

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 epeiric-sea 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.

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#### PALYNOMORPHS AS INDICATORS OF NEARSHORE AND OFFSHORE FEATURES IN MODERN SEDIMENTARY BASINS

Distribution of pollen, spores, cuticles, tracheids, as well as dinoflagellates, hystrichospheres, microforaminifers, and certain other microplankton, may be used within certain limitations to identify or assist in determining sedimentary environments and ancient paleogeographic patterns.

Special consideration is given to the modifying influence of marine circulation, currents, tides, *etc.* on patterns of distribution. Configuration and restrictions of basin and shorelines, patterns of surface or near-surface circulation resulting from prevailing wind regimes (resulting in localized areas of upwelling in different seasons), submarine canyons, and other such agencies and features cause significant modifications on distribution patterns of palynomorphs.

Direction, strength, and season of prevailing winds and storms exert some control in distribution of pollen and spores. Down-wind distribution areas show decreasing frequency from source areas.

Dilution of palynomorph concentrations in the vicinity of deltas and channels, where an abundant supply of terrigenous sediments is accumulating, seems to lower absolute frequencies of palynomorphs only in main channels and very near the shore.

Differential susceptibility to decay, which characterizes these entities, makes it difficult to depend on the presence or absence of particular pollen of plants which make up the communities on the coastal plains to identify nearshore position.

Use of total number of spores and pollen in sediments, to determine positions of former shorelines, should be amplified with a consideration of type of sediment at the sampling site and the nature of thanatocoenoses of marine faunas and algae.

Cuticles and tracheids are extremely abundant in fine sediments near the shore and decrease offshore. Cuticular fragments greater than 1 millimeter in diameter usually are not carried or are destroyed within a few miles of shore; tracheids greater than 50 $\mu$  and finer cuticles are deposited in decreasing numbers 50-100 miles offshore.

Some kinds of palynomorphs increase in relative frequency, compared with total pollen and spores, with increasing distance offshore. Mangrove and pine are typical of this group. Herbaceous pollen generally is more abundant near the shore.

Comparison is made of results of studies of palynomorphs in modern bottom sediments in the Gulf of California, Gulf of Paria, Mediterranean Sea, Sea of Okhotsk, and Gulf of Mexico for the purpose of indicating proximity to shorelines and deltas.

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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 has guided 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 *et cetera*. 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 continuous 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 basinal 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-