Genetically the barite-sulfide accumulations are considered to result from exhalative activity restricted to regionally developed basement faults. Accumulation occurred within a minor trough with resultant facies asymmetries being related to different topographic and paleochemical conditions during sedimentation and diagenesis.

JOHNSON, GENE O., Ohio Dept. Energy, Columbus, OH

Oil Shale Development in Ohio: An Overview

The energy resource contained in the oil shale of Ohio represents a significant reserve for future development. These black shales were deposited during the Devonian and Mississippian Periods beneath a deep equatorial inland Kaskaskia sea that accumulated detrital organic sediments at the bottom. The oil-rich shales of Ohio are the lower and upper Huron members, the Cleveland Member of the Ohio Shale, and the Sunbury Shale. Thermal maturation of the vitrinite in the Ohio shale averages 0.54 Ro in Ohio. The present distribution of the oil shale in Ohio is in the north-south central and northeastern parts of the state. The shale oil industry to develop these energy resources began with the pioneers, and in 1886 with the St. Louis Shale Oil Co. Financial and technological interest continues today.

JONES, PAUL H., Consultant, Baton Rouge, LA

Geothermal and Hydrocarbon Regimes, Northern Gulf of Mexico Basin

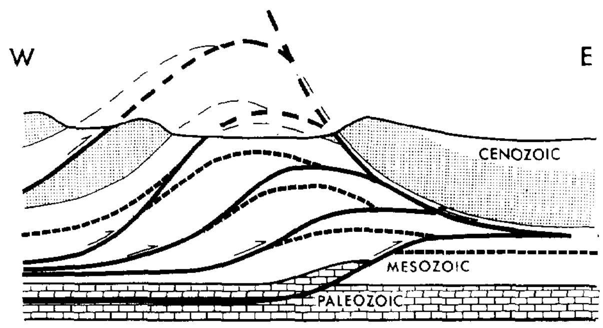
Geotemperature transients and the phenomena of heat flow define the fluid hydrocarbon regime in petroliferous sedimentary basins. The redistribution of heat and the thermo-physical properties of the rocks are mainly determined by the hydrogeology. As the temperature thresholds of smectite dehydration and kerogen diagenesis are passed, endothermic chemical changes convert solid rock mineral matter to fluids, reducing the net volume of mineral solids in each unit volume of rock and thereby increasing its porosity. As this occurs, the pore-fluid pressure rises markedly in response to the loss of load-bearing strength in the altered rock. Simultaneously, the aqueous solubility of fluid hydrocarbons is enhanced and the hydraulic permeability of the altered rock is greatly increased. Pore water carrying dissolved hydrocarbons moves through the altered rock and into adjacent aquifers, driven by steep hydraulic gradients. Subsequently, mass movement of water from the geopressure zone to the hydropressure zone migrates the dissolved hydrocarbons to traps, near which a sharp pressure drop causes exsolution.

The threshold temperature of smectite dehydration generally occurs a short distance below the top of the geopressure zone. The 100°C (212°F) isothermal surface closely approximates the top of the geopressure zone, except where water loss from the geopressure zone is in progress. At depths where temperature exceeds 150°C (302°F), petroleum occurrences are rare indeed. The abundance of natural gas, however, in both vapor phase and in aqueous solution, increases with pressure and temperature, and thus with depth, probably as a result of progressive natural cracking of petroleum residues in the rocks with deepening burial.

JONES, PETER B., International Tectonic Consultants Ltd., Calgary, Alberta, Canada

Oil and Gas Beneath East-Dipping Underthrust Faults, Alberta Foothills

Throughout most of its length, the Cordilleran front in Alberta is characterized by east-dipping Mesozoic and Cenozoic sediments overlying an east-dipping detachment surface that consists of one or more low-angle underthrust faults. More than 5,000 sq mi (13,000 sq km) of deformed sediments containing several major oil and gas fields are concealed beneath the detachment. East-dipping underthrusts of the detachment outcrop along east flanks



The Ideal Triangle Zone

of quasi-anticlinal structures sometimes called "triangle zones" because of their overall appearance in cross section. Oil and gas fields in triangle zones occur in Paleozoic carbonate and Mesozoic clastic reservoir rocks. Because of their complexity, triangle zones have also been the sites of some very expensive dry holes. Surface and subsurface data can be used to determine the geometry of a triangle zone and create an idealized model. The model can be adapted to structural problems both within and beyond the limits of the triangle zone, suggesting a new perspective on the tectonic development of the entire Foothills belt.

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Organic Facies Distribution: Contributor to Both Wins and Losses

The dearth of oil-prone marine source rocks (organic facies B) in the Tertiary-Mesozoic deposits underlying the Holocene shelves is a primary reason for the low success ratio when exploring for oil in these deposits. The predominant organic facies are C, which is gas-condensate prone and is usually dominated by terrestrial organic matter (OM) deposited at an oxic sediment-water interface, and D, which has a negligible generating capacity and is either dominated by highly oxidized OM from any source or by reworked OM deprived of its liquid generative capacity in a previous thermal event. The east and southeast coasts of the United States illustrate this problem in both a clastic and carbonate realm.

Oil-prone source rocks are rare under the shelves, but do exist. They are apt to be rather restricted in areal extent and reflect rather local conditions that permitted the development of anoxia at the water-sediment interface. These conditions are preferentially achieved during the structural developments that occur in the rifting stages. The lacustrine source beds that are the source of much oil in offshore Brazil, Gabon, and Cabinda are prime examples. Might such organic facies exist elsewhere under thick sedimentary piles? As shown by the Kimmeridgian in the North Sea, marine transgressions during the rifting stage are clearly an opportunity for the deposition of oil-prone marine source rocks (organic facies B). Although drifting usually ultimately leads to oxic deposition in an open ocean, anoxic conditions can be preserved at least episodically for a long time as indicated by the Cretaceous of the Atlantic. The correct projection of the organic facies and maturation of the Cretaceous "black shales" under the continental shelves will clearly be rewarded.