karstification of the exposed carbonate sheets will have significantly enhanced the reservoir potential of the previously deeply-buried Jurassic carbonates. However, no exploration wells have been drilled to test this play type so far. The salt can be diapiric in the anticlinal cores where the overburden lid was sufficiently thinned by erosion so that the compressed salt broke through, and extruded at the surface. Salt dissolution led to collapse of the overlying carbonates which has further enhanced the Mesozoic reservoir quality.

A NW downward tilt to the basin was produced during Cretaceous thermal subsidence which has been further enhanced by Tertiary sediment loading. This has produced NW directed downslope sliding with large extensional counter-regional faults producing NE-trending Pliocene aged minibasins in the hangingwalls (Fig 1). These counter regional faults developed on previously extruded allochthonous salt sheets which reached seabed soon after the Mid-Miocene compression initiated. Up to 4 km of strata was deposited in less than 2 million years within these minibasins, with deposition of key Mio-Pliocene reservoirs of the Magallanes, Cinco Presidentes and Orca Formations. Such rapid sedimentation implies a significant uplift and denudation event occurred in the onshore area some 2 Myr ago, which was presumably due to an enhanced compressive phase

along the Pacific subduction zone perhaps due to subduction of larger volcanic complexes along the Cocos Ridge. Although the cause is still not clearly understood. Finally, gravitational toe folding was also developed in the Pliocene to Recent (0-2 Ma) which trends NNE-SSW parallel to the western edge of the Campeche salt basin. The complex interplay between NE directed thrusting, and NW directed downslope tilting and sliding led to the large arcuate fold pattern observed at the present day.