ATLANTIC COASTAL PLAIN TERRACES AND TERRACES

Small sandy accretion beaches border channel peat accumulations which attain thicknesses of 20 feet. These are the sites of woody parts of the delta are occupied by large fresh-water swamp areas between major channels in the older mouths. Central parts of large islands and bark-organic clay, rather than peat. On the margins of the lands constitute most of the active subaerial delta. Al

nally clayey sand with local concentrations of shell forms the bulk of the subaqueous delta deposits. The two sequences are gradational within estuarine facies and conformable along former strandlines. The cyclic formations overlie an unconformity that has been cut into older stratigraphic units. Landward the unconformity surface consists of stream valleys and divides over which the continental sequence was deposited during a rise in sea-level. Seaward the unconformity has been modified by marine scour. The marine sedimentary sequence occurs on this scoured surface. Initial marine erosion proceeds landward during a rise in sea-level until estuaries are filled and sediments supplied to the ocean balance sediments being eroded. From this stage onward, during slow transgression through subsequent regression, coastal-plain accretion takes place seaward with construction of one or more barrier-island and tidal-marsh stages and seaward growth of deltas.

The terminal surface of the cyclic formation is the terrace which contains both continental and marine land forms representing the last processes operative in the area during regression. Thus geomorphology and pedology reflect the terminal nature of the underlying litho-, bio-, and environmental facies. The underlying stratigraphic facies illustrate the cyclic sequence of environmental stages necessary to develop the terminal land form.

Sedimentation in Malayan High-Tide Tropical Delta

The Klang-Langat delta empties into the Straits of Malacca at 3° N. lat. along the west coast of the Malay Peninsula. Both the delta and its catchment basin are located in the wet tropics with mean annual rainfall ranging from 80 to 140 inches. The subaerial delta occupies about 190 square miles. Wave energy levels along this coast are low to moderate; the range of mean spring tides is 15 feet. Tidal processes domi- nate sediment dispersal patterns and control delta form. An extensive tongue-shaped sand bank or shoal (Angsa Bank) is down-drift from the delta. The subaerial delta displays a maze of criss-crossing tidal channels separating mangrove islands. Although the system has the configuration of an estuary, it is in reality a complex delta of the Klang and Langat Riv-

eries.

Six major environments and facies are recognized in the active delta. The most seaward of these consists of well-sorted medium-grained sand deposited on extensive shoals or banks. Sorting reflects intensity of tidal currents. Local concentrations of shell and transported organic debris also are characteristic. This marine sand forms the bulk of the subaqueous delta deposits. Fringing the subaerial delta are broad low tidal flats composed of irregular-bedded, fine-grained sand, silt, and clay. Networks of small tidal creeks dissect the flats; shellfish and other burrowing organisms abound. Bottom sediment in major tidal channels is predominately clayey sand with local concentrations of shell and transported organic debris. Mangrove-overflowed islands constitute most of the active subaerial delta. Al-

though organic production is high, it is overshadowed by fine-grained detritus resulting in accumulation of organic clay, rather than peat. On the margins of the islands small sandy accretion beaches border channel mouths. Central parts of large islands and backswamp areas between major channels in the older parts of the delta are occupied by large fresh-water jungle-covered swamps. These are the sites of woody peat accumulations which attain thicknesses of 20 feet or more.

COLEMAN, JAMES M., SHERWOOD M. GAGLIANO, and WILLIAM G. SMITH, Coastal Studies Institute, Louisiana State University, Baton Rouge, La.

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are very similar in both lithologic character and sequence to those of the compound sedimentation unit of the Stairway Sandstone. However, because of the many thousands of square miles covered by the facies of the Stairway Sandstone, both modern models are considered to be inadequate. Therefore a more hypothetical model of epicontinental-continental sedimentation also is considered. Though having the disadvantage that there is no known present-day counterpart, this model nevertheless warrants some consideration. It is possible to explain many of the features of the Stairway Sandstone (and perhaps other formations) by its use.

CROWELL, JOHN C, Department of Geology, University of California at Los Angeles, Los Angeles, Calif., and ROBERT H. PASCHALL, State Board of Equalization, Sacramento, Calif.

THEME: STRATIGRAPHY GUIDES STRUCTURE: (A) INTERRELATION BETWEEN STRATIGRAPHY AND STRUCTURE (Crowell); (B) VENTURA BASIN, EXAMPLE OF THEME (Paschall)

INTERRELATION BETWEEN STRATIGRAPHY AND STRUCTURE

Earth deformation initially delineates basins and, together with climate and provenance, guides the distribution of sediments. In geosynclines and mobile belts the rise and fall of wells and troughs influence the facies sharply. Even in cratonic regions, tectonic control of sedimentation is clear. Crustal deformation also occurs after deposition, and the positionings and geometric details of structures are controlled by the mechanical properties and inhomogeneities of the strata. In such cases stratigraphy clearly guides structure. In many regions, however, deformation and deposition have occurred together, and an interplay continues intermittently for long periods of time. As a result, deformation guides deposition which in turn guides deformation of sediments. Such an interrelated continuum regulates the movements of fluids, including oil and gas, within the strata.

Modern analysis of basin history requires a careful reconstruction of the interplay between deformation and deposition. The analysis is most effective if one begins with the present and works backward in time, sorting out the geological events and their effects one by one. Knowledge gained recently of modern depositional environments and the geometry and distribution of sedimentary facies within them provides the geologist with reference models of the appearance of his study area in the past. It is not sufficient to visualize static strata as having been deformed suddenly after deposition and lithification. Instead the geologist must find techniques which permit him to reconstruct the panorama of constituent changes not only of the stratigraphy through time, but also the folding, faulting, and movements of fluids within the strata. (Crowell)

VENTURA BASIN, EXAMPLE OF THEME

The sediments of the Ventura basin are more severely deformed than those of most oil-producing provinces. This circumstance, in combination with the narrow linear aspect of the basin and the abundance of outcrops, yields more conspicuous examples of structural-stratigraphic relations than usually are encountered.

The basin's early history reveals a characteristic common to all depositional areas, i.e., the manner in which basin and basin-margin structure affected sedimentation. A second feature of basin history that is not so conspicuous elsewhere is the manner in which stratigraphy affected later deformation of the basin sediments, as well as oil accumulation in them.

Major high-angle reverse faults now exist locally along the north and south boundaries of the main Pliocene basin. The very thick (world-record) Pliocene section not only thins toward these faults, but also typically has a notable decrease in permeable sandstone percentage. The fault zones contain fine-grained terrigenous clastic rocks and siliceous shale, which served as a lubricant for fault movements. The fault zones proba-