laterally traceable beds composed of 1–5μ anhedral and a few euhedral stacked crystals. Two newly discovered occurrences of dolomite are as a minor constituent disseminated in unlithified carbonates and in a carbonate crust in the uppermost layer of a blue-green algal mat. The mat is growing today in a hypersaline lagoon adjacent to Baffin Bay, and the dolomite seems to be penecontemporaneous. The dolomite occurs with other carbonates which are forming as lithified grains embedded in the organic mat material.

With the exception of the lithified aragonite flakes and the lithified carbonate grains in the algal mat, all the lithified carbonates are found at core depths greater than 350 cm.

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Characteristics of Basins with Giant Fields

Approximately 270 giant fields located in 60 basins account for the principal world energy sources. To compare the geologic and historical development characteristics of giant fields, one of several possible basin classifications has been proposed. Three general basin types based on the different crustal thicknesses in *cratons, oceans,* and zones *intermediate* between the two are the basis of a classification of 8 types of basins. There appears to be a relation between the classified basin types and both their hydrocarbon characteristics and, to some extent, their historical development patterns.

Cratonic basins are typified by taphrogenetic, block structures out to the mobile zone where the intermediate crustal zone basins are developed. In general, cratonic basins have high-gravity, low sulfur crude and contain over three fourths of the world's gas and the great majority of known Paleozoic hydrocarbons. They have moderate oil recovery per cubic mile of sediments and are relatively predictable in hydrocarbon character. Intermediate basins are more or less directly related to "sea-floor spreading" and commonly display structural trends at angles to cratonic trends. Depending on the tectonics of the various leading edges of worldwide plates these basins are either intensely or relatively moderately deformed. They are commonly subject to high heat flow, at some time during their development. As a result of their tectonic history they are less predictable and their hydrocarbon characteristics are much more variable than those of cratonic basins. Ocean basins are little known and in water too deep for commercial prospect at present.

Normally accepted geologic conditions for the formation of hydrocarbons are enhanced by several special factors including the presence of evaporites, unconformities, regional arches, and suitable geothermal gradients resulting in giant and supergiant accumulations. The lack of significant reserves in Paleozoic rocks may be related to the advent of post-Permian "sea-floor spreading."

When the history of the world's oil basin development patterns over the last 100 years is analyzed it is noted that: (1) more producing basins are being found, but the industry is experiencing a lower success rate in its search; (2) although half of the producing basins contain giant fields, the odds are that only 1 of 5 or 6 basins have prospects of major reserves; (3) the time required to discover oil and develop it in a basin appears to be related to when it was explored, its size, and its geologic character. These factors are modified by terrain and market relations; (4) there has been a tendency to develop basins more rapidly in recent years.

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New Light on Petroleum Possibilities of the Basin and Range Province, Arizona

In 1947, in his presidential address, Earl Noble cited 6 masks that hamper explorationists in their search for oil: water, overthrust blocks, multiple unconformities, high-velocity limestones, younger volcanics, and thick deposits of relatively young clastics. Improved technology, courage, and success have removed some of these masks in many areas of worldwide exploration, but these masks continue to hinder the search in other areas.

Relatively thick sections of valley fill and volcanic cover have been the chief deterrents to exploration in the basins of southern Arizona. Meager geologic information, poor maps, and the public land situation have added to the negative attitude of companies and individuals. But new data are changing the picture.

Although Edwin McKee pointed out 25 years ago that Paleozoic seaways covered most of southern Arizona and that petroliferous rocks may be present in the intermontane valleys, only in recent years has field work by the U.S. Geological Survey confirmed the presence of Paleozoic rocks in some of the upfaulted mountain blocks. Oil and gas shows in thick Paleozoic sections in southwestern New Mexico and northern Mexico have added to the attractiveness of southeastern Arizona.

Other Survey geologists have developed information indicating a marine embayment of Pliocene age, extending into southwestern Arizona and southeastern California and covering about 15,000 sq mi. It may be larger. More surprising has been the discovery that salt domes exist in Arizona and that salt deposits may extend nearly 350 mi along the northern edge of the Basin-Range province. North of Kingman the salt is more than 4,100 ft thick. Near Phoenix several wells have proved the existence of a dome underlying a gravity minimum. Salt thickness is well over 3,600 ft. Near Florence, palynologists date a caprock core overlying salt as Pliocene(?).

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Effects of Depositional Environment and Postdepositional History on Chemical Composition of Lower Tuscaloosa Oils

The crude oils in lower Tuscaloosa Cretaceous reservoirs in Mississippi and Alabama can be divided into groups on the basis of their chemical compositions. One of these groups appears indigenous to the lower Tuscaloosa interval. The oils in this group, all in unfaulted structural and stratigraphic traps, are located in south-central and southwestern Mississippi, where the lower Tuscaloosa has been subjected to the deepest burial and greatest diagenetic influence. The remaining group of oils in the lower Tuscaloosa are commonly contained by faulted structures. They are situated where secondary migration routes across formational boundaries may have been created or where younger and/or older source beds have been brought into contact with the reservoir sandstones.

The chemical compositions of the crude oils were determined primarily by chromatographic and mass-spectrometric methods. Most useful were the analyses of the individual light-hydrocarbon components, the isoprenoid isoparaffins, the sterane naphthenes, the saturate and aromatic hydrocarbon compound types, and the stable carbon isotope ratios.

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FACIES RELATIONS IN HOLOCENE-PLEISTOCENE COASTAL SEDIMENTS: MODEL FOR INTERPRETATION OF ANCIENT TRANSGRESSIVE-REGRESSIVE SEQUENCES

A correlation model of adjacent coastal sedimentary lithosomes in a Holocene transgressive sequence and Pleistocene regressive sequence has been formed for use in the interpretation of ancient transgressive-regressive coastal sequences. During the present Holocene marine transgression in the mid-Atlantic coastal area, sedimentary lithosomes are forming in a series of coastal sedimentary environments in a typical transgressive vertical and horizontal sequence pattern. These transgressive coastal environments are directly adjacent to and over a mid-Wisconsin or Sangamon high sea regressive coastal environment sequence.

Diagnostic sedimentary structures and textures presently forming in the Holocene coastal sedimentary environments are used to identify adjacent Pleistocene coastal sediment lithosomes. These include beach, berm?, tidal delta, dune, and other barrier subenvironments, and fringing marsh, lagoonal and shallow marine-estuarine environments. Trends of Holocene and Pleistocene barriers diverge 25–35° with additional complexity in areas of major spit development.

In applying the concept "the present is a key to the past," studies of Holocene-Pleistocene transgressive-regressive coastal environmental relations suggest that great caution should be used in attempts to project coastal trends in ancient rocks. Transgressive-regressive vertical and horizontal sedimentary sequences formed during fluctuating sea-level conditions may occur adjacent to each other and appear to correlate. Accordingly, models of lateral and vertical facies relations in adjacent Holocene transgressive and Pleistocene regressive coastal sequences should be of use in facies correlation in similar but ancient geologic settings.

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TEXTURE OF RIVER AND BEACH SEDIMENTS SEAWARD FROM ACTIVE VOLCANIC HIGHLANDS, SOUTHWESTERN GUATEMALA

Sedimentologists have investigated grain-size distributions of sediments from various environments in an attempt to gain uniformitarian insight for reconstruction of ancient environments. However, modern river and beach sediments occurring seaward from active volcanic highlands have been little studied even though ancient analogues may be common locally.

The Pacific coastal plain in Central America is widest in Guatemala where it is abruptly terminated 10–30 mi inland by the steep slopes of a row of active Quaternary volcanoes. The slopes are locally bare of vegetation, and the strongly seasonal, torrential rainfall provides abundant bed load to low-sinuosity streams that discharge onto the coastal plain and flow seaward in a roughly parallel pattern.

Guatemalan river and beach-face sands are mostly moderately to moderately well sorted (river average $\sigma_I = 0.87\phi$ units; beach average $\sigma_I = 0.54\phi$ units), near symmetrical, mesokurtic, medium-grained (river average Mz $= 1.44\phi$; beach average Mz $= 1.45\phi$) volcanic arenites, composed predominantly of unweathered grains of angular volcanic rock fragments, plagioclase, and ferromagnesian and opaque minerals. River sands can be distinguished from beach sands by plotting mean size versus sorting, by coarsest percentile (C) versus median percentile (M), and by inspection of cumulative probability curves. Curves for river sands commonly show subpopulations inferred to reflect sliding and/or suspension populations. Saltation populations, in both river and beach sands, are usually polymodal because of mixing of grain populations differing in specific gravity and shape.

Published bivariant plots and other techniques are assessed in terms of the Guatemalan sands.

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SAND BODY CREATED BY MIGRATION OF FIRE ISLAND INLET, LONG ISLAND, NEW YORK

Dated maps show that Fire Island inlet, with a present channel maximum depth of 10 m, migrated 8 km WSW between 1825 and 1940 (when a jetty was built to stop migration). During those 115 years a substantial sand body, lying entirely below modern sea level, and hence having a high probability for preservation, was created by filling of the shifting inlet channel. The dimensions of this sand body are: length, 8 km; width, ~500 m; and maximum thickness, ~10 m. Assuming a triangular cross section with flat top at modern sea level the volume is 2×10^7 cu m. If average porosity is 25%, the pore space of the inlet filling would accommodate 3.3×10^6 bbl of fluids.

Study of the modern inlet from the bottom of the active channel to the spit at Democrat Point permits recognition of 3 major environments of sedimentation having 10 subdivisions; sediments of each subdivision display distinctive structures. The channel environment extends from 10.0 to 3.75 m below modern sea level. Its subdivisions are: (a) channel floor (−10.0 m), (b) deep channel (−10.0 to −4.5 m), and (c) shallow channel (−4.5 to −3.75 m). The spit-platform environment (−3.75 to −0.6 m) consists of bottomset, foreset, and topset subdivisions. The spit environment (−0.6 to +2 m) includes washover delta, bay (to −2 m), berm, and beachface subdivisions.

Despite the fact that the basal gravel layer is overlain by large sand waves (60–100 m long and 0.5–2 m high), the only large-scale cross-strata occur on washover deltas that occur locally at the top of the inlet sequence. In sands from the deep parts of the channel, where large-scale cross-strata might be expected because of the large sand waves, only small-scale, lenticular cross-strata occur. This absence of large-scale cross-strata results from the effect on the sand waves of reversing tidal currents.