to be straight or have a low sinuosity with sediment fills ranging from fine mudstones to coarse-grained sandstones. Delta-plain deposits consist of lagoonal, bayfill mudstones and small-splay or bayhead-delta sandstones formed in areas behind and marginal to the delta front. Numerous coarsening-upward sequences are capped by localized coals. Fluvial and upper delta-plain areas consist of channel, levee, and backswamp materials that are laterally discontinuous.

Features such as those observed in these wave-dominated delta deposits are easily recognizable on seismic lines. The seismic lines can be used to target favorable areas of hydrocarbon and coal accumulation.

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Hydrocarbon Exploration in Western Approaches, Offshore England

The North Sea has matured into its production phase and explorationists are now searching for hydrocarbons on the Atlantic continental margin west of England. The Western Approaches, one of these new exploration frontiers, is currently the subject of drilling to test hydrocarbon potential.

The Western Approaches forms an ENE-WSW trending structural trough southwest of England extending from the mouth of the English Channel westward to the edge of the continental shelf. The basin is believed to be the failed arm of a triple junction which originated in Permian-Triassic rifting associated with separation of the North American continent from western Europe and the opening of the Atlantic.

Seismic and gravity data indicate good sediment thickness in which Permian-Triassic, Jurassic, Cretaceous, and Tertiary sequences have been interpreted. Structure of the basin has been strongly influenced by Hercynian related tectonism in basement rocks. Four wells have been drilled within the last 18 months as the first exploratory attempts in this basin.

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Hydrocarbon Potential of Matilija Sandstone, an Eocene Sand-Rich, Deep-Sea Fan and Shallow-Marine Complex, California

The Matilija Sandstone Member, exposed in the Santa Ynez Mountains, California, records a major regressive event in the Eocene Santa Ynez basin in which turbidites were deposited in the basin and subsequently covered by shallow-marine complexes. Despite thick favorable source beds and generally good initial reservoir characteristics, the Matilija sandstone is not a productive unit in the basin. Lowered reservoir rock permeability (<1 md) and porosity (0-10%) are due to early compaction, cementation, and diagenesis.

The lower part of the Matilija sandstone is a 700-m-thick sand-rich deep-sea fan complex which overlies basin plain and turbidite deposits (Juncal shale). The Matilija sandstone consists of anastomosing outer-fan depositional lobes overlain by channelized middle- and inner-fan deposits. Cross-bedded sandstone, red-bed, and carbonate-evaporite sequences overlie the turbidites. Matilija sandstone deposition closed with rapid transgression which culminated in the deposition of basin plain and turbidite deposits (Cozy Dell shale).

The Matilija sandstone lower deep-sea fan complex has a high sandstone and shale ratio (4:1) and consists of submature arkoses of facies B. The average sandstone is medium grained, moderately sorted, subangular, massive, and contains 40% quartz, 35% feldspar (about equal amounts of potassium and plagioclase feldspars), 10% lithic fragments (mostly granitic and volcanic types), and smaller amounts of mica, chert, and heavy minerals. Early compaction, carbonate cementation, and authigenic pore-lining chlorite, albite, and quartz have reduced the initial porosity and permeability. Minor secondary fractures are the only effective porosity in these rocks now.

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Nearshore Lithofacies of Mannville Group, Lloydminster Heavy Oil Area, Saskatchewan

The Lower Cretaceous Mannville Group comprises a 200-m succession of poorly consolidated, fine-grained sandstones and shales in the Lloydminster heavy oil producing area of west-central Saskatchewan. Detailed study of closely spaced cores from several oil fields indicates the presence of six major lithofacies (here denoted by letters), and suggests some provisional interpretations of depositional environments.

Facies L consists of well-sorted sandstone characterized by low-angle cross-lamination and hummocky lamination. Nearly all oil production is from multistory facies L sandstone bodies, which average 5 m in thickness and commonly pinch out over a few hundred meters. Facies T includes moderately sorted sandstones with multidirectional trough cross-lamination. Facies M is composed of massive, fine to medium-grained, poorly sorted sandstone. Facies B comprises bioturbated sandstone-shale sequences with abundant oscillation ripples, desiccation cracks, and flaser, lenticular, and wavy bedding. Facies S includes two subfacies: massive shales (S_1) are commonly associated with laminated shales (S_2) that display desiccation cracks as well as flaser, pinstripe, and tidal bedding. Facies C comrises thin lignite beds composed of terrestrial plant debris.

Sedimentary structures in facies B and S indicate shallow-water deposition with intermittent exposure typical of tidal flats. Characteristic structures of facies L and T suggest beach, offshore bar, or sand-flat depositional environments. Facies M may represent thin channel fills. Intimate association of the lithofacies in vertical section indicates a nearshore depositional setting for the Mannville Group. A substantial number of petroleum reservoirs in the Lloydminster area appear to be intertidal sand bodies rather than the fluvial channel fills suggested in some previous studies.

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