gas sand. Through detailed examination of the geology and evaluation of alternative explanations of the waveform changes, successful interpretation was accomplished.

Total gas reserves geophysically discovered to date in the Colony formation are estimated at 110 Bcf.

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Vertical and Surface Seismic Profiles Map Aquifers in Madison Group and Red River Formation, Powder River Basin, Wyoming-Montana

Intensive energy development activity in the Powder River basin of eastern Wyoming has placed heavy demands on the water resources of the state. The U.S. Geological Survey is therefore investigating the water resource potential of the Madison Group and Red River Formation, such water to be produced from depths of 2,500 to 7,500 ft (762 to 2,286 m) to supply some of the needs. The exploration seismograph is a promising tool to aid in well-site selection; under some conditions it can be used to detect porosity development at depth.

In-situ measurements of the acoustic properties of the Madison–Red River interval have been made using vertical seismic profiles in several wells. Surface seismic profiles were then run over the wells. The combination of these results with well-log data and regional geologic subsurface studies gives considerable insight as to commercial quantities of water at depth.

The investigation also has petroleum-exploration significance. Madison porosity development often provides an excellent oil and/or gas reservoir in the adjacent Big Horn and Williston basins.

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Explorable Structures in Old Bahama Channel, North of Cuba

Approximately 3,500 km of reflection seismic profile, augmented by some gravity and magnetic data, revealed five domal structures beneath water depths of 500 m in the western reaches of Old Bahama Channel. Closure crossings span as much as 10 km. Cores of these structures are overlain by up to 400 m of semiconsolidated sediment. Cores may be salt diapirs or subducted shallow-water carbonate blocks or both. The size of these structures and their occurrence in relatively shallow water make them attractive exploration targets at the present time.

Additional seismic characteristics of the semiconsolidated sediments comprising the basin fill are (1) extensive continuity of reflections probably resulting from interbedding of shallow-water carbonate turbidites with pelagic oozes, and (2) crinkling of reflections at depths of several hundred meters which may be a compaction phenomenon. Normal faults are common in the sediments. In some places, related faulting and apparent flowage in the sediments may result from compaction and attendant water loss or from flowage of evaporites deeper in the section.

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Graded Beds as Paleogravimetric Cameras

Physicists over the past century have postulated that the universal constant of gravitation, G, is decreasing with time. Assuming an annual rate of decrease of 10^{-10} parts per year the gravitational acceleration of the earth, g, would have been 22% greater two billion years ago. Distal turbidites occur in geologic deposits as old as 2.5 billion years. Utilizing the relations developed by Scheidegger and Potter, a functional relation between g and measurable characteristics of a graded bed may be constructed. This relation, a "paleogravimeter," was tested in terms of sensitivity to changes in g as well as possible confounding effects such as sediment concentration, density, and grain packing. Only the sediment concentration in the turbidity current had a measurable effect. By utilizing Middleton's result that the transition between "distribution" grading and "coarse-tail" grading occurs at particle concentrations of 30%, a selection criteria can be established for the "paleogravimetric camera." In this respect it is meaningful to measure only beds deposited from currents of the same particle concentration. When this is done the paleogravimetric change can be measured. The paleogravimetric camera can be improved by substituting more realistic relations for Stokes' Law and allowing viscosity to vary as suggested by Roscoe. Preferably however, a purely physical model for sedimentation from a turbidite should be developed in place of the Scheidegger-Potter relation.

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Retrogradational Shelf Sedimentation: Viking Sandstone (Lower Cretaceous), Central Alberta

The Viking Sandstone in the Joffre-Joarcam area of central Alberta consists of a series of overlapping sediment sheets becoming progressively younger westward toward the paleoshoreline. During the regression at the beginning of Viking deposition, streams meandered across the former shelf surface depositing sand in deltas (today's irregular-shaped reservoirs). An ensuing transgression, punctuated by minor regressions, reworked shoreline sediment deposited during the regressions into linear shelf sand bodies (today's linear reservoirs west of the irregular-shaped reservoirs). During the transgression, the retrogradational nature of the sediment sheets, which contain the sand bodies, was formed.

Well-log cross sections show that the Viking thickens westward, pinches out eastward, and that each sediment sheet contains several northwest-trending shoestring sandstone bodies. Cores of the sandstone bodies and their underlying beds exhibit a coarsening-upward succession of: (1) silty marine shale; (2) intercalated silty shale and rippled sand (locally a structureless bioturbated clayey sand); and (3) glauconitic cross-bedded sandstone. A polymictic pebble conglomerate occurs randomly within this sequence.

Submerged deposition on a shelf tens of miles from the paleoshoreline is documented by: (1) marine shale enclosing the Viking; (2) no consistent landward-seaward facies changes; (3) abundant glauconite; (4) an