well exposed over a very wide area. As a result, there is a sufficient variety of representative structural features and stratigraphic sections exposed at the surface so that it is possible to establish a reasonably accurate evaluation of the oil prospects of this large sedimentary basin.

Normally, in the evaluation of a new sedimentary basin, it is necessary to drill many deep holes to arrive at a fair assessment of the stratigraphic section and the potential oil and gas reservoirs. In the Arctic Islands, however, the exposed stratigraphic sections are so numerous and so conveniently spaced that relatively modest sums of money spent in studying exposed sections can take the place of many millions of dollars spent in acquiring similar stratigraphic detail by drilling. For example, facies studies of the type commonly made between well borings for the purpose of outlining oil- and gas-producing trends can be made in the Islands relatively cheaply by studies of outcrops.

As proof of the above concept, it is shown that hydrocarbon seepages are associated with what has been interpreted to be buried reef trends, and that reefoid and other related buried reservoirs can be identified by surface expression of deep-seated features.

The writer's conclusion is that surface geology, supplemented with seismic and other geophysical methods, will reduce the number of dry holes drilled on the Arctic Islands far below that normally required in a new-basin area.

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Graded Flood Deposits and Turbidites: Comparison and Significance

Similar assemblages of sedimentary structures may be produced in two different environments if similar depositional processes are active in both environments. A study of some non-marine Carboniferous rocks in southeastern Massachusetts seems to support this conclusion.

Several sections of the Pennsylvanian Wamsutta Formation comprise alternations (cycles) of coarse- and fine-grade beds. Most of the alternating cycles represent vertical accretion, over-bank, flood-plain deposits. Many of the beds are graded graywacke which displays sole markings. The grading may be repetitive. These properties generally are thought to be typical of turbidites and deep-water flysch, and of eugeosynclinal deposits. These sedimentary types have been discussed at length in the recent literature, as have other features, including horizontal, ripple-drift, and convolute laminations, and intraformational conglomerate associated with graded sandstone. However, well-developed mudcracks interbedded in sandstones indicate that the normal depositional environment was a sub-aerial one which became periodically submerged and then exposed. The top stratum probably was subjected to these floods on a seasonal or annual basis. The typical sedimentation unit rests on an erosion surface, cuts into the underlying bed, and grades upward from conglomerate or sandstone at the base to massive siltstone at the top. Each sedimentation unit represents an episode of flooding on the flood plain, on levees adjacent to sinuous channels, and in crevasse splays and low-lying areas.

Flood and turbidity currents have much in common: (a) flows may appear suddenly in a foreign environment; (b) flows are characterized by high discharge, velocity, turbulence, and load; (c) the sediment load comprises a wide range of size grades; (d) currents are able to erode the bottom and remove scoured material; and (e) the sediment load is released progressively as the intensity of the flow decreases away from the source. The resulting beds are graded vertically and laterally. Similar depositional processes active in environments as different from each other as flood plains and marine slopes and basins can produce similar assemblages of sedimentary structures.

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Morrow County, Ohio—Case History of Exploration and Production

Regional geologic studies of the Cambro-Ordovician in the eastern part of the United States led to the delineation of several areas in north-central Ohio for further investigation. Reconnaissance gravity, magnetic, and seismic surveys were completed in July, 1960. As a result of these surveys, several acreage blocks were acquired in Morrow County, Ohio, for exploratory drilling to evaluate the possibilities for oil production. The discovery in June, 1961, of the Myers field, located in Canaan Township, Morrow County, was the forerunner of a major exploration and drilling program, resulting in the discovery of approximately 150 oil fields in Morrow County by the end of 1964. Reservoir characteristics, completion techniques, development activity, production, and other information related to the potential of the Cambro-Ordovican in Morrow County and other parts of Ohio are discussed.

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Cambrian and Ordovician Oil Potential of Illinois Basin

More than half of the sedimentary rocks of the Illinois basin are of Cambrian and Ordovician ages. Within the area of the basin where younger Paleozoic rocks already have produced about 2.9 billion barrels of oil, these older sediments still remain virtually unexplored. Three holes have tested the Cambrian and Lower Ordovician rocks within the productive region. The Galena (Trenton) near the top of the Ordovician is productive on the western and northeastern flanks of the basin, but has been tested by less than one well per thousand square miles in the deep part of the basin and on the southern flank.

Cambrian and Ordovician rocks probably are more than 6,000 feet thick in much of the deep part of the basin. They thicken and become finer-grained and darker basinward, indicating that a basin structure was present during early Paleozoic time. The rocks appear to be entirely marine; they contain brines whose salinity is more than 10 per cent. Dolomite, sandstone, shale, and limestone are present in that order of abundance.

Indications of hydrocarbons in these beds on the basin flanks have been slight. Sparse seismic data in the basin and drilling in neighboring provinces indicate that structures beneath the pre-Middle Ordovician unconformity are complex and correspond only in part to those in the younger rocks. Drilling depths of 6,000–14,000 feet, which would be required to test these older rocks, are not great by modern standards.