region, with Lake Huron now on the verge of exploitation. Offshore development in Lake Erie has been concentrated in two main areas: in the east and underlake extensions of the Clinton-Medina gas fields are being proven; in the west end further biostromic Guelph gas-bearing reefs and extensions, as well as dolomitized Trenton oil and gas production are being sought.

Operating problems may be summarized as follows: relatively high costs of offshore contract drilling, short operating season (6–7 months), weather, disappointing results to-date of drilling based on geophysical surveys (seismic, gravity, magnetic, sparker), and attempts by the fishing industry and by champions of possible lake-pollution to prevent lake-drilling. Also the economics of offshore oil production are an unknown factor which will have to be determined by the type of production encountered.

The favorable marketing conditions in the heavily populated areas surrounding the Great Lakes provide ample incentive for offshore exploratory work. However, because of the problems mentioned, one of the main keys to a profitable natural gas operation has been to minimize drilling development and production costs. Some companies have accomplished this by operating their own offshore towers and by sub-contracting the actual drilling operations.

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Structure of Continental Margin of Northeastern North America

During the last 20 years extensive geophysical investigations have been carried out on the emerged and submerged Atlantic coastal plain of the United States. These include over 300 seismic refraction profiles, numerous gravity measurements from both submarines and surface vessels and total intensity magnetic measurements from ships and aircraft.

The geological structure of the area between Newfoundland and Cape Hatteras has been determined in some detail by these measurements. The predominant features are two linear troughs paralleling the edge of the continental shelf and separated by a ridge in the basement. The shelf trough contains up to 18,000 feet of sedimentary material while the outer one contains in excess of 25,000 feet in places.

Comparisons of this structure with the Appalachian Mountain system taken as a whole reveal many interesting parallels. Prior to the Taconic orogeny the Appalachians must have resembled the present continental margin in general characteristics.

The picture south of Cape Hatteras is not as clear. The structure is more complicated and the refraction results are more difficult to interpret due to the presence of calcareous sediments. The Cape Fear arch appears to be the dividing line between the two structural types.

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Marine Seep Detection—New Reconnaissance Exploration Method

Many major oil accumulations of the world are associated with oil or gas seeps. At the least, seeps prove the existence of mobile hydrocarbons in a basin. At the most, and when used with other geological and geophysical data, they can aid in locating exploratory wells.

An effective and inexpensive instrumental technique for locating gas seeps has been developed for use in water-covered areas. If a seep is present, some of the methane dissolves in the water as the gas bubbles rise to the surface. Currents spread this methane-enriched water into a long plume. A boat samples the water continuously, operating over a grid laid out at right angles to the current. The gas dissolved in the water is broken out of solution, and trace concentrations of methane detected using an infrared analyzer. This equipment has detected seeps at distances as great as six miles. A novel system of location using navigational radar is used in carrying out the survey.

Several surveys on marine seeps have been carried out using equipment mounted on various vessels ranging in size from a 14-foot outboard-powered skiff to a coastwise freighter. Under most conditions, the cost of the survey is a few cents per acre. In new basins, the method promises to be of considerable value in localizing areas of interest for more expensive exploration methods.

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Colloidal Nature of Petroleum

The distribution of nitrogen, sulphur, metals, saturates, and aromatics, among the various molecules and particles in petroleum, is of importance in geochemical speculations on the origin of crude oil. Investigations with the ultracentrifuge are believed to give a truer picture of this distribution, while previous studies have used distillation and precipitation that alter the property being studied. Centrifugation of whole crude oil in a preparative ultracentrifuge at about 80,000 times gravity for 2–5 days gives a gradient in concentration of some constituents in the liquid and a relatively small amount of solid sediment. Examination of the solid by x-ray diffraction permitted identification of kaolinite and sodium chloride among the inorganic constituents and high-molecular-weight waxes among the organic. Most of the asphaltenes remain in the liquid phase and are concentrated in the lower portions of the tube along with nitrogen, sulphur, nickel, and vanadium. Layer analysis of the centrifuged samples leads to a particle diameter distribution curve with a maximum at about 60 Angstroms. Viscosity is considerably affected by asphaltene content and can be used as a measure of separation.

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Dependence of Petroleum Source Materials on Rate of Burial

Organic matter, including parent materials of hydrocarbons and porphyrins, is produced by phytoplankton living in oceanic surface waters in quantities far greater than required for petroleum. Mostly, however, these materials are regenerated in the water and at the bottom, and thus are lost to petroleum. An understanding of petroleum genesis includes knowledge of how they can be preserved.

Radiocarbon age determinations at several depths in cores from basins off southern California show that the rate of deposition of total sediment varies from 8 to 125 $mg/cm^2/year$. Highest rates occur in basins close to shore where rates are similar to those for the now-filled Los Angeles and Ventura basins during the Pliocene epoch; the grain size, content of calcium carbonate, and interruption by turbidity currents also are similar. Most of the sediment is detrital silt and