

Unconventional and Tight Sandstones In Jurassic Paleovalleys Of The Alberta Plains: J3 & J2 Sandstones, Medicine River Area, West Central Alberta, Canada

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In the Alberta Plains we have re-examined the Jurassic valley-filling rocks in the Medicine River area and focused our attention on the enigmatic J3 sandstones that, as noted previously, are continental and marginal marine in nature. Significantly, these sandstones while porous provide the seal to the Medicine River Jurassic “D” Pool. These unconventional properties are the product of early and extensive pedogenic and groundwater silicification events that modified the porous system of the J3 and to a lesser extent that of the upper J2 sandstones. Overprinting of the J3 sandstones typically spans their vertical extent, whereas overprinting of the J2 sandstones is localized to the stratigraphic interval subjacent to the J3 sandstones. Silica was introduced during extended periods of subaerial exposure and prior to deposition of the Lower Cretaceous, Ellerslie Member, and has resulted in a complexly aggregated duripan. Previous studies have highlighted the fact that J3 sandstones are immature and submature, have mud-sized and cryptocrystalline matrices, and have grain- and mud-supported fabrics with quartz and chert grains and kaolinite clay. Our study confirms these observations and extends them to J2 sandstones in close proximity to J3 sandstones.

Muddy and cryptocrystalline matrix materials in addition to kaolinite include abundant opal, poorly crystalline silica, chert, micro and megaquartz, neoformed clay and iron sulfides. Sand-sized quartz and chert framework grains frequently are corroded and angular. Grains and matrices are disposed in Terrazo (T)/Floating (F), Grain Supported (GS), and Matrix (M) fabrics; all fabrics that are common in silcretes. A number of different pedogenetic remains are present that include illuvial clay deposits in soil channels, peds and microfracture sets, cutanic deposits (ferrans, argillans and silans), root structures and animal burrows, and abundant nodular and disseminated iron sulfides.

In summary, the fine grained and cryptocrystalline matrix material in J3 and J2 sandstones is silica- and clay-rich, sulfidized, soil plasma that accumulated in response to pedogenic vadose and soil groundwater processes. As a consequence, the original J3 and J2 paleovalley filling sandstones were extensively modified and cemented by early clay, silica and sulfides. We have characterized the J3 and J2 silcretes with 9 pedofacies (PF) and illustrate them with the 08-28-39-03W5 core that spans the J3 and upper J2 intervals.