The distribution of potential hydrocarbon source beds within the New Albany Shale group of Illinois was determined by studies of the stratigraphy, lithology, and organic matter of the shales. Shelf-to-basin correlations (across western Illinois to southern Illinois and western Kentucky) reveal a complete and continuous transition from high-energy, aerobic, shallow-water (<50 m ?) environments (fossiliferous limestones) to low-energy, dysaerobic, moderately deep-water (~50 to 150 m ?) environments (bioturbated greenish-gray shales and thickly laminated olive-black shales) to very quiet, anaerobic, deep-water (>150 m ?) environments (finely laminated black shales).

The types and abundance of the organic matter preserved within the shales were predominantly controlled by the depositional environment. Appreciable amounts (3 to 15%) of mixed humic-sapropelic kerogen were preserved in the anaerobic black shale environments. The kerogen assemblage is interpreted to be well-preserved, locally derived organic material. Only small quantities (typically <1%) of humic (degraded ?) kerogen were preserved in the dysaerobic greenish-gray shale environments. This kerogen assemblage is interpreted to result from selective preservation of only the organic constituents most resistant to destruction by benthic invertebrates (detritus feeders) and aerobic bacteria.

Petroleum generation in the New Albany shales is likely to have occurred only in the anaerobic black shales where the sapropelic and liptinite fractions have been preserved and where sufficient organic maturation has taken place. Gas generation may have occurred in the greenish-gray shales where humic kerogen has been preserved selectively, but in very small quantities due to the low maturity and paucity of organic matter in these shales.

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Uranium Solution Mining—Integration of Exploration and Production Development

The observations and conclusions are based on a study of uranium deposits in Weld County, Colorado. The deposits occur along geochemical interfaces (roll fronts) in the sandstones of the Fox Hills and Laramie formations of Late Cretaceous age.

The uranium deposits are epigenetic and were formed by solutions moving down through a pre-Oligocene unconformity developed on the gently dipping Cretaceous strata in the southern part of the Cheyenne basin.

Uranium solution mining has become important as a means of exploiting roll-front deposits with geologic and hydrologic characteristics amenable to controlled solution flow.

The interaction between exploration and mine development in evaluating the technical, economic, and environmental feasibility is of paramount importance for a successful solution mining project. Exploration provides data such as total reserves, minable reserves, lithology, thorough interpretation of geophysical logs, and geohydrologic observations to assist mine development in establishing well field patterns, mine economics, well completion methods, and solution control and containment methods. Mine development aids exploration by providing information generated during metallurgical testing, groundwater evaluation, mining, and aquifer restoration. In particular, radon and gross alpha activity measurements which are made in the groundwater prior to mining are significantly valuable in developing the ore body, and in regional exploration in similar lithologies.

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Crystalline Overthrusting of Paleozoic Shelf in Southern Appalachians Mapped by COCORP Reflection Data

COCORP seismic reflection data have shown that the early Paleozoic shelf in the southern Appalachians has been overthrust by a thin sheet of crystalline rocks. The profiles extend from southeastern Tennessee to the Carolina slate belt in Georgia and show that the thrust sheet attains a maximum thickness of 15 km along this traverse. Sedimentary rocks which are interpreted as shelf sediments extend beneath the Blue Ridge and Inner Piedmont. Their discovery suggests an expansion of hydrocarbon exploration of the eastern thrust belt and perhaps other similar thrust belts. Near the Inner Piedmont-Charlotte belt boundary a transition in reflection character of the sediment layers and deep crust suggests that a major crustal transition was present in this area during the early Paleozoic. Preliminary field data and palinspastic reconstructions imply this transition marks the boundary between continental and oceanic crust of the early Paleozoic. Further profiling to be conducted in the winter of 1979-80 may provide important new information on the nature and extent of the overthrusting.

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Prospective and Future Hydrocarbon Provinces of Bering Sea, South of St. Lawrence Island

The Bering Sea can be divided into three hydrocarbon provinces that coincide approximately with three major geomorphic areas, namely the continental shelf, the slope rise, and the abyssal basin. The significant findings of several recent USGS studies on the regional tectonic framework and hydrocarbon potential of these provinces are summarized.

The shelf province is underlain by a continental platform that is extensionally rifted along its outer edge. Mesozoic rocks form the basement complex and thick Mesozoic(?) and Cenozoic sedimentary sections fill the rift basins. Recent evidence documents (1) several deep sedimentary basins within the shelf province, (2) shallow-water Mesozoic and Cenozoic sedimentary rocks from the continental slope, and (3) confirmation of postulated subsidence along the shelf edge.

The slope-rise province, which includes the marginal Umnak plateau, delineates the deep-water transition from oceanic to continental crustal rocks. In Mesozoic time, oceanic crust may have collided with continental crust beneath this province. At present, thick (6 to 10 km) accumulations of Cenozoic and Mesozoic(?) sedi-

ment on oceanic crust are found throughout the province. Other significant findings include: (1) seismic evidence for underthrusting and for deeply buried folded sedimentary rock at the base of the slope, (2) geologic evidence for 2 to 4 km of differential subsidence, and (3) the discovery of uplifted and deformed Mesozoic(?) oceanic crust beneath Umnak Plateau.

The abyssal-basin province lies entirely in water depths greater than 3,000 m and is underlain by (igneous) oceanic crust. This Mesozoic crust may be a piece of trapped oceanic plate that since early Tertiary time has been covered by a 3 to 8 km-thick sedimentary section. Recent observations include the delineation of regionally thick and locally deformed sediment bodies, discovery of numerous velocity-amplitude features (deep-water "bright spots"), and geologic and geophysical evidence for extensive, potential reservoir beds.

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Multifold Seismic Data Across Outer Bering Sea Continental Margin

Recent U.S. Geological Survey multifold seismic reflection records from the outer edge of the Bering Sea shelf show that a thick sedimentary section underlies the continental slope and rise. The subject segment of the Bering Sea margin extends from Cape Navarin in Siberia south to Pribilof Canyon, a distance of 700 km. This part of the margin is covered by 200 to 3,400 m of water, is incised by several large submarine canyons, and is underlain by up to 10 km of strata. The strata are thickest (7 to 10 km thick) at the base of the slope near Cape Navarin and near Zhemchug Canyon. A maximum thickness of 10 km (5.9 s two-way time) occurs in uplifted rise and slope deposits that lie in 800 m of water near the mouth of Zhemchug Canyon.

Rocks dredged from the continental slope indicate that upper Eocene or lower Oligocene rocks rest unconformably on Mesozoic (Upper Jurassic and Lower and Upper Cretaceous) rocks that form the acoustic basement. The reflection profiles and dredge data obtained from the sediment-draped areas of the margin suggest that the upper half of the thick sedimentary section at the base of the slope is younger than early Oligocene age. The age of deeper rocks may be as old as Mesozoic.

Several aspects of sediment wedges along the Bering Sea margin make them favorable targets for future hydrocarbon exploration: (1) the large total thickness of Cenozoic rocks; (2) the presence of structural and stratigraphic features such as diapirs, faults, crustal warps, onlaps, and pinch-outs; and (3) the possibility that Cenozoic sediment source areas may be rich in organic and coarse-grained detrital debris.

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Paleoenvironmental Control of Biogenic Structures in Upper Devonian Prodeltaic Turbidite Deposit

The Rock Stream Formation near Ithaca, New York, is a proximal, submarine fan-like deposit of an epicratonic sea. Turbidites and interbedded shale were deposited in alternating channel and interchannel facies. This lithology is in sharp contact with overlying mudstones which were probably deposited on a progradational slope.

The complex environmental parameters which affect the distribution of trace-making organisms is shown by their ichnologic distribution. Three associations occur within the submarine fan. (1) The *Paleodictyon* association consists of five ichnogenera representing pascichnia. These are followed stratigraphically by (2) the *Arenicolites* association consisting of 12 ichnogenera representing domichnia and fodinichnia. Two repichnia compose (3) the *Pteridichnites* association. This last association is ubiquitous to the study section. Food resources significantly influenced behavior as the population shows a trophic shift within a lithologically consistent section, from grazing (like *Nereites*) to the endobenthic feeding and dwelling behavior of a shallow-water assemblage. Within the *Arenicolites* association, substrate texture and cohesion differentially influence the distribution of suspension-feeders and deposit-feeders through a trophically consistent assemblage. Multiple ichnogenera among any one behavioral class rarely occur in the same bed. Ecologic competition affects the distribution of individual phylotaxa within a behavioral class. Ecologic competition may have depended mostly on spot concentration at the time of substrate availability. On muddy substrates which may vary widely in cohesiveness, trophic group ammensalism allows fodinichnia to inherit a similar lithology from domichnia. The complexity of ichnogeneric distribution is produced by ichnotaxa ambiguities as well as ecological controls.

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Introduction (to SEPM Research Symposium): Source Beds—Depositional Environments and Early Diagenesis

In recent years, symposia and publications on hydrocarbon source beds have dealt primarily with organic geochemical and late diagenetic aspects. The present symposium is designed to balance the source-bed approach with treatment of depositional-environmental and early diagenetic factors.

The first two presentations discuss kerogen as an indicator of depositional environments; and the next three topics examine, respectively, source type shales, source type carbonates, and the evaporitic environment.

Subsequent papers are arranged by geologic age, commencing with studies in the Holocene to late Tertiary, and moving to progressively older strata. This younger-to-older stratigraphic order permits the coverage to begin with examples in which direct or quasi-direct environmental verification is possible, and to follow with investigations in which the evidence is indirect. In this sequence of stratigraphically restricted papers, most of the lithic examples are shales, mudstones, or other argillaceous rocks.

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