Persimmon Creek field, with an area of about 2 mi^2, produces from north-south-trending "Brown" sand bars 8 to 20 ft (2.4 to 6 m) thick with 14 to 22% porosity. By analogy, in this part of the Anadarko basin, Morrow exploration should focus on locating porous upper lower Morrow sandstone above basinward-plunging Chester noses.

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Sea-Level Changes and Tectonic Control of Unconformities, Western Interior, U.S.A.

Unconformities are conspicuous stratigraphic features in the Phanerozoic strata of the Western Interior, U.S.A. Important unconformity traps for petroleum are found in strata of Ordovician, Mississippian, Permo-Pennsylvanian, and Cretaceous ages. The role of the unconformity in trapping petroleum is principally by truncation of porous zones and by providing a seal for the trap. Lenticular zones of porosity and permeability in sandstones immediately above the erosional surface are also important stratigraphic traps, both in marine and nonmarine strata.

An unconformity is defined as a sedimentary structure in which two sets of strata (or groups of rocks) are separated by an erosional surface where the erosion may be by subaerial or submarine processes. Factors to be considered in evaluating unconformities are structural discordance, nature of contact, hiatus, duration of erosion, areal distribution, and cause.

Principal causes for unconformities are sea-level changes, tectonics, or a combination of both. Two examples of unconformities controlling petroleum occurrences are as follows: (1) porosity beneath a paleokarst surface at the top of the Mississippian carbonates (Kevin-Sunburst field, Montana), and (2) the fluvial sandstones of Early Cretaceous age (Muddy Formation) that fill an incised drainage system resulting from a sea-level drop and subsequent rise approximately 97 m.y.B.P. (Recluse field, Powder River basin, and Third Creek field, Denver basin).

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Origin, Migration, and Entrapment of Natural Gas in Alberta Deep Basin: Part 1

The Alberta Deep basin, situated along the northeastern front of the Rocky Mountain belt, is the deepest part of the Alberta synclinal sedimentary basin. This trough-shaped deep basin, extending across northwestern Alberta and into northeastern British Columbia, covers an area of 65,000 km^2 (25,000 mi^2).

Enormous volumes of natural gas have been found in recent years within the thick, clastic Mesozoic sediments which partly fill the deep basin. These sediments exceed 3,100 m (10,200 ft) in total thickness.

Based on detailed geochemical analyses of more than 300 rock samples (mainly cutting samples) from several wells in the Elmworth gas field, information was obtained on the hydrocarbon source strata and the generation and redistribution of hydrocarbons.

The clastic Mesozoic rock section contains numerous shaly zones which are very rich in organic matter, and also a suite of coal strata. This section, containing mainly type III kerogen, is the ideal gas generator. Maturity ranges from about 0.5% vitrinite reflectance to about 2.0% in the deeper part of the section. Maturity has also been defined in terms of the "Methylphenanthrene Index" which is based on aromatic hydrocarbons. Apparently the mature section is still in an active phase of hydrocarbon generation. Due to the tightness of the rocks, hydrocarbon transport mechanisms seem to be dominated by diffusion processes. The light hydrocarbon distribution patterns observed throughout the wells suggest a dynamic trapping mechanism. Light hydrocarbons are lost at the top of the mature hydrocarbon generating zone and are replenished in the middle part of the section where rich source rocks are found.

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Oxygen Isotopes as Index for Paleosalinity During Deposition of Pennsylvanian Marble Falls Limestone of Central Texas

One major goal of a depositional model is to portray variations in salinity across an ancient facies tract. Qualitative determination of paleosalinity gradients with whole-rock, oxygen isotope analyses of limestones is usually hampered by the effects of cementation and reequilibration with formation water at depth. Numerous characteristics of the Marble Falls Limestone make it ideal for facies analysis using isotopes. Burial did not exceed 1 km and the low vitrinite reflectance, averaging 0.30%, indicates cool temperatures. A closed system during stabilization is manifested in high strontium levels in calcite (2,000 to 5,000 ppm).

The Marble Falls was deposited on the Llano platform which was bordered on the east by the Fort Worth basin. An east-west sediment profile consisted of black spiculite, algal boundstone, oolitic grainstone, spiculitic wackestone, and calcareous shale. Carbonate mud within spiculite and boundstone of the foreslope environment is isotopically "marine" ($\delta^{18}O = -2.52 + 0.55$ per mil PDB, $n = 12$). The whole-rock composition of grainstone ($\delta^{18}O = -4.00 \pm 0.56$, $n = 10$) is in accord with a two-component mixture consisting of marine ooids and meteoric cement, supporting the contention that the platform rim was exposed. The high standard deviation of the del values for spiculitic wackestone from the platform interior ($\delta^{18}O = -3.76 \pm 1.24$, $n = 20$) is due to changing amounts of runoff from the Concho arch. Calcite within the shale, a marsh deposit, is depleted ($\delta^{18}O = -5.10 \pm 2.26$, $n = 2$).

It is rare to find limestone sequences with facies-specific oxygen isotopes because most have undergone complex cementation histories or burial-related recrystallization. In limestones known to have escaped burial, oxygen isotopes should be of great utility for paleosalinity determinations, when combined with other types of data.

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Sedimentology and Stratigraphy of Upper Mannville in Parts of East-Central Alberta

Thick (15 to 35 m) sandstones occur in the upper Mannville (Colony, McLaren, and Waseca Members, collectively about 45 m thick) over a substantial area (T35 to 65, R1 to 20W4) of east-central Alberta. The sandstones can occur in belts flanked by zones dominated by siltstones and shales. The upper Mannville is a continental sequence in this area and the thick sandstones have previously been interpreted as (1) deposits of a network of vertically aggrading, laterally stable channels, and (2) valley-fill deposits. Investigation of a densely drilled area in the Wainwright field (T45, R6W4) shows that the absence of two 2-m thick shales that separate three correlatable sandstones, 9 m, 4 m, and 5 m thick, results in a 20-m thick sandstone in one location. This suggests that the "thick" sandstones may be the result of the amalgamation of several sandstone sequences.

Trace-fossil evidence and lateral continuity of the uppermost

(≃10 m) lithologic units of the upper Mannville in the Wainwright area indicate that these beds were deposited in a marine depositional environment. The same interval in a nearby well (11-21-47-2W4) has been confirmed as marine (contains dinoflagellates) and also contains dicotyledonous tricolpate pollen grains. The presence of this type of pollen grain means that, at least locally, the disconformity that is supposed to occur at the base of the overlying Joli Fou Formation occurs instead within the sandstones at the top of the Mannville, as suggested by Stelck.

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Correlation of Lower Ordovician Rocks to Their Geophysical Log Signature

To create meaningful structural maps related to geologic processes from well log data, one must consistently select the boundaries of the formations in question. Different workers use a variety of names and markers for the Lower Ordovician strata in Ohio, causing confusion and discrepancies in correlation and interpretation. So, it is apparent that some standard must be established.

The currently accepted nomenclature, in ascending order, is the Knox Dolomite (upper region), Glenwood or Wells Creek Formation, Black River Limestone, and Trenton Limestone. The Ohio Geological Survey has generated a sample log for these formations based on data from several wells in Licking County of central Ohio. One cannot use this as a type log for the entire state, particularly when choosing the top of the Black River Limestone. Previously, a very thorough chemical description and correlation was made and several bentonite beds were used to define the Black River. Still, this description is not easily distinguished on the geophysical logs. However, assuming the postulate that the Trenton and Black River were deposited contemporaneously and those names have no time significance, only three formations need be considered and can be consistently recognized on any log in the state.

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Transition from Slope to Fan Facies, Lower Cretaceous Sediments, Andean Foothills, Southern Chile

In southern South America, mid-Cretaceous compressional deformation transformed an Early Cretaceous back-arc basin-slope-platform setting into a protocordillera-foreland basin. The Lower Cretaceous sedimentary rocks exposed in the Andean foreland fold and thrust belt at lat. 51°S record an abrupt transition from back-arc basin-slope facies to foreland-basin submarine-fan facies.

The Zapata Formation of Portlandian to Albian age represents deposition on the slope of a coeval back-arc basin which formed to the west. The 600-m section consists predominantly of rhythmically interbedded and extensively bioturbated mudstone and siltstone. The siltstone beds are laterally continuous and contain sedimentary structures suggesting deposition by turbidity currents. Sporadic turbidite sandstones occur as shallow channel-fill sequences or as thin, laterally persistent graded beds rich in coarse detrital mica. Slumped intervals are common, and show a northwest-southeast trend of slump fold axes, which parallels the axis of the back-arc basin to the west.

The overlying Punta Barrosa Formation of Albian to Cenomanian age was deposited contemporaneously with deformation in the cordillera to the west. It represents a rapid change in depositional regime, signaled by an abrupt increase in sandstone beds. The thick sandstone beds are lenticular, commonly amalgamated, and show thickening/coarsening-upward and thinning/fining-upward cycles indicative of deposition in a submarine-fan environment. NNW to SSE paleocurrent trends indicate a longitudinal basin-fill pattern; this persists through the Upper Cretaceous flysch sequence. The Punta Barrosa Formation thus represents the establishment of submarine-fan deposition associated with the initiation of a foreland basin on the site of the preexisting back-arc basin slope.

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Fluvial Model for Lower Cretaceous Lignite, Northern Ontario

The Mattagami Formation is an erosional remnant of unconsolidated sand, clays (commonly kaolinitic), lignite, and rare conglomerate, extending 180 km east-west and 70 km north-south. The maximum known thickness is 130 m and the formation thins to the north. Outcrops are rare and drill-hole data are limited regionally. Devonian carbonates and shales and Jurassic shales underlie the Mattagami Formation and thick Pleistocene tills and clays overlie it.

An east-west-trending post-Mesozoic fault forms the south boundary of the Mattagami with Archean gneisses. Small isolated Mesozoic outliers occur farther south. The Grand Rapids arch trends northwest from the southeast corner, which is defined by Precambrian inliers and outcrops of Middle Devonian carbonates.

Across 50 km west of the arch, the Mattagami Formation contains many clean quartz cross-bedded sands, which lack correlative beds between drill holes. On Adam Creek, sand cross-cutting dark-gray shales suggests laterally migrating streams eroding flood-plain deposits. Lignite beds are thin and discontinuous.

East of the arch, the Mattagami is mainly clay with minimal sand, and total thickness is much less than in the west. Two lignite beds comprise the Onakawana deposit (185 million tons proved, approximately 5,000 BTU dry basis) with a total thickness of 16 m and known lateral continuity of 12 km. These are flood-plain and associated swamp deposits.

The paleogeomorphic Grand Rapids high was a barrier for the great northwest-trending river system meandering across 50 km, and preventing the river's incursion in the flood-plain and swamp environment to the east. North of the Onakawana lignite deposits and parallel with them, the interpreted trend of the river system is a prime target for exploration drilling.

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Depositional-Tectonic Setting of Clastic-Hosted Lead-Zinc Sulfide Deposits

Clastic-hosted, stratiform lead-zinc sulfide deposits (MacArthur River H.Y.C., Mt. Isa, Broken Hill, Australia; Sullivan, Howard's Pass, Anvil Range, Jason-Tom, Canada) precipitated from exhaled, hydrothermal fluids in similar depositional and tectonic settings. Host rocks suggest sedimentation in anoxic water below storm waves in areas devoid of active bottom currents. Depths were at least 150 to 200 m as inferred from the absence of storm-influenced deposits. Such numbers are suggested by calculations involving fetch distances of the ancient basins and by