of Mississippian carbonate rocks. Trap capacity is governed by horizontal displacement, vertical uplift, convergences of allochthonous and autochthonous structural strike, and probable seal quality to the thrust planes. Approximately 18 significant gas-bearing structures containing 5 tcf marketable reserves have been discovered.

The surface geology of the Inner Foothills is characterized by outcrops of Paleozoic carbonate rocks and relatively undeformed Mesozoic strata. 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. 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 14 tcf of gas may still be found.

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On the Use of the Modified Lopatin Method

The modified Lopatin method (detailed description in AAPG Course Note Series 17) can provide quick estimates of the state of organic metamorphism. To do so, it is necessary to evaluate the thermal history of a potential source rock. Under favorable conditions, such as uniform burial in an environment of constant geothermal gradient, it is possible to approximate the actual thermal history by a linear temperature rise. For such simple situations, the method yields essentially instantaneous results without the help of any artificial aids. The method is equally applicable to more sophisticated models, but those require a careful analysis of the burial history and an evaluation of the possible changes of the terrestrial heat flow during the lifetime of a source rock.

Examples of the use of the method will be shown and the current limitations imposed by various uncertainties and approximations will be discussed.

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North-South Compression of Rocky Mountain Foreland Structures

Petroleum exploration beneath Precambrian on the flanks of Rocky Mountain foreland structures has revealed substantial throw on east-west-trending thrusts which has not been predicted by underthrust models of west-directed tangential compression. Recognizing this north-south compressional component in the foreland necessitates a new look at the forces that formed these structures.

Initial compression that developed foreland structures was dominantly from east to west and was caused by westward movement of the North American plate during the opening of the Atlantic Ocean in Late Cretaceous. Atlantic spreading progressed to the North Atlantic and Arctic Oceans in Late Cretaceous and early Tertiary. It is proposed that movement of the North American plate evolved from west to southwest to south, causing not only significant southwest and south movement on several foreland basement-involved thrusts, but also termination of movement in the detached Idaho-Wyoming-Utah thrust belt.

Major east-west-trending foreland structures include the Owl Creek Range, the south flank of the Wind River Range and the south flank of the Granite Mountains in Wyoming, the Uinta Mountains in Utah, and the north flank of North Park basin in Colorado. North-west-trending foreland thrusts, such as the southwest flanks of the Casper arch, and Gros Ventre and Wind rivers in Wyoming developed during the transition from east-west to north-south compression.

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Investigation of Beasman Prospect, Sykesville Mining District, Maryland, with a Proton Precession Magnetometer

The Sykesville copper-iron district is centrally located in the Piedmont upland of Maryland. Extending through the northeastern half of the district is the Monroe and Beasman prospect, where magnetite-quartz veins occur in steeply dipping faults or shear zones. To find the locations and configurations of the veins, traverses parallel and perpendicular to the strike of known localities of magnetite have been made using the proton precession magnetometer. A magnetic anomaly map with profiles will be developed and interpreted using the dipole system method and known geology of the area. Preliminary results suggest that the veins are discontinuous parallel to strike and dip toward the southeast.

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Near-Surface to Deeper Burial Cementation Patterns and Foreland Basin Evolution, Middle Ordovician Ramp Carbonates, Virginia

Middle Ordovician ramp carbonates, Virginia, were deposited in a subsiding foreland basin bordered by developing tectonic highlands. Ramp carbonates are largely occluded by nonferroan, clear rim, and equant cements which contain cathodoluminescent zones consisting of nonluminescent (oldest), bright and dull (youngest) cements. The zonation largely relates to increasingly reducing conditions of pore waters. Zoned cements in peritidal beds have complex zonations, pendant to pore-rimming fabrics, and are associated with vadose silt (which abuts all cement zones); these cements are vadose to shallow phreatic. Major cementation of subtidal facies occurred under burial conditions. Zoned burial cements have a simple zonation reflecting progressive burial (up to 3,000 m) of carbonates. Shallow burial nonluminescent cement formed from oxidizing, meteoric waters which expelled anoxic, connate marine waters; meteoric waters were carried by aquifers from tectonic upland recharge areas. Deeper burial, bright and dull cements formed at depths (2,000 to 3,000 m) and temperatures (75 to 135°C) associated with hydrocarbon emplacement during the Late Devonian or Mississippian. Final, clear dull cement fills tectonic fractures and was emplaced during late Paleozoic deformation. Deeper burial diagenesis appears to be genetically linked to late Paleozoic, Mississippi Valley-type mineralization. Zoned peritidal and burial cements are mainly confined to southeastern parts of the ramp, where cementation was influenced by meteoric waters from developing uplands on the southeastern margin of the foreland basin and carried northwest by aquifers. Cements in northwestern peritidal and subtidal ramp facies are dominated by nonzoned dull cements, where cementation was little influenced by upland-source meteoric waters. The close association of zoned cements and regional