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SHALLOW SAND BARS AND NEARSHORE PROCESSES

Detailed daily topographic maps of beach and inner nearshore areas indicate a cyclic pattern of processes and responses in this environment. This pattern is the result of complex interaction between shoreline configuration, nearshore sand bars, and environmental variables such as barometric pressure, wind velocity, breaker height, and longshore currents. The key indicator in this pattern is barometric pressure. As it changes there are corresponding changes in coastal processes which thereby cause morphologic changes in the beach and inner nearshore area.

A model can be constructed which is characterized by the following sequence:

(1) During high-pressure and low-energy conditions, a shallow discontinuous sand bar is present with somewhat regularly spaced rip channels. The shoreline is sinuous with protuberances (cusps) behind the sand bars and embayments adjacent to rip channels. Slow-moving longshore currents and small waves prevail. Waves break on sand bars and cause their shoreward migration. Shoreline sinuosity is increased as protuberances grow and embayments are slightly eroded.

(2) Falling barometric pressure results in increased wind velocity and subsequently in greater wave height. The resulting rapid longshore currents are deflected by the sinuous shoreline and rip currents are formed. These rip currents excavate channels in the bars and new sand bars are formed as sediment accumulates in the relatively low-energy areas between rip channels. As a result there is apparent migration of the bar form.

(3) When wind, waves, and longshore currents decline, conditions return to those described in (1) above, but with the bar displaced alongshore with respect to its original position.

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BASAL MARINE AND DELTAIC DEPOSITS OF PENNSYLVANIAN AGE IN WESTERN KENTUCKY

Sedimentary rocks of Early Pennsylvanian age unconformably overlie Mississippian rocks of Chester age in the western Kentucky coal field. Regional truncation of the formations of Chester age and the existence of a series of southwestward-trending channels, commonly incised 200–300 ft into the formations of Chester age, are the main evidence of the unconformity. The main channels are filled with sandstone and shale; the smaller, shorter channels mainly are filled with shale. In the study area, well cuttings containing sparse microfossils, fragments of macrofossils, sandy and oolitic limestone, and glauconite indicate a marine environment during late phases of the filling of the channels. Both the sediments filling the Pennsylvanian channels and the remnant hills of Mississippian rocks between the channels are overlain by deposits of a former river and delta system that presently form a deep freshwater aquifer in the study area. The geometry of this Pennsylvanian river and delta system indicates the distribution of offshore barrier bars, lagoons, tidal channels, delta-front distributaries, and a bar that was probably formed by long-shore currents. Production and shows of oil and gas from laterally equivalent Pennsylvanian sandstone are peripheral to the barrier bars on their former seaward side.

Because the marine transgression probably extended across much of western Kentucky and part of Illinois, other examples of the depositional model suggested here may be present in a much larger area. An understanding of the complex details of early Pennsylvanian deposition may be obtained by applying the principles of the model to adjacent areas.

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PALEOTOPOGRAPHY: KEY TO LOCATING CONCEALED STRUCTURE AND RELATED PETROLEUM TRAPS

Recognition that bedrock structure is reflected by modern topography in many areas has helped in successful exploration for petroleum reservoirs. However, application of this relation in other areas has proved unsuccessful. In such areas, older geologic patterns are concealed by divergent younger ones. Mapping of buried topography related to the older structural patterns may be an exploration technique deserving consideration.

Two established oil regions in Nebraska—one in the southern part of the panhandle (D-J basin) and the other in the southwestern part of the state (Cambridge arch area)—have no recognizable relation between modern topography and underlying petroleum reservoirs. However, mapping of buried unconformities shows a definite relation between the occurrence of oil fields and paleosurfaces. In western Nebraska, oil and gas fields producing from Cretaceous sandstones coincide with paleotopographic ridges on the pre-Tertiary surface with striking regularity. Similarly in southwestern Nebraska, oil fields producing from Pennsylvanian strata coincide fairly well with paleotopographic highs on the pre-Cretaceous surface.

This relation between established oil reservoirs and overlying paleotopography in 2 entirely different geologic regimes indicates a predictability pattern that should be utilized in future development in these and other petroleum-producing regions.

DE VOTO, R. H., F. A. PEEL, J. V. TARANIK, Colorado School Mines, Golden, Colo., and W. H. PIERCE, New Mexico Inst. Tech., Socorro, N.M.

LATE PALEOZOIC TECTONISM IN CENTRAL COLORADO

Detailed mapping and stratigraphic and sedimentologic studies within thick sequences of Pennsylvanian and Permian strata of central Colorado show that most of the major faults called "Laramide" underwent significant displacements in the late Paleozoic. Abrupt eastward facies changes from fine- to coarse-grained sediments and from gray to red strata, and abrupt thinning of the section across the faults indicate that the north-northwest-trending Gore, Mosquito-Weston, Williams Range, and Elkhorn faults were offset as much as 8,000–9,000 ft during the deposition of the Minturn and Maroon strata during the Pennsylvanian and Permian Periods. The Hartsel uplift was faulted as much as 6,000–8,000 ft along its bounding, north-northwest-trending Agate Creek and Santa Maria faults, thereby splitting South Park into several local depositional basins during the Pennsylvanian and Permian.

Lithofacies evidence within Madera (Minturn) strata, and a Permian angular unconformity between the lower and upper members of the Sangre de Cristo Formation show that the north-northwest-trending Pleasant Valley fault was offset as much as 11,000 ft during the Pennsylvanian and Permian. Abrupt facies