ondary dolomite porosity has been destroyed by the precipitation of secondary minerals.

Porosity development and reduction by cementation can be explained by near-surface geochemical conditions which are thought to have existed in and around these topographic highs. Dolomitization occurred as meteoric waters were introduced into the subsurface from partly exposed tidal flats. Microcrystalline dolomite was precipitated as waters with high Mg/Ca ratios percolated down from the tidal flats. Rapid nucleation precluded the formation of sucrosic dolomite and porosity. As the Mg/Ca ratio dropped owing to dolomite crystallization, nucleation rates dropped and sucrosic dolomite and porosity developed downdip from the crests of the topographic highs.

In this manner, a "ring-shaped" zone, of reservoir quality porosity formed surrounding paleotopographic highs. Application of this proposed model to petroleum exploration in the Williston basin provides a significant guide for the drilling and accurate development of Ordovician Red River prospects.

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Middle and Upper Ordovician Paleogeography of Region Bordering Transcontinental Arch

Following a period of Whiterockian erosion, Middle Ordovician seas transgressed into the North American continental interior, and a diachronous sheet of clastic sediments (St. Peter, McLish, Winnipeg) lapped onto the margins of the Transcontinental arch. The arch served as a major clastic source region during subsequent deposition (especially Decorah). Middle Ordovician clastic sediments adjacent to the Transcontinental arch and in the Williston basin were probably deposited in a humid climatic regime, and carbonate deposition predominated in an arid belt that included Wisconsin, southeastern Iowa, Missouri, and Illinois, where carbonate oolites and evaporites are noted. Clastic source areas on the Transcontinental arch were inundated, as the marine transgression continued, and a continuous sheet of carbonate sediments (Galena, Viola, Red River, Bighorn) spread across most of the continental interior by the close of the Edenian. Migration of North America across latitudinally-related climatic belts brought the Williston basin area into an arid climatic regime by middle-Late Ordovician as evidenced by the deposition of upper Red River evaporites.

Widespread carbonate deposition was replaced by Dubuque-Maquoketa and Stony Mountain carbonate-clastic deposition as source regions emerged on the Transcontinental arch and Ozark uplift. The lower Maquoketa is conformable with the underlying Dubuque over most of the eastern Mid-Continent, and the joint occurrence of organic-rich shales and phosphorites is attributed to a low-oxygen, phosphate-rich water mass in the Maquoketa sea. The Ordovician closed with red clastic deposition, intermixed with carbonates and/or ironstones, adjacent to the arch.

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Model of Autocementation of Quartz Sands as Suggested by SEM Study of St. Peter Sandstone

Autocementation of quartz sand commonly involves growth of α-quartz in crystallographic continuity with the host grain (overgrowth). This mechanism is not well understood, but SEM examination of quartz grain surfaces from the St. Peter (Ordovician) sandstone suggests that overgrowths develop by recrystallization of a precursor matte or druse which covers much of the original grain surface. However, the matte is always absent along grain contact, and commonly exhibits foliation concentric with the host surface. A cyclic process is thereby suggested for the matte, but one which does not permit deposition between grain contacts. Alternating wetting and drying episodes in which dissolved material is deposited on the sand grain during each cycle is a possible mechanism. Numerous small (1 to 2 μm) euhedral kaolinite crystals scattered over and embedded in the matte are evidence of this mechanism. In the St. Peter sand, it appears that a pore fluid saturated with quartz and kaolinite, and containing numerous kaolinite crystallites, repeatedly came into contact with the sands and evaporated leaving a residue of SiO_2 and kaolinite during each cycle. Whether these cycles were diurnal, annual, or reflect rises and falls in the water table is not known, but it is likely that the cementation involved stages requiring complete removal and reinjection of pore fluid, but not as an uninterrupted process in a permanent, continuous pore fluid.

In this process, the driving forces (e.g., evaporation and a changing water table) are easy to identify and quantify. However, a static situation involving a stationary pore fluid does not present any obvious driving force for either mass transfer or recrystallization.

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Thrust Geometry of Northern Absaroka Sheet, Idaho and Wyoming

Seven major thrusts comprise the Absaroka-St. John thrust system in the Snake River Range southwest of Jackson Hole. The Absaroka thrust forms the base of this system in which earlier, higher thrusts are folded by later, lower thrusts. Shortening within the system is 17 km, excluding the basal detachment. Recent mapping requires a revised nomenclature for the thrusts to recognize that thrust sheets substitute for one another along strike.

There are three different thrust geometries in the area: (1) upward opening wedge-shaped imbricates; (2) horses; (3) complex systems of horses and imbricates. The St. John, Elk, Ferry Peak, and Baldy thrust sheets are wedge-shaped, thickening from about 700 m in the west to 800+ m in the east. These sheets all carry Cambrian limestones and their fault surfaces merge with the basal Absaroka detachment to the west. The Absaroka thrust sheet is isolated as a large horse between the Absaroka and St. John thrusts, which merge at depth to the west and on the surface to the east. The Thompson thrust lies at the base of a complex fault-zone of horses and imbricates resulting from the partitioning of fault slip throughout a well-developed karst and solution breccia zone in the upper Mission Canyon formation.

The Absaroka-St. John thrust system was uplifted and partly eroded as a result of later deformation asso-