Taylor Hill. All three fields had previously produced oil from the O'Hara Limestone Member of the Ste. Genevieve formation. New production has been established in the three fields from the deeper Salem and Warsaw limestone section. Oil in all three fields is found in a combination of structural and stratigraphic traps. New reserves in Ewing East and Taylor Hill total about 400, 000 bbl of oil. The Bessie field is currently in the development stage but preliminary indications show the reserves should greatly exceed those of Taylor Hill and Ewing East.

Recent geophysical work in the Ewing area, employing a portable mini-hole seismic crew, indicates several more untested features which occur along the same Middle Mississippian depositional trend that created the producing facies in the above fields. The new portable mini-hole seismic operation has made it possible to survey areas previously unaccessible by deep hole or vibroseis crews.

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Buried Structures in Marine Exploration

Examples are presented of what most geologists call "buried structures." Improvements in reflection seismograph techniques and data processing have produced deeper penetration and better resolution of data which have led to the location of many "buried structures" in the Gulf of Mexico and other marine areas.

Some of these structures are buried diapirs—some are related to growth fault development. In either situation, local movement ceased and the structures were overridden by sediments prograding over a subsiding basin.

Recognition of these undrilled structures has sparked intense bidding competition in recent offshore lease sales in the Gulf of Mexico and the Atlantic offshore. Buried structures will be important targets in offshore exploration for years to come and will contribute substantially to the nation's reserves of oil and gas.

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Paleochannel Across Louden Anticline, Fayette County, Illinois: Its Relation to Cypress (Chesterian) Stratigraphic Entrapment of Petroleum

Structural mapping of the base of the Beech Creek (Barlow) Limestone across Louden oil field, Fayette County, Illinois, reveals a northwest-southeast trending saddle that is more than 1.5 km wide and 6 km long, and is perpendicular to the major axis of the Louden anticline. This depression coincides with the abrupt appearance of a thick, fine-grained, argillaceous limestone (so-called "false Barlow") subjacent to a regionally normal thickness of coarse-grained, bioclastic Beech Creek Limestone. Sandstone beds in the Cypress Sandstone, which generally underlie the Beech Creek, are thin or absent beneath this area of false Barlow.

This feature is believed to be a major tidal channel that breached deposits of shallow marine or eolian sands that had accumulated along the crest of the anticline. The trend of the channel, perpendicular to the anticlinal axis, and the restriction of the channel to the crestal area only, with no apparent extension off-structure, strongly suggest that the Louden anticline was topographically high during Cypress deposition. The channel was filled during latest Cypress deposition by marine shales and fine-grained limestone (false Barlow). During the main phase of sand deposition, the channel profoundly influenced local sandstone depositional patterns; two thick, offshore sand bars or barrier islands accumulated near its southeastern terminus along the flank of the anticline. These flanking sand bodies pinch out updip against lagoonal shales and are true stratigraphic traps that have since produced several million barrels of petroleum.

The recognition of large marine bar sand bodies in the Cypress Sandstone opens new prospects for oil exploration in the Illinois basin. Henceforth, Cypress sandstones should not be viewed as massive blanket sands or overlapping fluvial channel sands, but rather as complex sequences of shallow marine sandstone. Favorable areas to explore for stratigraphic traps in the Cypress include the flanks of major anticlines, areas of thick false Barlow, and near linear gaps in the areal distribution of Cypress production.

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Depositional Trends of Lower Silurian "Clinton" Sandstone, Northeastern Ohio

The Lower Silurian clastic rocks of the northeastern Ohio subsurface represent a deltaic sequence of complexly intertonguing sandstones and shales. These rock units overlie Ordovician shales throughout the area. The complexity of sandstone and shale facies resulted from migration of distributary channels during the constructive phase of deltaic progradation. At the close of delta growth, a transgressive pattern of lithofacies occurred, culminating in the deposition of a carbonate unit, the "Packer Shell" (Brassfield) which serves as an overlying distinct marker bed for correlation. The overall thickness of the interval between the base of the Packer Shell and the underlying Ordovician shales is nearly constant, allowing these shales to be used as a lower bounding surface for mapping the sedimentary package of "Clinton" sandstones and shales.

Depositional trend maps were constructed using conventional subsurface techniques and compiled using the SYMAP computer contouring program. The total sandstone lithosome of the Clinton and sandstone quality (based on gamma-ray log deflection) are shown on isopach maps of the Clinton. A total of more than 2,600 wells were used in the study of several counties in northeastern Ohio after conventional stratigraphic work was completed.

The trends show dominant sandstone depositional environments in the deltaic sequence which prograded westward on a low slope across eastern and central Ohio. Cross sections delineate the three-dimensional aspects of sand bodies and show the complexity of the facies changes between distributary and interdistributary deposits. The cross sections also show the effect of the interfingering nature of the Clinton reservoirs over small distances on petroleum production. In addition, they illustrate that the threefold subsurface division of the Clinton into the "Stray," "Red," and "White" is not locally reliable; instead the interfingering sand and shale lithosomes should be mapped in this interval.

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Prospects for Coal Development in Michigan Basin

Coal in the Michigan basin is in thin, relatively discontinuous, laterally variable seams of non-coking, high volatile B and C bituminous rank, with a range of 10, 300 to 12,300 Btu.

The known coalfields range in size from about 100 to 1,500 acres (40 to 60 ha.), mostly in less than 250-acre (100 ha.) areas. Known remaining reserves are generally in beds less than 3 ft (0.914 m) thick. Ash and sulfur content are lower in the northeastern part of the basin, 3 to 9% and 1 to 3%, respectively, in the thicker and more continuous seams which have been mined, but to the south and west these qualities deteriorate to undesirable levels. However, it is possible the rank and quality both might be substantially improved by more modern cleaning technologies than were available at the time of the earlier mining when most of the analyses available were made.

The coal-bearing strata are of Early and lower Middle Pennsylvanian age as determined by marine invertebrate and plant fossil paleontologic techniques. This sequence ranges in thickness from the eroded edges basinward to as much as 650 ft (198.12 m) but the thickness is exceedingly variable owing to its deposition on an erosional surface of several hundred feet of relief which was developed entirely on rocks of varying levels of Mississippian age, and to the post–Middle Pennsylvanian erosion surface. The overlying strata in the center of the basin are consolidated shales, siltstones, and gypsiferous deposits of the "Redbeds" sequence of Late Jurassic age. Peripherally to this thin veneer above the Pennsylvanian in the central part, 300 to 600 ft (92 to 183 m) of unconsolidated Pleistocene gravels, silts, clays, and peat buries the Pennsylvanian over most of the areal extent. The relief on this pre-Jurassic plus pre-Pleistocene surface exceeds 200 ft (61 m) in many places and erosional channels appear to have removed the Pennsylvanian strata including the coals in a number of places.

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Devonian Shale Exploration Rationale Tested in Northeast Tennessee

Devonian shale exploration rationales are characterized by some geologic fracture-creating mechanism, for natural fracture systems are essential to natural gas production, even with advanced stimulation technology. One rationale predicts intense fracturing in the shale wherever proximally associated with the major thrust faults of the Appalachian Valley and Ridge province. Gruy Federal No. 1 Grainger County, TN (DOE EGSP-TN9), tested this rationale. The well penetrated the Saltville thrust fault (stratigraphic throw over 10,000 ft or 3,048 m) and encountered 720 ft (220 m) of Devonian-Mississippian Chattanooga Shale in the lower plate. A total of 220 ft (67 m) of core was extracted from the most highly organic intervals of the shale, and a full suite of wire-line logs was run. Widespread and locally intense fracturing observed in the core and evidenced by the logs vindicates the exploration rationale. By the time this paper is presented the well will have been stimulated and the well test results will be available.

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Facies, Paleoecology, and Depositional Environments of Energy Shale Member (Pennsylvanian) and Their Relation to Low-Sulfur Coal Deposits, Southern Illinois

Thick deposits of Energy Shale (Carbondale Formation, Desmoinesian) are associated with low-sulfur coal deposits in the underlying Herrin No. 6 coal in southern Illinois. The Energy Shale consists of wedges, up to 85 ft (25.9 m) thick, which thin away from the Walshville Channel (interpreted as a major distributary channel deposit in the study area).

Facies recognition and interpretation of depositional environments are based upon lithology, sedimentary structures, vertical and lateral relations, geometry, and paleoecology as well as organic matter content and total sulfur content.

Four facies are recognized in the surface mines studies. The thickest and coarsest facies is adjacent to the Walshville Channel and is characterized by numerous fining-upward channel-fill sequences of sandstone, siltstone, and silty shale. It is interpreted as a series of crevasse distributary channel-fills in the proximal parts of splays. This proximal splay facies grades laterally into shale with abundant plant remains, thin coal beds (splits from the Herrin No. 6 coal) and some siderite concretions. It is interpreted as the distal deposits of crevasse splays. The distal splay facies grades laterally into what is interpreted as an interdistributary bay-fill facies consisting of shale with laterally persistent siderite layers. Sixteen miles (25.8 km) from the Walshville Channel, a zone at the top of this facies is extensively burrowed and contains pectinoid bivalves, indicating some marine influence. The bay-fill facies grades laterally and vertically into shale, containing a moderately diverse marine fauna composed mostly of stunted individuals. It is interpreted as a marginal marine facies.

The Walshville Channel and the crevasse splay facies of the Energy were partly contemporaneous with Herrin peat deposition. The sulfur content of the Herrin No. 6 coal is highest beneath the marginal marine facies (the thinnest) and the proximal splay facies (the thickest) of the Energy Shale.

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