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Regional Upper Cretaceous (Senonian) Petroleum Source Rocks in the Middle East and North Africa

Organic-rich carbonates have been recognized as major hydrocarbon source rocks in many prolific basins. The present study focuses on the Upper Cretaceous (mostly Senonian) sequence in the Middle East and North Africa. These Senonian bituminous rocks (SBR) mainly include carbonates but also phosphorites and siliceous rocks deposited along the southern margins of the Tethys Ocean. The bottom conditions were dysoxic to anoxic, resulting in accumulation of abundant marine sapropelic organic matter with organic carbon values as high as 20 wt%. The SBR kerogen is sulfur-rich (type II-S), tending to generate oil in early stages of maturation.

Most of the SBR in the study area are immature due to shallow burial. However, where significant Tertiary tectonics occurred, oil generation and accumulation is evident. Prominent examples are: East Sirte Basin in Libya, Suez province in Egypt, Dead Sea Graben in Israel and Jordan, Euphrates Graben in Syria, and Southeast Turkey.

The Dead Sea basin is presented as a case study of this type of tectonic setting. It is a small pull-apart basin, located along a left-lateral transform boundary, the Dead Sea rift, between the Arabian and Sinai plates. The basin formed at about 15 Ma, but major subsidence took place in the last 4 m.y. Hydrocarbons in various forms (gas, oil, asphalts) were encountered in beds ranging from Paleozoic to Recent. Correlation studies, including products from hydrous pyrolysis experiments, clearly established the SBR as the source for these hydrocarbons. A unique aspect of the basin is that the combination of fast SBR burial to great depths (<10 Km), with the labile, sulfur-rich kerogen, gave rise to early oil generation and to an exceptionally short-lived oil window (several hundred thousands of years). Preliminary calculations indicate generation potential of more than 20 billions barrels of oil in the basin!