ty—Late Pennsylvanian, post-Wolfcamp–pre-Leonard, post-Triassic–pre-Late Jurassic, pre-Cretaceous, and post-Paleocene.

Early structural exploration along the southeast Powder River basin rim resulted in several oil and gas discoveries, notably Lance Creek field with pay zones of Cretaceous, Jurassic, Permian, and Pennsylvanian ages. Recent exploration has resulted in stratigraphic discoveries in Cretaceous and Pennsylvanian rocks. This rather sparsely drilled area appears to have excellent potential for additional stratigraphic traps in Cretaceous and Pennsylvanian sandstones.

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Relations Between Sedimentary Facies and Diagenesis in Frenchman Formation (Maestrichtian) of Southern Saskatchewan

The Frenchman Formation of southern Saskatchewan is a fluvial deposit which ranges in thickness from only a few meters to over 70 m in a distance of about 50 km. The detritus was derived from the Cordillera mainly on the west and southwest. The rocks and sediments of the Frenchman Formation are arranged in fining-upward sequences, typically with the following arrangement of sedimentary facies from bottom to top of each sequence: large-scale trough cross-bedding in medium to coarse-grained silty sand; trough cross-bedding with individual sets topped by ripple lamination or parallel-laminated silt with plant remains; ripple cross-lamination in fine sand and silt; parallel-laminated fine-grained silty sand or alternating sand and carbonaceous material; interbedded purple, green, and silty clays. Single sequences are up to 40 m thick. The sands are interpreted as channel-fill deposits and the clays as overbank deposits; the ratio of channel to overbank deposits ranges from 0.2 to 5.3. Where exposures permit and the formation is thick enough, sand bodies can be traced for up to 4 km. However, some sands clearly are lenticular and persist in outcrop for less than 1 km. Many parts of the Frenchman sands are cemented with calcium carbonate and the distribution of the cement shows a close relation to the sedimentary facies. In the coarse-grained sands with large-scale cross-bedding, patterns of cementation have been influenced strongly by the anisotropy of permeability; preferred directions of cement development are parallel with the trough axes of cross-bedding and parallel with the dip of foresets in cross-bedding, and cementation in such zones commonly occurs to the extent that an expanded fabric has developed. In the finer grained sands and silts, development of cements is related principally to the overall direction of bedding, and cements are concentrated in spheroidal concretions whose planes of maximum projection parallel the bedding.

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Nonmarine Depositional Environments and Uranium Exploration in Lower Cretaceous Antlers Formation, North Texas

Detailed geologic and geochemical investigations of the Sherman quadrangle for the National Uranium Resource Evaluation (NURE) program have included fluvial deposits of the Antlers Formation which are exceptionally well exposed in cliffs along the shores of Lake Texoma, Grayson County, Texas. These deposits accord with the classical mixed-load, meandering-river model, with erosively based pebbly sandstones grading upward into silty sandstones and carbonaceous mudstones with sporadic lignitic material. Lateral-accretion bedding of presumed point-bar origin is inclined at angles up to 10°. Thickness of these lateral accretion units permits estimates of channel depth of as much as 12 m. Distinct channel forms, some of which are clay filled, are up to 100 m wide, but substantially lower estimates of channel width are obtained from dimensions of the point-bar stratification. Flanking and overlying the in-channel sands are inclined levee deposits, chutes and chute bars, proximal to distal crevasse splays, and organic-rich backswamp clays.

Preliminary radiometric analyses show low to very low readings for the major channel sands, with a general trend of increasing radioactivity with decreasing grain size, decreasing bed thickness, and increasing organic content. Thus the most distal, or sediment-starved, overbank facies composed of dark laminated clays and lignites show the highest values. These analyses indicate substantial local epigenetic enrichment, but the deposits encountered to date are too small to be considered a potential resource.

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Flood-Plain Sequences of Fine-Grained Meander-Belt System, Lower Wasatch and Upper Fort Union Formations, Central Powder River Basin, Wyoming

Models of fine-grained meander-belt systems generally emphasize the coarser sandstone facies of channel origin and neglect the relatively fine-grained overbank sediments of the flood plain. This emphasis is unfortunate because of the volumetric importance of the flood-plain sequences in many ancient stratigraphic successions such as the Tertiary coal and uranium-bearing rocks of the northern and central Rocky Mountain and Great Plains provinces. An appreciation of the processes of formation, and lateral and vertical successions of these deposits can provide valuable information for mining and reclamation activities.

Macroscopic and microscopic studies of 18 continuous cores through the lower Wasatch and upper Fort Union Formations in a 4-sq mi (10 sq km) area of southeastern Campbell County, Wyoming, allow recognition of six flood-plain environments associated with point-bar sequences. These flood-plain sequences, recognized on the basis of primary and secondary sedimentary structures, presence and type of bioturbation, organic content, and presence or lack of preferred vertical and lateral successions, include lacustrine, lacustrine delta fill, well-drained and poorly drained swamps, crevasse splay, levee, and abandoned channel. Recognition is based in part on comparison with criteria developed for Holocene sequences of the Atchafalaya flood plain.

Lacustrine deposits consist of highly organic, parallel-laminated clay with some silty laminations. Burrow structures are quite common and nodules of pyrite are present. Calcium carbonate is common along bedding planes. Lacustrine delta fills form coarsening-upward sequences which grade upward from lake deposits into interlaminated silts, clays, and sands with abundant ripple laminations, steeply dipping spill-over foresets, and loading features. Burrowing and pyrite nodules are present in the lower part and coarse organic debris and roots are common in the uppermost part. Poorly drained swamps are best recognized by their high content of organic fragments and root bioturbation that destroys most depositional structures. Pyrite and siderite are common as nodules. Well-drained swamps, in contrast, are relatively high in silt content and contain few organic fragments. Roots and root bioturbation structures are well preserved and stratification is only vaguely discernible. Iron oxide nodules are common, especially as crusts surrounding roots. Calcium carbonate nodules also are present in these deposits. Crevasse-splay deposits are similar to those of well-drained swamps except that stratification is better preserved and thin (less than 1 m) coarsening-upward sequences are common. These sequences contain ripple laminations, shallow scour-and-fill structures, and may be capped by rooted beds of sand. Natural levees are recognizable as fining-upward sequences with a well-stratified, burrowed, sandy lower part grading upward into a finer grained, root-bioturbated upper part with iron oxide and calcium carbonate nodules. Finally, abandoned channel-fill sequences consist of a complex interlayering of swamp, lacustrine, lacustrine-fill, and crevasse-splay deposits lying on, and often below, point-bar sequences.

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Painter Reservoir–Clear Creek–Ryckman Creek Nugget Sandstone Trend in Absaroka Thrust Plate, Uinta County, Wyoming

Nugget Sandstone reserves in the southwestern Wyoming part of the Thrust Belt province are rapidly being developed in the Painter Reservoir field, Ryckman Creek field, and the Clear Creek area. This series of northeast-trending fields is situated on the hanging wall of the Absaroka thrust.

Painter Reservoir field, discovered in 1977, is located 5 mi (8 km) northeast of Evanston, and is the most southerly of the three areas. Ryckman Creek field, discovered in 1976, lies 10 mi (16 km) farther northeast. Between the two fields, the most recent discovery on the trend is the Clear Creek area where Chevron tested 25 MMCFGD from the Nugget Sandstone in September 1978.

Each area is a separate, structurally controlled Nugget Sandstone reservoir. Field limits and structural details are not yet firmly established, but seismic and drilling data outline similar structure forms, each area appearing as an asymmetric overturned fold. The hydrocarbon columns range from an estimated 500 ft (150 m) in the Clear Creek area to over 1,000 ft (300 m) in the Painter Reservoir field. The column at Ryckman Creek is approximately 575 ft (175 m). A significant gas column is present in each area.

The Nugget Sandstone reservoir rock is cross-bedded and cross-laminated. This cross-stratification creates local variation in porosity and permeability. Along the trend, average Nugget Sandstone porosity and permeability appear to decrease somewhat from north to south. At Ryckman Creek field the Nugget Sandstone is more porous and homogeneous than in Painter Reservoir field. The Clear Creek area porosity and permeability data are limited with the field in an early stage of development.

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Whitney Canyon Field—Potential Gas Giant in Wyoming Thrust Belt

Recent drilling in the Absaroka plate of the thrust belt has confirmed the presence of a major gas-condensate accumulation in the Whitney Canyon area of Uinta County, Wyoming. Reserves are primarily in porous and/or fractured Paleozoic carbonate formations. Triassic carbonate rocks also appear to be commercially productive.

The discovery well, which was scheduled as a 13,400-ft (4,020 m) test, was spudded in October 1976. Mechanical problems were encountered at a depth of 10, 691 ft (3,027 m) in the Permian Phosphoria Formation and the well was subsequently completed in the Triassic Thaynes Formation. Paleozoic gas production was established in 1978 by the Amoco-Chevron-Gulf 2. This well drilled a nearly normal stratigraphic section of Jurassic Twin Creek Limestone through Ordovician Big Horn Dolomite before crossing the Absaroka thrust at a true vertical depth of 15,516 ft (4,655 m). Cretaceous sandstones and shales were drilled to a total depth of 16,224 ft (4,867 m) or 15,894 ft (4,768 m) true vertical depth. A development well approximately 1 mi (1.6 km) north of the Amoco-Chevron-Gulf 2 drilled a similar stratigraphic sequence.

The Whitney Canyon structure is a north-south-trending geophysical anomaly with little or no surface expression; its general shape can be defined quite well with reflection seismic. At the Phosphoria level, the structure is approximately 10 mi (16 km) long and 2 mi (3.2 km) wide with 2,500 ft (750 m) of structural closure.

Gas tested from the Triassic Thaynes Formation is sweet, whereas the Paleozoic gas is sour with a hydrogen sulfide content of 18% or less. Environmental considerations and construction of a gas treatment plant probably will delay Paleozoic gas production until 1982.

Although reserve estimates are quite speculative, the Whitney Canyon structure appears to be in the giant field category.

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Influence of Diagenetic Reactions on Nonmarine Up-