Experimental data support the evolution of carbon dioxide and hydrocarbon gas concurrently with oil generation and demonstrate effective accommodation of oil in water saturated with carbon dioxide and hydrocarbon gas at the temperatures and pressures which are present at depth in source rocks. Oil carried by gas-saturated water migrating from source rocks can be unloaded in and near reservoir traps or enroute to a reservoir by removal of carbon dioxide from the water. This unloading is accomplished by reaction of carbon dioxide with "carbon dioxide-starved" or unconditioned sediments contacted by the oil-bearing water as it moves up faults and permeable strata or by coming out of solution because of low pressure at shallow depths. Carbon dioxide reactions with the source rock matrix have previously been saturated with the large amount of carbon dioxide generated which also provided a surplus to saturate the pore water. After the pore water is saturated with carbon dioxide, the mobilized oil can leave the source rock with water expelled by compaction. In noncompacting situations the hydrocarbons can diffuse over reasonable distances from the source rocks into adjacent permeable beds.

The observed capacity of gas-saturated water to carry oil enables reasonable and available volumes of migrating water to transport and unload enough oil to fill reservoir traps.

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Microbiological Prospecting for Hydrocarbons

Microbiological prospecting falls under the broad category of soil analysis and thus involves the use of near-surface samples. Most of the methods are designed to detect certain types of microorganisms or the products of their metabolism. Because these methods are predicated upon the microbial utilization of uprising hydrocarbons, they detect microseeps. Therefore, their utility resides in determining the presence of subterranean hydrocarbon deposits and in roughly defining the aereal extent of the deposits. Various methods have been patented and numerous field trials have been made, including blind tests and tests conducted prior to drilling.

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Geology of Gu-Dao Oil Field and Adjacent Areas

Gu-Dao oil field is located geologically in the center of Zhan-Hua basin, Bohai Bay hydrocarbon-bearing province, and geographically in the coastal zone of the lower Yellow River valley. Zhan-Hua basin is a Cenozoic block-faulted basin, with an area of 2,100 sq km. The intensive subsidence of the faulted blocks was followed by deposition of thick Tertiary continental strata (the Eocene series itself is as thick as 4,500 m), at a sedimentation rate of 0.127 mm/year. The strong block faulting in the basin led to the formation of buried Paleozoic hills, which controlled many overlapping Tertiary structures. Almost 90 of the known oil reservoirs are in these structures.

Gu-Dao oil field produces from one of the late Tertiary overlapping structures which is cut along the north and south side by two faults striking nearly east-west. These faults controlled the origin and the development of the comparatively intact structure. A long period of faulting caused vertical migration of large quantities of oil and gas, and the formation of a series of multiple pays. The hydrocarbons are distinctly zoned. That is, in the Paleozoic and lower Tertiary rocks, they are high-paraffin crude oil of high wax and low sulfur content. The upper Tertiary rocks contain highly viscous aromatic-cycle alkane crude oil of low wax, high sulfur content, and dry gas occurs in the upper part of the Neogene and Quaternary. The analysis of the data shows that hydrocarbons are derived from the same source rock—the lacustrine lower Tertiary Sha-He-Jie formation—distributed in the depression surrounding the Gu-Dao structure. A secondary reservoir was formed along the faults during the multiple tectonic movement during the late Tertiary, as a result of the upward migration of hydrocarbons from lower Tertiary rocks. Hence the Gu-Dao oil field is a combination of both primary and secondary reservoirs.

The main oil-bearing formation in the Gu-Dao oil field, the upper Tertiary Guan-Tao formation, comprises a set of fluvial deposits, with channel sand bodies as the principal reservoirs. The reservoir extends along the long axis of the Gu-Dao structure, and constitutes the major producing area.

The oil field was discovered in 1968 and full production was begun in 1971. The development policy of water flooding at an early stage, either internally, separately, or quantitatively, was adopted according to reservoir characteristics of high viscosity, sand-out, or differences in pays. A series of measures has been taken to control sand and to reduce viscosity. Although 7 years have elapsed since the beginning of production, present oil production per well is equivalent to that of the early stage, a rising trend in productivity is obvious, and good development effects are insured.

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Carbon Isotope Measurements of Hydrocarbons Adsorbed in Near-Surface Sediment Samples

Geochemical surface exploration for hydrocarbons can be markedly improved by carbon isotope analyses of methane which is adsorbed in near-surface sediments. This technique allows isotopic determinations on samples of 25 μL of methane with an overall $\delta^{13}C_1$ reproducibility of approximately ± 1 part per thousand.

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Geologic Significance of LANDSAT data on some Known Giant Fields

If land-satellite data had been available and applied to areas over which giant fields were found, how effective would have been the use of the data in the exploration effort and what kind of useful geologic information would have been generated from the satellite images? This question obsessed the author and prompted the effort to find an answer by obtaining satellite images of