where large sediment supplies are recorded by seaward progradation of deltas and barrier islands.

Widespread sheets of sandstone and conglomerate, like the Ericson Sandstone of the Rock Springs uplift and the Castlegate Sandstone of eastern Utah, represent braided piedmont plain deposits of sand and gravel spread beyond the bases of newly uplifted areas under conditions of humid to subhumid climates. These are commonly underlain and overlain by meander belt deposits consisting of broad silty-shale floodplain deposits and narrow channel sandstones and conglomerates. The upward sequence of braided alluvial sheets of sandstone and conglomerate and predominantly shaly meander-belt deposits records progressive headward erosion of tributaries and consequent expansion of drainage basins.

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PRINCIPLES OF CEMENTATION AND POROSITY-OCCLUSION IN SANDSTONES

Widespread, porosity-occluding vadose cementation is restricted to hot arid and semiarid regions where carbonate (caliche) is concentrated, and to hot regions with wet-season, dry-season climates (savannah lands) where iron and aluminum hydroxides and oxides (laterites and bauxites) are concentrated. Rapid evaporation-triggered precipitation of carbonates, hydroxides, and oxides results in initial precipitation of finely crystalline grain-coating cement films (which separate grains) and in later replacement of grains by cement to form increasingly enriched concentrations. Textures and structures of caliche, laterite, and bauxite are homologous and uniquely reflect vadose processes. The mechanism by which ions are concentrated as vadose cement is upward diffusion from the water table through moist soil following periods of infiltration, and evaporation-triggered precipitation in water films during drying intervals.

Cementation below the water table or in water-filled voids (aqueous cementation) in fresh water or seawater, occurs slowly and, because large crystals have time to grow, the cement is coarsely crystalline. Soon after burial silica is precipitated as epitaxial overgrowths on quartz grains at shallow to moderate depths under conditions of low temperature and slightly acid pH. At greater depths silica precipitation is followed by calcite precipitation and replacement of quartz under higher temperature and pH. Silica mobilized at depth by replacement and solution of quartz, diffuses upward and carbonate diffuses downward where it precipitates as optically continuous or polycrystalline overgrowths on available calcite "seeds" deposited with sands or with intercalated calcareous shales or limestones. Transportation of cementing materials by opposed diffusion gradients, through very slowly moving or static interstitial water, overcomes inadequacies inherent in the supposition that they were transported upward by abnormally large volumes of water, required to transport cementing materials, expelled from compacting clays below depths where clays continue to undergo significant compaction.

In Upper Cretaceous sandstones of the Rocky Mountain region faceted silica overgrowths were precipitated at shallow to moderate depths of burial on sands which accumulated as braided alluvial sheets (piedmont plains), extending outward from newly created uplifts, point bars deposited in channels of meandering rivers on swampy coastal plains, deltaic distributaries and barrier islands, consisting of lagoonal, backshore beach, foreshore beach, surfzone, and infra-surfzone sands. Silica overgrowth molding and merging formed loosely cemented sandstones, but did not occlude porosity. Concentrations of oyster shells in lagoonal and backshore sands and concentrations of *Inoceramus* in distal extensions (infra-surfzones), where sands intermesh with calcareous offshore marine shales, provided calcite "seeds" upon which porosity-occluding calcite cement crystals were precipitated as epitaxial and polycrystalline overgrowths at considerable depths by downward diffusion of carbonate.

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STRATIGRAPHIC AND SEDIMENTOLOGIC ANALYSIS OF MISSISSIPPIAN MADISON FORMATION IN SOUTHWESTERN SASKATCHEWAN

Rocks of Mississippian age in southwestern Saskatchewan consist of a sequence of relatively similar carbonate rocks ranging from 340 ft to 1,030 ft thick. A vertical change in lithologic character not generally reflected on a geophysical log permits an informal division of these rocks into a lower, generally sparsely fossiliferous argillaceous or bituminous limestone unit, and an upper, commonly fossiliferous nonargillaceous limestone unit. The lower unit shows some lateral variations from locally developed bituminous limestone to argillaceous limestone. Red ferric oxide coloration is common in the argillaceous rock, as is glauconite, particularly in the basal part. The upper unit is characterized by a preponderance of crinoid remains generally in the form of alternations of particle-supported crinoidal limestones and micritic limestones with varying percentages of crinoid columnals. Bryozoa, brachiopods, and solitary corals also are concentrated in this sequence of rocks.

The variable thickness of Mississippian rocks is probably related to the effects of regional erosion on the post-Mississippian–pre-Jurassic erosion surface which have resulted in removal of progressively older beds in a northwesterly direction. A paleotopography having a distinct northeast-southwest grain was developed on the erosion surface. Local paleotopographic relief is in the order of 100 ft and regional relief is approximately 400 ft from west to east.

At present oil in commercial quantities is obtained from only 1 well in the study area. This oil accumulated in a dolomitized crinoidal limestone that subcrops on the western slope of a paleotopographic ridge. The ridge is on the easterly plunging Battle Creek anticline. The prospects of discovering additional hydrocarbon accumulations in the Mississippian rocks of southwestern Saskatchewan are enhanced greatly by the presence of excellent local source rocks as represented by the bituminous limestones of the lower carbonate unit.

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STRATIGRAPHY OF CRETACEOUS FOX HILLS SANDSTONE, EAST FLANK OF ROCK SPRINGS UPLIFT, SWEETWATER COUNTY, WYOMING

The Upper Cretaceous Fox Hills Sandstone on the east flank of the Rock Springs uplift is a regressive sequence of sandstone and siltstone which was deposited in shallow neritic and estuarine environments. It