The Oligocene-Miocene section along the deep western gulf apparently was deposited as part of an older deep-sea fan complex with a western source. The lower part of the fan sequence (Oligocene-middle Miocene) is characterized by strong, discontinuous reflectors and is interpreted as relatively coarse-grained material deposited in a channelized midfan environment. The upper Miocene part of the fan consists of fine-grained laminites and is characterized by prograding clinoforms, deposited as lobes seaward of a midfan zone of bypass.

The overall upper Tertiary fining-upward sequence in the western gulf and the gradual cessation of turbidites from a western source probably were due to the late Tertiary development of the Mexican Ridges foldbelt. This foldbelt apparently formed, or is still forming, owing to large-scale downslope gravity sliding of a more competent Tertiary section over incompetent, possibly geopressured, shales.

The northern margin of the deep Gulf is defined by the Sigsbee Scarp, which represents the southern extent of a zone of salt deformation along the entire Texas-Louisiana slope. The western scarp bulges southward and is characterized by salt wedges thrust 10 to 15 km seaward over Pleistocene rise sediments. East of the bulge area the scarp is formed by the seawardmost series of vertical salt ridges that have uplifted and deformed Pleistocene sediments. The salt deformation along the scarp probably is continuing today as a result of both downslope gravity forces and massive sediment loading in a large Pliocene-Pleistocene depocenter farther upslope.

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Hydrocarbon Accumulations in Overthrust Belt of Alberta

Estimated proved and probable ultimate reserves of marketable natural gas in Alberta are 80.5 Tcf of which approximately 10.5 Tcf are in Paleozoic carbonate reservoirs that have been involved in thrust faulting in the Foothills belt of Alberta. Interpretation of exploration data in this belt has contributed significantly to our understanding of the geology of the southern Canadian Rocky Mountains as a whole.

The Foothills belt is the easternmost of four major physiographic and structural divisions of the southern Canadian Rocky Mountains between the interior plains and the Rocky Mountain trench. The eastern boundary of the Foothills belt is marked by a zone of underthrusting, referred to as the triangle zone. The western boundary is defined by the surface trace of major thrusts which bring Paleozoic or older strata to the surface.

The Precambrian basement dips regionally to the west and is not involved in thrusting. The basement is overlain by a westward-thickening prism of Paleozoic sedimentary deposits which contain important reservoirs in Upper Devonian and Mississippian carbonate rocks. Approximately 8% of the reserves are in the Upper Devonian and 87% in the Mississippian. There is close correlation between reserves found and facies trends within the Mississippian Rundle Group. A widespread organic-rich source rock, the Exshaw Formation, provided the major charge for both Mississippian and Devonian reservoirs. Jurassic marine shales overlie the Mississippian in the southern part of the belt and form an effective seal and possible source rock. In the northern part of the belt, the Mississippian is overlain by Triassic sedimentary rocks in which reservoirs are present. The overlying Cretaceous and Tertiary section consists of clastic deposits, both marine and nonmarine in origin. Cretaceous sandstones generally lack reservoir qualities and less than 5% of the reserves found to date are in the Cretaceous.

The Foothills belt is divided longitudinally into two zones, an eastern or outer Foothills belt, and a western or inner Foothills belt. The outer Foothills are characterized by closely spaced listric thrust faults that repeat the Mesozoic section. Some of the thrusts cut deep enough to carry a single or multiple thrust slices of Mississippian carbonate rocks. Trap capacity is governed by horizontal displacement, vertical uplift, convergences of allochthonous and autochthonous structural strike, and probable seal quality of the thrust planes. Approximately 18 significant gas-bearing structures containing 5 Tcf marketable reserves have been discovered. Jumpingpound and Jumpingpound West are typical fields in this belt.

The surface geology of the inner Foothills is characterized by outcrops of Paleozoic carbonate rocks and relatively undeformed Mesozoic strata. The thrusts in this zone usually have large displacements, measured in tens of miles and commonly involve most of the Paleozoic section. Usually two or more thrust sheets are stacked in a general anticlinal form and provide multiple objectives. To date, 14 gas-bearing structures have been discovered in this zone containing approximately 5.5 Tcf of gas. The gas-bearing structures in the Waterton-Carbondale and Moose Mountain Panther River areas are typical. Previous interpretations which attempt to relate the gas-bearing structures of the Foothills belt to faulted stratigraphic traps or ancestral folds seem untenable. The gas-bearing post-lower Paleocene structures probably are related to the time of maturation of the major source rock and the west-to-east deformation of the southern Canadian Rocky Mountains. Despite the large areas of the Alberta Foothills belt in which exploration is restricted, it is estimated that 6 to 15 Tcf of gas may still be found.

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Application of Depositional Models in Coal Exploration and Mine Planning

Geologic studies have shown that many parameters of coal beds (thickness, continuity, roof and floor rock, sulfur and trace-element content, and ash) can be attributed to the depositional environment in which the peat beds formed and to the tectonic setting at the time of deposition. With an understanding of the depositional setting of the coal seam and contemporaneous tectonic influences, the characteristics and variability of many of these parameters can be predicted.

On a regional scale, depositional models can be used to predict the trends of coal bodies. At the lease-tract level, coal thickness variations are closely related to the preexisting depositional topography. In addition, the