

Sedimentary Basins and Petroleum Plays of Yemen

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After the first modern discovery of oil in Yemen in 1984 and the unification of North Yemen and South Yemen in 1990, the country joined the Middle East's petroleum-producers. Located in the southwestern part of the Arabian Peninsula, Yemen possesses Paleozoic, Mesozoic, and Cenozoic basins. Yemen's little-explored Paleozoic basins include the Rub' Al-Khali basin (southern flank) in the north, the San'a basin to northwest, and the island basin of Suqatra. Linked to the separation of India/Madagascar from Afro-Arabia, major extensional basins formed in Yemen during the Late Jurassic/Early Cretaceous. The location and NW-SE orientation of these basins, including the Siham-Ad-Dali', Sab'atayn, Say'un-Masilah, Balhaf and Jiza'-Qamar basins, were controlled by the Precambrian structural grains (the transtensional Najd fault system) of the Arabian shield. The relatively better-explored Sab'atayn and Say'un-Masilah basins (separated by Jahi-Mukalla High from each other) are both filled with syn- and post-rift sediments and display many similarities in source rocks and reservoir rocks, although the Tithonian evaporite is absent in the latter. The sub-salt turbidites in the Sab'atayn basin offer a new major oil play. The relatively less-explored Balhaf and Jiza'-Qamar basins, located respectively in central and eastern Yemen, contain a thick succession of post-rift Cretaceous sediments, although their depositional environments change from the continental in the west to fully marine conditions to the east. The Jiza'-Qamar basin has good oil potential in its onshore sector where it is filled with Upper Cretaceous coal-shale source rock and marl-limestone reservoir; the basin continued its subsidence during the Paleocene. The Balhaf basin is characterized by good Jurassic source rocks and overlying reservoir rocks at several stratigraphic levels. The least-explored Siham-Ad-Dali' basin in the westernmost Yemen contains highly bituminous Jurassic source rocks as well as potential pay-zones within Jurassic sandstones deposited directly atop the source rock or atop the fractured metamorphic basement. Cenozoic rift basins of Yemen formed by the Oligocene/Miocene rifting of the Gulf of Aden (the Mukalla-Sayhut, Hawrah-Ahwar and Aden-Abyan basins) and the Red Sea (the Tihamah basin) and were filled with a thick sedimentary succession displaying continental, evaporite, and shallow to deep marine facies, injected locally by alkali-basalt rift volcanics.