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Sedimentology of Terrace Deposits at Bend Area of Wabash River

Late Pleistocene terrace deposits lining the valley walls of the Wabash River record the change in fluvial regime imposed on the river by the advance and disintegration of the Trafalgar (East White Sublobe) ice sheet.

In the lower part of the terraces, sediments accumulated in a shallow braided stream environment where fluctuating flow was controlled by storms and by diurnal and seasonal melt cycles. The sediments consist of: (1) horizontally bedded cobble gravels deposited as longitudinal bars and channel lags; (2) planar cross-bedded pebble gravels that accumulated as transverse bars and lateral accretionary wedges on bar margins; (3) trough cross-bedded pebbly sands deposited in channels during low flow stages; and (4) thin ripple-bedded sands and silts, and laminated muds deposited by spillover into abandoned channels and irregularities on bar surfaces.

Short-term flow variations are recorded by thin alternating bar and channel sediments, which were deposited during waning flow, when channels were cut and filled on surfaces of bars formed during flood stage. Longer term variations are recorded by thicker sequences consisting of thin bar and channel deposits formed during high but fluctuating flow, alternating with thick channel deposits that accumulated during prolonged periods of low flow. These braided stream sediments were deposited during ice advance and intitial stages of ice disintegration.

The other type of deposit occurs in the upper part of the terrances and consists of large-scale trough cross-bedded cobble gravels. These sediments accumulated after the drainage network from the disintegrating ice field was fully developed and uniform rapid flow was established.

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Comparison of Middle Eocene Sporomorph Assemblages from Southern California and Gulf Coast

Fifteen samples from the Delmar Formation and Ardath Shale (lower middle Eocene) and six from the Mission Valley Formation (middle or upper part of the middle Eocene) of San Diego contain about 180 sporomorph (pollen and spore) taxa. The high diversities of Pinaceae-Podocarpaceae, *Ephedra-Ephedripites,* Palmae, Onagraceae, Bombacaceae-Sterculiaceae-Tiliaceae, and perhaps Euphorbiaceae are similar to those of the modern flora of the region. The flora apparently represents a warmer climate than does the coeval flora of the Gulf Coast. The Eocene flora of San Diego only moderately resembles the present flora of southern California and northwestern Mexico—for example, Fagaceae (oaks, etc) are very rare or absent; this suggests a different climate from that of the present (probably more moist and perhaps summer-wet rather than summer-dry).

In contrast, the middle and upper Eocene assemblages of the Gulf Coast are rich in Fagaceae pollen; these assemblages suggest that the Eocene climate was somewhat warmer but otherwise rather like the present climate of this region.

Relatively few sporomorph taxa are common to the middle Eocene of southern California and the Gulf Coast. Sporomorph correlations between the two regions are also difficult at present because the ranges of the San Diego taxa are unknown above or below the middle Eocene in southern California. Nevertheless, *Milfordia hungarica* and *Yeguapollis* may prove to be useful for correlating the middle Eocene from southern California with the palynologically better known Gulf Coast units.

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Miocene calcarenites of Menorca exhibit abundant terrigenous dolomite, both as medium-grained polycrystalline rock fragments and as fine-grained individual abraded crystals. Petrographically, this detritus looks both like neighboring Jurassic dolostones and like Triassic Muschelkalk dolostones of the same general area. To determine which stratigraphic unit(s) provided this terrigenous dolomite we characterized the iron contents of Jurassic and Triassic dolostones, using the electron microprobe, and then, with the probe, we matched the composition of the Miocene detritus with its source. As was expected from their present greater surface exposure, Jurassic dolostones proved to be the principal source. The trace of Triassic dolomite detritus in Miocene samples analyzed is proportionate to the small area of Triassic exposure relative to that of the Jurassic.

Dolomitization of the Miocene resulted in (1) pervasive fine to medium-crystalline dolomite and (2) overgrowths on terrigenous dolomite grains. In some samples, dolomite overgrowths occur in the absence of pervasive dolomite, indicating that seeding by terrigenous dolomite grains enhanced dolomitization. Later calcitization of Miocene dolomite favored centers of the pervasive variety of dolomite crystals and the inner margins of the dolomite overgrowths. These patterns of dedolomite indicate that the two occurrences of dolomite, the pervasive variety and the dolomite overgrowths, are behaviorly correlative, and suggest that they are temporally correlative as well.

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Computer Technique for Color Facies Mapping from Digital Sample Log Data

As a broad brush exploration tool, the regional lithofacies of a rock unit can be mapped in a traditional stratigraphic display with a computer.

Digital sample log data is retrieved for a correlated interval and summarized to yield net feet of various rock types for each well. Rock-type ratios are calculated for a grid, and points are analyzed to determine where they fall on a conventional 100% triangle. A test is made of the isopach to define the limits of the stratigraphic unit. Colors are assigned based upon the subdivision of the triangle, and are calculated and plotted accordingly. Two triangle subdivision schemes are available.

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Preliminary Middle Tertiary Paleogeographic Maps of Area Represented by Two-Degree Los Angeles Map Sheet, California

Recent work by graduates of California State University, Northridge, serves as the basis for constructing six preliminary middle-Tertiary paleogeographic maps of the area represented by the two-degree Los Angeles map sheet of California. The

maps are made partially palinspastic by a limited restoration of rocks along the San Gabriel and Big Pine faults to the positions occupied during the time represented by each map. The maps show that the area was divided into two depositional basins by the northwest-trending San Rafael highland. Fluvial deposition occured in both basins during the Oligocene. In the northeastern Cuyama-Soledad basin, Oligocene-Miocene marine deposits transgressed eastward over a large delta. In the southwestern Ventura basin, marine transgression was from the southwest. In the late early Miocene the ocean breached the San Rafael highland and created a strait between the remaining San Rafael peninsula and the newly formed Ynez island. During the medial Miocene, marine transgression continued, further connecting the two basins into one and shrinking the size of Ynez island. Slight marine regression in the southeast at this time was caused by tectonic uplift in the region of the present-day Simi Hills. During the latest middle Miocene, movement occurred on the San Gabriel fault, thus isolating the Soledad basin and creating an inland lake. With continued fault movement, this lake moved southward during late Miocene and merged with the ocean creating a large estuary. Marine transgression continued in the southeast during the late Miocene, while marine regression occurred in the northwest.

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Internal Breccias near Early Geosynclinal Platform Margins

The Triassic and lower Jurassic limestones of the island of Hydra (Greece) were deposited on the Pelagonian platform, near its western edge which strikes north-northwest-south-southeast. In this region, five main breccia horizons are recognized. Internal breccias are characterized by mutual fitting of clasts, indicating relatively small displacement. Transitions downward into fissures and almost undisturbed rock sections, and upward into mass flows, provide important clues as to their origin. The clasts are generally monomictic and consist of shallow-water, slope or basin ridge limestones. The matrix is derived from above and consists of basin sediments which are commonly red.

Each of the five breccia horizons represents a sequence of: (a) platform buildup; (b) tilting caused by unequal subsidence; (c) deposition of basin sediments on top of the platform carbonates; and (d) brecciation of the platform limestones and absorbing of the overlying basin sediments. In many places, early lithification and repeated brecciation also occur. These main breccia horizons correlate very well with major tectonic phases in the early geosynclinal history of the northern and eastern Alps.

Although submarine breccias are commonly related to faults, there is no evidence for this in the Triassic and Jurassic sequences of Hydra. We suggest that the breccias were produced by large migrating flexures, and that such flexures are a tectonic alternative or substitute for faults in the early stages of Tethys formation. The study of brecciation of the type discussed may provide more precise information on the configuration and evolution of early geosynclinal platform margins and shelf-to-slope breaks.

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Origin of Casing Annulus Gas in Cognac Field and Significance of Marine Sediment Hydrocarbon Surveys

Data clearly demonstrate that a near-surface geochemical anomaly over the Cognac field, offshore Louisiana, is either the result of upward migration along well-defined paths (faults) or is a false anomaly.

A pre-sale (1974) hydrocarbon survey in the Cognac area was discussed at the 1978 annual AAPG convention. Analysis of 6 ft (2 m) deep sediment samples resulted in the delineation of hydrocarbon anomalies that included the discovery well of Cognac field. A part of this survey included the determination of methane δC^{13} values (δC_1) on three sediment samples having anomalous concentrations of hydrocarbons. The δC_1 values (-38.1, -39.2, and -37.3 ppt PDB) plus the methane/ethane ratios (C_1/C_2 = 7 to 15) are excellent evidence for thermal hydrocarbons.

Later, during the drilling of developmental wells, gas pressure buildup was encountered in the casing annulus of several wells. This gas probably enters the casing annulus at casing shoes located about $-2{,}000$ and $-4{,}000$ ft (-610 and $-1{,}220$ m; subsea). The casing annulus gas is nearly pure methane (98.3 to 99.6%), with a C_1/C_2 ratio of nearly 2,000 and δC_1 values around -68 ppt PDB. Thus this gas is of low temperature, bacterial origin. It is probably related to gas shows found between $-2{,}200$ and $-3{,}500$ ft (-671 and $-1{,}067$ m) in these wells.

Thus if the near-surface gas anomaly is the result of leakage from a deep reservoir, the leakage must have developed along well-defined migration paths (faults), so that it did not become mixed with the shallow bacterial gas. Diffusional migration would have resulted in a mixing of bacterial gas and thermal gas.

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Enhanced Oil Recovery Site Selection Using Reflection Seismology

Eight lines of 2-D high resolution seismic data were acquired at a proposed enhanced oil recovery site in Montague County, Texas. Areal extent of the producing field is roughly 200 acres (80 ha.), of which 35 acres (14 ha.) were selected for the experiment. The producing formation is a Pennsylvanian sand, 40 ft (12 m) thick and 1,800 ft (549 m) deep. High-frequency broadband data (50 to 175 Hz) were collected using both shallow (10 ft or 3 m deep) and subweathering explosives. Additionally, a detailed vertical seismic profile was conducted to tie sonic logs to the seismic data. Results confirmed an area of good reservoir continuity while eliminating others owing to small-scale faulting and changing sand thickness.

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Tectonic History and Progressive Development of Fold-Thrust Belt in Eastern Gulf of Alaska

The geology of the Gulf of Alaska, east of Kayak Island, records the temporal variation of three fundamentally different tectonic settings that developed owing to the interaction between plates along the western margin of North America. A late Meosozic to early Tertiary convergent margin setting is indicated by nearly contemporaneous plutonic belts, forearc-basin sequences, and accretionary terranes. In contrast, the middle Tertiary continental margin in the eastern Gulf of Alaska was relatively stable and is characterized by sedimentation in a subsiding basin with local extensional tectonism. The present tectonic setting was probably initiated during the