Detailed facies analysis of Holocene marsh deposits in coastal Delaware reveals a variety of environments of varying organic composition. An understanding of the depositional environments and early diagenetic histories of these sediments is necessary to evaluate their potential as source rocks.

Distributions of marsh facies are related to sea-level changes, compaction, shoreline configuration, drainage, sediment supply, and other factors. The overall factor controlling marsh deposition in coastal Delaware is relative sea-level rise. This produces a transgressive sequence of fresh- to brackish- to salt-marsh deposits. Three typical stratigraphic sequences are developed: broad marsh-continuous barrier sequence, broad marsh-discontinuous barrier sequence, and tidal-river marsh sequence. The first two sequences contain predominantly high- and low-marsh sediments. The tidal-river sequence contains thick sections of brackish-marsh sediments. Freshwater and salt-marsh sediments may contribute significant and relatively equal amounts to that sequence.

Degradation of plant fragments can be related to surface conditions in depositional environments as well as to changes that occur with depth. Some marsh sediments are better potential source rocks than others. Carbon values are largest in detrital organic facies, large in brackish-marsh facies, variable in high-marsh facies, and small in low-marsh facies. Noncarbonate carbon values range from 2.33 to 10.9. Premaceral compositions show small amounts of preresinites, presclerotinites, and fusinites, and large amounts of premicrinites. The largest previtrinitic, preresinitic, premicrinitic, and presclerotinitic compositions occur in brackish-marsh facies. Kerogen typing suggests these sediments might produce hydrocarbons with both humic and lipid compositions.

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Deep Basin, Alberta

The Deep Basin, Alberta, is the site of a major gas accumulation which will have a profound impact on the North American energy scene. Approximately 20% of the total western Canadian drilling activity over the past year has been within the limits of the Deep Basin.

Hydrocarbons have been found in 20 rock units ranging in age from Permian to Late Cretaceous. The majority of the reserves are contained within the Lower Cretaceous Spirit River Group and the Jurassic Nikanassin formation. Spirit River sediments were deposited in a series of transgressive and regressive cycles which can be mapped by gross lithologic characters and verified by sedimentologic and paleontologic criteria. The most favorable reservoirs are developed in chert-granule and fine-pebble conglomerates and associated medium-grained sandstones which are characteristic of a beach environment. Finer grained, poorly sorted sandstones of the foreshore facies form the reservoir for tight-formation gas. An even larger resource of tight-formation gas is found in the fluvial sandstones of the Nikanassin which present the same technologic challenges to economic development as their Spirit River equivalents. Detailed petrophysical studies have been utilized in the design of drilling and completion programs and the interpretation of potential pay horizons.

The current oversupply of gas in western Canada will result in the deferment of tight-sand gas production until additional markets become available.

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Tectonic Significance of Microstructures in Idaho-Wyoming Thrust Belt and Hinterland

Mechanics of foreland thrust belt development can be explained using paleostress orientations from dynamic analyses of microstructures in quartz, calcite, and dolomite. Deformation in the hinterland must also be considered since the two basic models—gravity spreading and lateral tectonic compression—predict substantially different stress fields in this region.

Petrofabric studies in the Meade plate show that compression was dominantly layer-parallel, trending approximately east-west. On overturned fold limbs, compression at 50-80° to bedding suggests a locking angle which agrees well with existing theoretical and experimental analyses of kink-folding. Observed kink-fold geometries may be a necessary result of ramp configurations in the decollement thrust surface. These data are in accord with either of the two principal models.

Dynamic analyses at scattered localities in the southern Idaho hinterland show primarily layer parallel or subparallel, east-west compressson in all demonstrably allochthonous rocks at all structural levels. Fold vergence and local overturning indicate eastward translation along the undated, but probably Mesozoic, younger-over-older thrusts characteristic of this region. Near metamorphic core complexes, Tertiary thermal events may have affected preservation of older microstructures. Parautochthonous Precambrian metasediments between foreland and hinterland record compression at high angles to bedding. The age and origin of these microstructures are unknown at present.

These studies indicate that maximum compression was nearly horizontal and oriented approximately east-west throughout southeastern Idaho during thrust belt activity. Therefore, the lateral tectonic compression model is favored.

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Permian Trace Fossils of Western Wyoming and Adjacent Areas

Burrows are common to abundant in much of the Permian Phosphoria Formation and correlative units in western Wyoming and adjacent states. Surface traces are rare. Coarse phosphorite units are characterized by straight, full-relief traces with fine-grained fillings. They are commonly horizontal but some are vertical. Sandstones contain burrows varying greatly in orientation and regularity. Carbonate rocks and certain cherty units typically contain burrows similar to those of modern crustaceans; the burrows are filled with skeletal material, fine-grained carbonate rock, phosphorite, or chert.