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Global Source Rock Distribution in Time

Twenty-one layer maps are presented showing source rock distribution worldwide from the Precambrian to the Pleistocene. Data at hand are inadequate to display source rock distribution in meaningful quantitative terms (e.g., initial volume and type of organic matter for geological time intervals). The common procedure, therefore, is to relate source rock importance in time to measurable yardsticks such as ultimately recoverable hydrocarbon reserves alleged to have been generated from specific source rock intervals. Although source rock type, thickness, richness, and wide regional distribution are vital parameters to account for the hydrocarbon richness of a specific basin, other factors such as size of drainage area, level of organic metamorphism, migrational aspects, trap storage capacity, timing, and retention are of equal importance. Present concepts of source rock distribution and abundance in time are subject to revision when the sources of unconventional hydrocarbon resources such as heavy oil, asphalt, tar, and gas hydrates are considered. In addition, the source rock potential of undrilled areas and traps must also be incorporated in any worldwide material balance estimate. The hypothesis is advanced that the organic matter of Oligocene to Pleistocene sources has generated the largest portion of the world's hydrocarbon resources in terms of energy equivalents. The bulk of these resources is shallow bacterial gas trapped in the form of gas hydrates in permafrost areas and in shallow layers in the deeper parts of the oceans.

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Exploration Geology and Depositional Modeling of a Continental Tight Sand Reservoir, Abo Formation, Chaves County, New Mexico

The Wolfcampian-Leonardian age Abo Formation has been the major objective of exploration efforts in southeastern New Mexico since 1980. The Abo Formation in Chavez County consists of red and green mudstones and shales interbedded with very fine-grained reddish-orange sandstones. The sandstones are subarkosic arenites deposited in a fluvial/delta plain environment on the northwest shelf of the Permian basin. Producing sandstones are characterized by very low in-situ permeabilities (0.006 to 0.01 md) and porosities (determined from CNL density logs) ranging from 5 to 12%. Petrographic analysis of the producing zones yields only traces of visible porosity ($\approx$ 1%), indicating the relative importance of fractures to total porosity. The importance of this secondary porosity is substantiated by the concentration of production within an area of major southwest-northeast-trending buckles that result in folded and fractured zones parallel to their strike. Abo sediments were derived from the predominantly granitic Pedernal uplift to the north and west of the producing area. The prograding fluvial/delta plain is evidenced by calcareous mudstones at the base of the Abo with calcite fracture fillings grading upward into anhydritic mudstones containing anhydrite fracture fillings and bird's-eye lenses. In general, three main producing zones are found in the upper Abo Formation. These sandstones occur either as a single thick (6 to 10 m, 20 to 33 ft) sand or several thin (2 to 4 m, 6.5 to 13 ft) sands separated by thin mudstones. Changes in thickness and character of these three major sands represent lateral shifts in subaerially deposited, braided paleochannels. The relatively homogenous mudstone intervals between producing sands and at the base of the section represent delta switching and tidal backreef (submarine) deposition.

Gas wells in the Abo initially produce from 200 to 4,000 MCFGPD of dry (1,000 Btu) gas after considerable acidizing and fracturing. The modeling of the depositional environment of the Abo is critical to the selection of prime drilling locations. Paleochannel development and trends, as well as significant interbedded mudstone intervals, are essential for good Abo potential. Several stratigraphic and diagenetic trapping processes may result in hydrocarbon accumulations within these anastomosed fluvial sandstones. Channel fills are most commonly contained laterally and vertically by mudstones. Differing amounts of calcite and anhydrite cement and argillaceous matrix within the sandstones may create diagenetic traps within the channels. The best Abo wells are located in areas where paleochannels are well developed and intersect southwest-northeast-trending structural zones. The completion of these wells can be complicated by inadequate cementing prior to fracturing resulting in the fracturing of containing mudstones and shales instead of gas-bearing perforated sandstone intervals.

The relatively shallow, 950 to 1,300 m (3,100 to 4,300 ft), depths to encounter pay, combined with the higher allowable tight gas (107) price in the Abo, have stimulated significant activity in this new play that is certain to expand as the reservoir and trapping mechanism is better understood.

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Oil-Oil and Oil-Source Rock Correlations in Gulf of Suez, Egypt

According to published geological studies, there are two theories regarding the origin of petroleum in the Gulf of Suez area. One theory advocates that the majority of the oil accumulations in this region originate from two different source rocks: Eocene limestones and Miocene marls. The other theory states that only Miocene marls and shales of the Gharandal and Ras Mallah groups are the source rocks. The present study is a geochemical evaluation of Eocene limestones as potential source rocks. The geological samples studied comprised eight oils from six major accumulations in Miocene, Eocene, and Cretaceous formations, and 15 core samples from Eocene limestones in the region. Samples were analyzed for their petroporphyrin types and distributions using established analytical techniques that included uv/vis, mass spectrometry, and high pressure liquid chromatography (HPLC). These techniques permitted the determination of several petroporphyrin parameters such as yield, distribution, and the ratios of nickel to vanadyl complexes and of DPEP to etio types. These geochemical parameters were then employed for oil-oil and oil-source rock correlations of the samples analyzed.

In general, the oils had higher porphyrin contents, higher vanadyl to nickel porphyrins ratios, and lower DPEP to etio ratios compared to the shales. Most importantly, however, the porphyrin distribution (HPLC fingerprints) for the oils were significantly different from those of the shales. The shale samples showed three different fingerprints, one of which is uncommon of petroporphyrins found in petroleum and related bitumens. Among the oils, two different fingerprints were observed, regardless of their geological age. Although these observations suggest more than one source for the oils, they could not corroborate the the assumption that the Eocene formation is a potential source rock. Other geochemical implications of the findings will also be discussed.