and the upward transition from flood to ebb dominance are interpreted as reflecting the onlap of estuary-mouth sands over inner estuarine channel/shoal deposits.

The closest modern analogs to this type of transgressive sequence are the estuarine retreat sand complexes on the eastern United States shelf.

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Understanding Field Development History Using 3-D Seismic Survey

A mature oil and gas field in south Louisiana produces from multiple pay zones having various fault-related traps, simple closures, and stratigraphically controlled sands. Seismic understanding of the field is complicated by an ancestral river channel, its tributaries, and surface variances such as lakes, marshes, and canal levees. Surface access restrictions include wells, flow lines, tank batteries, and oyster beds. A careful study indicated the field to be complex, thus opening the possibility of further development if the significant subsurface parameters could be better defined. A 3-D seismic survey was planned and conducted to explore this possibility.

The 3-D survey was implemented using dynamite as the source with a "3-D swath" layout of shot-and-receiver locations. Approximately 4 sq mi (10.4 sq km) of 6-fold subsurface control was obtained with depth-point spacing equal to 82 ft (25 m) in both directions. This closely spaced control provided adequate subsurface definition of the proposed objectives. A 3-D migration algorithm was used for proper subsurface imaging of the data and yielded good fault definition. The regularly spaced 3-D migrated data were displayed in a series of equally spaced horizontal sections and printed in a movie format. These data were used by interpretive personnel to generate a set of depth maps that compare favorably with those generated in a conventional manner. Subsequent drilling in the field has demonstrated the validity of the technique.

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Trace-Makers as Historians in Large-Scale Cycles of Western Interior Cretaceous Strata

Previously established stratigraphic framework and gross depositional history have permitted analysis of nature and distribution of trace fossil assemblages from western margin to basin center for upper Albian to lower Maestrichtian deposits of the western interior sea. Cluster analysis of trace variety and density reveals distribution patterns which represent habitats similar to those determined previously for mollusks. Trace fossil "habitats" were, however, controlled more closely by substrate nature and events related directly to sedimentation than were the habitats determined by body fossil analysis. Changes in sediment type, depositional rate, and early diagenetic phenomena were recorded with greater accuracy by these groups of trace-makers, which may be used to elucidate the more detailed history of the study interval. The analytical method was applied to several bioturbated carbonate beds of the Greenhorn Limestone that are traceable over large areas of the basin. Bed-by-bed analysis suggests that subtle changes in depositional parameters and/or nature of overlying water column were imparted to certain beds with distinct and characteristic trace fossil assemblages. Basin-wide analysis and mapping of trace fossil assemblages from such beds can be used to improve environmental resolution of this part of the Upper Cretaceous.

Despite great utility of these trace fossil assemblages for environmental analysis, gross interpretations (e.g., water depth) based on trace fossil assemblages alone, must be made with caution. Traces from "deep-water" Upper Cretaceous carbonate rocks are compared to traces in texturally similar but clearly shallow-water Illinois basin Mississippian carbonate rocks. Environmental parameters such as salinity or oxygen availability, that are less readily suggested by lithology, may be largely responsible for such trace fossil assemblage similarities.

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Organic Facies—Stratigraphic Concept and Exploration Tool

An organic facies is a mappable subdivision of a stratigraphic unit, distinguished from the adjacent subdivisions on the basis of its organic matter (OM), without regard to the inorganic aspects of the sediment. Both the concept of organic facies and its usefulness to explorationists are based on the following facts: (1) OM in sediments consists of several types which can be distinguished by microscopic and geochemical techniques; (2) different types of OM generate and migrate different amounts and types of oil and gas; (3) the same types of OM, and consequently similar generation products, commonly extend over thousands of square miles laterally and hundreds of feet vertically; (4) the distribution of organic facies is not capricious, but is determined by the origin of the organic remains and the free oxygen of the depositional environment; (5) organic facies can be mapped and extrapolated; and (6) the organic facies concept is a major exploration tool because it aids in understanding and predicting both the location and types of oil and gas deposits.

Several organic facies are defined by the microscopic, geochemical, generation, and migration characteristics of their OM, and examples are given of their geologic setting, vertical and horizontal distribution, and their economic significance.

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Trace Fossils and Stratigraphy of Devonian Black Shale in East-Central Kentucky

In recent years trace fossils have been studied in carbonate and siliceous rocks. Shales have largely been ignored. This study describes trace fossils from the "anoxic" Upper Devonian black shale in east-central