

Persimmon Creek field, with an area of about 2 mi², 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 km² (25,000 mi²).

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 Elsworth 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 hydrocar-

bon 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" ($\delta^{18}\text{O} = -2.52 \pm 0.55$ per mil PDB, $n = 12$). The whole-rock composition of grainstone ($\delta^{18}\text{O} = -4.00 \pm 0.56$, $n = 10$) 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 $\delta^{18}\text{O}$ values for spiculitic wackestone from the platform interior ($\delta^{18}\text{O} = -3.76 \pm 1.24$, $n = 20$) is due to changing amounts of runoff from the Concho arch. Calcite within the shale, a marsh deposit, is depleted ($\delta^{18}\text{O} = -5.10 \pm 2.26$, $n = 2$).

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