source beds adequate to form large hydrocarbon deposits are probably absent from the central and western gulf. Farther west the lower Tertiary igneous core of the Aleutian Ridge is overlain by broadly deformed Neogene and younger deposits. These beds are 2 to 4 km thick in summit basins, and probably much thicker below the Aleutian terrace along the ridge's southern flank. Although these basins include diatomaceous and turbidite sequences, the probable abundance of readily altered volcanic detritus cautions against optimistic expectations of large quantities of oil and gas along the Aleutian Ridge.

Five extensive (25,000 sq km) basins filled with as much as 15 km of mostly Cenozoic beds are present beneath the Beringian shelf, and, therefore, north of the Aleutian subduction zone. Except near Siberia, the deposits in these basins are little deformed. Elongate St. George and Navarin basins, along the southern or outer edge of the shelf, have formed on a collapsed foldbelt of miogeoclinal rocks that include beds of Jurassic and Cretaceous age. Subsidence of the foldbelt occurred after subduction of oceanic crust ceased beneath the Beringian margin (60 to 70 m.y. ago) and shifted south to the Aleutian Ridge. In contrast, Norton basin, which underlies the inner or northern edge of the shelf, is floored by Paleozoic and older rocks of Brooks Range affinity that subsided in response to Cenozoic strike-slip faulting in western Alaska. A speculative reading of the geologic history of the Beringian basins implies that some of them could harbor commercial volumes of oil and gas. South of the Beringian margin, the abyssal floor (3 to 4 km) of the Bering Sea basin is underlain by 4 to 10 km of undeformed deposits chiefly of Cenozoic age. Drilling results, and the detection of deep-water bright spots (VAMPs), suggest that hydrocarbon deposits (of unknown volume) occur in the basin. Its basement of Lower (?) Cretaceous oceanic crust was presumably separated from the north Pacific by the formation of the Aleutian Ridge in latest Cretaceous or earliest Tertiary time.

Since early Mesozoic time, the evolution of the structural framework of the north Pacific margin has been controlled by the subduction of more than 10,000 km of oceanic lithosphere. However, recognition that segments of the margin are underlain by deeply submerged miogeoclinal rocks of Mesozoic and early Tertiary age, and the results of DSDP drilling at Pacific margins, attest that the evolution of Alaskan and Bering Sea margins is not adequately described by models of accretionary tectonics or back-arc spreading. Little understood aspects of subduction and post-subduction tectonics that cause and control marginal uplift and subduction are thought to hold important clues to the economic potential of the frontier basins of the north Pacific and Bering Sea regions.

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Deep-Water Reservoirs: Submarine Fans and Fantasies

Many large oil and gas fields are producing from turbidites and associated deep-water rocks; examples include the Los Angeles and Ventura basins, many fields in the Great Valley of California, and some less obvious turbidite areas such as the Bradford field, Pennsylvania. For future exploration, and for the development of existing fields, it is important to understand the different types of turbidites, how they are related, and how they fit into an overall submarine-fan model that can be used predictively.

The basic deep-water (below storm wave base) facies consists of classic turbidite monotonous alternations of parallel-bedded sandstones and shales. As the sandstones thicken and the shales become thinner or absent, the classic turbidite facies grades into massive sandstones and pebbly sandstones. These are characterized by vertical amalgamation of sandstones, channeling, and scouring. The distribution of these facies on modern submarine fans is understood only sketchily, and hence the predictive fan models have been constructed largely on facies relations and observed channels in ancient rocks, and on subsurface data. Classic turbidites, with excellent bedding continuity, suggest a smooth seafloor, whereas the massive and pebbly sandstones suggest a channelized inner fan. Different types of thin-bedded classic turbidites indicate levee, interchannel, and distal-fan fringe environments.

Sequences of turbidites in which beds become thicker upward may indicate progradation, and thinning-upward sequences may indicate channel filling. Both can be recognized on electric logs.

Fan models can lead to fantasies when applied uncritically as examples from the Ventura basin and Great Valley illustrate.

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Abstracts

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Geology of Wheaton Consolidated Oil Field, Gibson County, Indiana

The Wheaton Consolidated oil field is in Union and Barton townships of Gibson County, Indiana. The field has produced oil since the 1920s from a sandstone reservoir referred to as the "Jackson Sand," which is equivalent to the Big Clifty Formation of surface terminology. The Big Clifty Formation is part of the Stephensport Group, and is Chesterian or Late Mississippian in age.

Within the field area the Big Clifty Formation can be mapped between the underlying Barlow Limestone and overlying Golconda Limestone. The lower contact appears to be sharp over the field area. The upper contact of the Big Clifty intergrades with at least one tongue of Golconda which pinches out into the Big Clifty.

The Big Clifty Formation includes sandstone, shale, and mudstone with minor amounts of sandy limestone. A typical sequence from top to bottom includes: black shale; thin red mudstone; gray shale; silty limestone; interbedded gray shale and very fine-grained, white, sandstone; well sorted, fine-grained, white, sandstone; and thin gray shale. The percentage of sandstone within the Big Clifty Formation varies significantly.

The thickness of the Big Clifty Formation ranges from 64 to 89 ft (19.5 to 27 m). The unit dips to the southwest and is 940 ft (287 m) below the surface within the northwest part of the study area and 1,330 ft (405 m) below the surface in the southwest part of the study area.

The areas containing high concentrations of sandstone form two elongated trends within the study area. The sandstone trends strike N55°E, and trend axes lie approximately 1 mi (1.6 km) apart. The sandstone bodies are approximately ¾ mi (1.2 km) across and 5 mi (8 km) long, and range in thickness from 3 to 40 ft (~1 to 12 m).

The sandstone bodies may represent shallow marine offshore bar or strandline deposits.

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Coal Geology and Resources of Eastern Kentucky

In 1979, 107 million tons of coal were mined in the Eastern Kentucky coal field; of this total, 50 million tons came from surface-mining operations. Original resources are estimated at about 33.5 billion tons, with remaining coal estimated at approximately 29 billion tons. Recoverable-coal estimates cannot be reported because of lack of reliable data particularly in the area below principal drainage.

Major production comes from Big Sandy, Hazard, and Cumberland River Coal Reserve Districts. These areas are an important source of low-sulfur (1 to 2%), high-volatile A and B coal, often used for blending in coke production; however, the larger part of production supplies the compliance coal market.

Physical and chemical characteristics of the coal and associated rocks vary geographically and stratigraphically, reflecting the controls of sedimentary environments. In general, the following relations have been recognized: high-sulfur conditions in coal and related overburden are associated with rocks having marine or brackish-water affinities; splits are commonly associated with crevasse splays; and bad roof conditions are frequently associated with paleochannels and related slumps.

The eastern Kentucky coal resources program, operated jointly by the Kentucky Geological Survey and the Institute for Mining and Mineral Research, is in its third year, due for completion in 1982. Detailed geologic maps resulting from the recently completed Kentucky cooperative geologic mapping program provide the stratigraphic framework for this project. A more accurate assessment of coal tonnage, a better understanding of coal stratigraphy, and the development of models for determining mineability are the major goals of this project.

The deep mining potential looks promising for the northeast-southwest trending "Appalachian Trough" in southeastern Kentucky. Experiments with longwall mining are presently being conducted in this area.

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Middle Ordovician Shelf Carbonate Sedimentation Around Bathymetric Highs in Southwestern Ontario: A Persian Gulf Analogy

Sedimentation patterns around three classes of bathymetric high in the Persian Gulf vary according to regional setting and diameter of the high. Around basin-center highs, the sedimentation patterns are concentric but become progressively asymmetric toward the coast (coastal highs) due to accretion of bioclastic sand on windward sides. Where the diameter of the high exceeds 5 km, downwind tails of bioclastic sand enclose muddy lagoonal-type sediments. Highs submerged below 10 m favor active submarine lithification on their crests, while emergent highs favor beach-rock lithification without dolomitization.

The Persian Gulf bathymetric high model can be directly applied to the Middle Ordovician carbonate rocks of southwestern Ontario and can be used to explain the complex biofacies and lithofacies relations, as well as the location of Ordovician hardgrounds. Both Persian Gulf and Ontario Ordovician hardgrounds occur predominantly on bioclastic and intraclastic sands, deposited in shoaling areas around the islands or highs where rates of deposition are low, especially on accretion tails. Both hardground occurrences exhibit certain faunal similarities, for example, encrusting bryozoans, sponges (stromatoporoids), abundant browsing gastropods (associated with algal mats); similar large branching burrow tunnels are present at omission surfaces in both examples. However, the abundance of pelmatozoan echinoderms and the absence of encrusting corals and bivalves in the Ordovician of southwestern Ontario contrast with recent hardground faunas.

A preliminary justification of the Ordovician-Persian Gulf comparison is presented in terms of general lithofacies and biofacies comparisons and location of hardgrounds. Unfortunately the study is handicapped by poor exposure and lack of precise stratigraphic control; a program of shallow drilling is needed to test some of the inferred sediment distributions around Ordovician submarine highs.

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Geology and Geophysics of Middle Mississippian (Valmeyeran), Ewing Area, Jefferson and Franklin Counties, Illinois

Since 1976, significant new oil reserves have been discovered in the Ewing area of Jefferson and Franklin Counties, Illinois. One new field and three deeper pool discoveries contain oil reserves in excess of 1.2 million bbl. These oil reserves are in Middle Mississippian limestone at depths of less than 4,000 ft (1,219 m).

Spring Garden field, discovered in November 1977, was drilled on a seismic prospect and has 600 acres (240 ha.) under production from the McClosky Limestone Member of the Ste. Genevieve formation. A study of a core from the field indicates the reservoir was deposited in an oolite bar or beach environment similar to present-day deposition at the Lily Bank oolitic shoal in the Bahamas. The trap at Spring Garden field is formed by the updip pinch-out of porous oolitic limestone into a tight micritic lime mud on a structural nose. The field has primary recoverable reserves of 600,000 bbl of oil.

Based on seismic work and well control, deep tests were drilled in three old fields: Bessie, Ewing East, and