

for his exploratory talents; (3) a realization that pricing policies must recognize and accept the changes in cost accounting brought about by increasing concern for the environment and preventing its pollution; and (4) stability of employment prospects, so that he not only obtains a position upon graduation from college, but has assurance in middle life, if he proves competent. It is not only necessary to be a well-trained geologist initially, but he must have continuing curiosity, self discipline, and enthusiasm. He must continue to assert the difference between being a professional and a hired hand.

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SOME CONCEPTS ON CEMENTATION OF SANDSTONES  
(No abstract submitted)

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PETROGRAPHIC ANALYSIS OF SANDSTONES IN STRATIGRAPHIC EXPLORATION

All the fundamental rock properties (composition, texture, and sedimentary structure) are required to determine the depositional environments of sandstone bodies. Once depositional environments have been established, however, petrography alone can be a significant factor in identifying environments. Petrography is particularly useful if only small samples are available, such as core chips or side-wall cores. Thin-section analysis of such samples yields compositional and textural data which can be environmentally sensitive.

This is confirmed by a study of the Muddy Sandstone in the subsurface of the eastern Powder River basin. In this area, barrier bars are characterized by high quartz content (>90%) and low matrix (<10%); delta destructional bars by moderately high quartz (60-90%) and matrix (10-40%); and fluvio-deltaic sediments by low quartz (45%) and relatively high matrix (35%) and rock fragments (20%). The vertical sequence of mean grain-size change in each environment is significant, but maximum grain size is also a key value and is generally a grade coarser in fluvio-deltaic than barrier or delta-destructional sandstones. Plots of quartz mean size versus quartz content are environmentally sensitive, and from only a few thin sections an estimate may be made of depositional environment when other data are not available.

Indirect tools, such as electric logs, appear unreliable for identification of environment, unless the environment is established first on the basis of fundamental rock properties.

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SEDIMENTATION OF PIOCENE SANDSTONES IN SANTA BARBARA CHANNEL, CALIFORNIA

Pliocene rocks in the Ventura basin, including the part under the Santa Barbara Channel, provide an excellent area to study a strongly deformed but essentially intact turbidite basin. Conglomeratic beds, containing typical turbidites, are present along the northern margin of the basin.

Isopach, sand-isolith, and sand-percentage maps of

the Pliocene Repetto and Pico Formations in the east-west Central basin show thick deposits bounded on both sides by thinner deposits in the Rincon trend on the north and the Montalvo trend on the south. Deposition was controlled by partly effective fault barriers on the north and south margins of the Central basin. Sand-isolith and sand-percentage maps indicate local increases in sand in the north on the Rincon trend suggesting the presence of ancient subsea fans in the Repetto and lower Pico. The overall decrease in sand on the west denotes a major influx of sand from the east down the Central basin axis. The first influx of sand from the southern margin of the basin is found on the sand-percentage map of the middle Pico "A." Deposition of sand was also affected by topographic highs associated with growing faults and anticlines.

Distribution, textural properties, primary structures, and microfauna of sandstones in the Ventura basin are comparable to the modern deposits in the nearby Santa Monica basin. Stratigraphic maps reveal Pliocene subsea fans, and observations of outcrops and cores show the same type of beds as described in the Santa Monica basin. Hence, sedimentation was controlled by sand deposition in and at the foot of submarine canyons in the form of subsea fans.

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BEACH AND NEARSHORE PROCESSES AND MORPHOLOGY IN NONTIDAL ENVIRONMENT

Recent detailed studies of the beach and nearshore environments of eastern Lake Michigan have revealed almost no significant differences compared with similar marine environments, except for the absence of marine tidal fluctuations. The morphology and the processes operating in both areas are remarkably similar; however, the rates at which these processes operate appear to be more rapid in Lake Michigan.

Beach profiles reflect environmental conditions which may or may not be associated with seasonal cycles. Storm conditions yield nearly identical flat profiles in both areas with characteristic lag deposits of heavy minerals in the back-beach zone. Quiescent conditions produce accretionary beaches except when lake levels rise gradually for prolonged periods.

The inner nearshore profile in both Lake Michigan and marine areas is commonly characterized by an ephemeral bar which migrates shoreward and is welded to the beach. The bar forms during the waning phase of a storm and migrates shoreward during low-energy conditions. Migration of the bar generally proceeds more rapidly in Lake Michigan than in tidal areas. The crest of the bar is not exposed in Lake Michigan until welding occurs, whereas, it is exposed during low tide in comparable marine environment.

Farther from shore are relatively stable bars whose number and position are controlled largely by the slope of the nearshore bottom. These features also show generally comparable morphology in both areas, although they seem somewhat less stable in the marine environment.

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