by the western sea resulted in deposition of red sandstones and conglomerates that lensed out on the positive eastern portion of the area. Resubmergence in the Lower Cretaceous accompanied by east-west faulting divided the area into a deeper southern structural element and a northern platform. Carbonate deposition was almost continuous for the southern element throughout the Cretaceous although embayments contemporaneous with the first stages of submergence resulted in local evaporite development. An extensive evaporite basin existed during the Lower Cretaceous in the shallower and stiller seas of the northern platform. Continued submergence in Middle and Upper Cretaceous resulted in the carbonate covering of the evaporite sequences. Continued deepening and turbidity during the Eocene resulted in the deposition of silty limestones, siltstones, and shales. A general re-emergence at the end of the Eocene is marked by localized occurrences of Oligocene and Miocene limestones and clastic sediments.

The Maya mountains are a positive element that remained static following the late Permian-Triassic emergence. Between the Maya mountains and the northern platform of the Peten lies the Chuquibul embayment, and area that may be of importance for the stratigraphic accumulation of oil.

The basin is buttressed southward by the Santa Cruz Mountains, and east-west Paleozoic range. In front of the mountains lies the Alta Verapaz thrust zone, the effect of Tertiary forces, terminating in an arcuate front extending across the southern portion of the Peten basin.

The southeast end of the Bartlett Deep is represented by Lake Izabel within the basin, and the shore areas of this trough have been filled with a great thickness of Upper Cenozoic sediments.

Oil impregnated rocks, in outcrop and in well cuttings have been found throughout the Cretaceous section and further accumulation is considered likely in the Jurassic redbeds and Permian limestones.

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Pre-Matawan Cretaceous Sediments

The record of the post-Jurassic transgression which caused the formation of the northern Atlantic Coastal Plain begins with the Potomac group, non-marine sediments of early Cretaceous age. Lithologically similar non-marine and transitional sediments of early late Cretaceous age, the Raritan and Magothy formations, overlie the Potomac group. The lithologic similarity of the several formations, and disagreement as to the significance of their contained plant fossils, which are the major means of dating the exposed deposits, have caused some recent confusion in their stratigraphic interpretation.

Recent laboratory and field studies show that heavy minerals are useful for local correlation, and permit the following conclusions.

1. A considerable wedge of Lower Cretaceous sediments is present in the shallow subsurface of southern New Jersey, and was derived principally from the crystalline Piedmont of Pennsylvania and Delaware.

2. During Raritan time the Piedmont was covered by Cretaceous sediments and the materials which make up the Raritan formation were supplied from older sedimentary terranes northwest of the Coastal Plain except in the northern New Jersey-Long Island area which received sediments derived from crystalline rocks exposed in southern New York and New England. Similar conditions prevailed during the deposition of the Magothy formation, but during Magothy time, the Cretaceous sediments were stripped from the Piedmont and it again became a site of active erosion.

3. The Potomac group and the Raritan formations are dominantly fluvial sediments at the outcrop and in the shallow subsurface, but marine facies of the Raritan are present only a few miles downdip from the outcrop areas. No marine Lower Cretaceous has been reported from the northern Atlantic Coastal Plain.The Magothy formation is transitional marine at the outcrop.

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Laboratory Experiments on Form and Structure of Offshore Bars and Beaches

Beaches and bars have been formed during experiments conducted in a 45-foot wave tank at the Sedimentation Laboratory of the U. S. Geological Survey in Denver. By changing one variable at a time, factors responsible for major differences in primary structure and in shape of sand body have been determined. These factors are: depth of water, intensity of wave action, and supply of sand. Stages in the development of the bars and beaches were marked with dark layers of magnetite and cross sections were preserved on masonite boards coated with liquid rubber, thus making a record of cross-stratification patterns and sand-body shapes.

Offshore bars develop at the point of wave break. Where this occurs in very shallow water an emergent bar commonly forms; where it is in somewhat deeper water a submarine bar is built; where still deeper no bar develops. Increase in intensity of waves tends to build a bar forward toward, and even onto the beach. Weaker waves build upward to form barriers with lagoons to shoreward. Abundant sand furnished on the seaward side of a developing bar, simultating conditions developed by some longshore currents, causes gently sloping, seaward-dipping beds to form. In contrast, shoreward-dipping strata of steeper angle are characteristic of bars developed where the sand supply is limited.

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Geochemical Investigations of Athabasca Oil Sands

Analyses were performed to evaluate the organic composition and the mineral content of the McMurray oil sands in northeastern Alberta, Canada. The samples came from the Abasand Quarry near McMurray and from three bore holes, drilled along a southwest-northeast cross section in the Fort MacKay and Bitumount area.

The bitumen content is related to the particle size of the rock. Impregnation is not restricted to one particular sediment type in the McMurray formation. For example, sandstone zones in the Bitumount core were found to contain as much as 17 per cent organic material soluble in methylene chloride; the bitumen content of the shale layers is lower. The elementary composition of the organic material was found to be uniform throughout the entire 246-foot section of the McMurray formation in the core. An organic sulphur content of approximately 5 per cent extends throughout the core. The aromatic character of the bitumen was shown by spectroscopic methods of analysis. The bitumen con-