NEW CONCEPTS IN OCEANIC SEDIMENTATION

NORMAN J. HYNE*

February 22, 1971

The deep sea drilling project, deep submersibles, and new techniques in studying deep ocean sedimentation are changing our ideas of deep ocean sediments. The mechanics of sediment transport are becoming controversial as serious objections are raised as to the importance of turbidity current and new contour currents and turbid water layers are being discovered. Continental Drift and Sea Floor Spreading have also strongly influenced the ocean sediments. These concepts of deep ocean sedimentation are now important with the increasing probability that oil and oil traps can be found in this environment.

*University of Tulsa

NORWAY'S EKOFISK FIELD— A LANDMARK IN NORTH SEA BASIN EXPLORATION

JACK H. LEWIS*

October 12, 1970

In seven years, the North Sea has passed from a little-known basin to an established major gas and oil province. Ekofisk Field, the first significant oil discovery, occurs on an elongated dome formed by diapiric movement of the deeper Permian salt. The Danian (basal Tertiary) limestone reservoir has been penetrated by four wells on the structure. Early studies show the limestone is a typical biomicrite consisting of coccoliths and foraminifera, probably deposited in a deep quiet-water environment. Formation tests in all wells indicate reservoir continuity and high production rates of low-sulfur 35° API oil. Commercial production will begin early next year by unusual use of conventional facilities.

*Phillips Petroleum Company, Bartlesville, Oklahoma

MINERAL RESOURCES OF OKLAHOMA

CHARLES J. MANKIN*

The mineral industry provides a principal economic base for the State of Oklahoma, as well as an important source of tax revenue. For the past three years the gross income from mineral resources has exceeded $1 billion annually. This amount ranks the state as fourth in the nation in gross mineral production. However, 95% of the total mineral production is derived from oil and gas. With the declining petroleum reserve picture for our state, the prospects for further expansion and development of the mineral industry will have to rely upon alternative resources. The further development of coal and industrial minerals provides an opportunity to offset the declining petroleum production. Owing to the diversified geology of Oklahoma, a broad spectrum of industrial minerals is available for development. With the advent of the Arkansas River Navigation Program the opportunity for expansion for industrial mineral activities in eastern Oklahoma offers promise for future growth of the minerals industry.

*University of Oklahoma, Norman, Okla.

ROLE OF SEDIMENTOLOGY IN THE DISCOVERY AND DEVELOPMENT OF CARDIUM OIL FIELDS, WESTERN CANADA

ERIC R. MICHAELIS*

March 22, 1971

Two billion barrels of oil are contained in a series of isolated linear sand bodies which form the Cardium Sand. This formation is traceable throughout 10,000 square miles of the Alberta Basin of Western Canada. Traps are purely statigraphic. From the beginning, exploration was aided by synthesis of sedimentologic and stratigraphic data. The talk will trace the history of exploration and development of these giant oil reserves and illustrate the utility of conceptual models in exploration. A variety of models representing regressive deltaic, transgressive shelf and deep sea, turbidite deposition will be discussed. The best model for the Cardium Sand can be

chosen using only the gross geometry and stratigraphy of the tongue. This could be determined from sparse control early in the play. This sedimentologic model of the sand tongue can be used to determine exploration strategy.

*Amoco Production Company, Tulsa, Okla.

NEARSHORE-MARINE SANDSTONES, ROCKY MOUNTAIN CRETACEOUS

D. G. McCUBBIN*

March 8, 1971

Important types of sandstone bodies in the Cretaceous sequence of the Rocky Mountain region include regressive shoreline sandstones and more restricted barrier-island and transgressive-marine deposits. Each is supplied by longshore transport and deposited in nearshore-marine environments. Differences depend, in part, on the rate of sediment supply in relation to the rate of subsidence. Recognition of type and knowledge of similarities and differences provide useful guides in exploration.

Regressive shoreline complexes were formed by seaward progradation of beach and shoreface deposits. They are as much as 100-ft. thick and sheet-like in geometry, extending tens of miles both parallel and perpendicular to the shore. They are replaced laterally and overlain by alluvial deposits, with channels locally scoured into the marine sequence. These sandstones are very common in the Rocky Mountain Cretaceous but rarely contain stratigraphic oil accumulations.

Barrier-island sandstone bodies were formed by upward (and seaward or lagoonward) accretion of beach and nearshore-marine deposits. They also are as much as 100-ft. thick, 10 mi. wide, and tens of miles long parallel to shore. They commonly overlie nonmarine or lagoonal deposits and are overlain by lagoonal or marine shales. Some contain stratigraphic oil accumulations.

Transgressive-marine sandstones occur in significant thicknesses only where transgression was slowed locally by topographic relief. In one example where the paleotopography is related to differential erosion of the truncated sequence ("strike valleys"), the sandstone bodies are as much as 50-ft. thick, a few miles wide, and tens of miles long. They rest directly on the erosion surface, thin laterally by onlap, and are overlain by marine shales. Sandstones of this type contain stratigraphic oil accumulations, but appear to be relatively uncommon.

*Marathon Oil Corporation, Littleton, Colo.

THE GEOLOGY AND DISCOVERY OF PRUDHOE BAY FIELD, EASTERN ARCTIC SLOPE, ALASKA

DEAN L. MORGRIDGE*

November 7, 1970

The Prudhoe Bay Field is recognized as one of the largest oil fields in North America with estimated reserves of five to ten billion barrels. Reconstruction of the geologic history suggests that the combination of geologic controls on the field will be difficult to find duplicated elsewhere.

Hydrocarbons are present in Jurassic and Permo-Triassic sandstone and Pennsylvanian-Mississippian carbonate reservoirs. These strata, locally folded into a westerly-plunging, faulted anticlinal nose, are truncated by a pre-Cretaceous unconformity resulting in the subcropping of progressively older reservoirs to the northeast. Most of the hydrocarbons are trapped below the unconformity and are contained in the Permo-Triassic Sadlerochit formation. This reservoir is present in the field area as a uniform wedge of alluvial-deltaic standstone and conglomerate.

The pre-Cretaceous clastic reservoirs were derived from the ancient Beaufort Arch, north of the present coastline. In contrast, the unconformably overlying Cretaceous and Tertiary sandstone and marine shale were derived from uplifts on the steep south flank of the basin, near the present Brooks Range.

In 1944, during World War II, the U.S. Navy initiated the first extensive Arctic exploration program. This program was carried on for ten years at a cost of over $55 million. Drilling was conducted principally in two areas, the Barrow High and the Arctic Foothills belt. The Umiat Field, located on a foothills anticline, was the largest oil