

Dutton and Willis, 1998

Data Set 21

Reference: Dutton, S.P. and B.J. Willis, 1998, Comparison of outcrop and subsurface sandstone permeability distribution, lower Cretaceous Fall River Formation, South Dakota and Wyoming: *Journal of Sedimentary Research*, v. 68, n. 5, p. 890-900.

Author's affiliation: Bureau of Economic Geology, University of Texas

Age: Early Cretaceous

Formation: Fall River Formation

Location: Buck Draw Field, Powder River Basin, Wyoming, United States

Wells: 10 cored wells in Buck Draw field

Depth range: 3742-3868 m

Lithology and grain size: Mineralogically mature quartz arenites to sublitharenites. Plagioclase is the most abundant feldspar in the subsurface. The mean grain sizes of Buck Draw field sandstones are lower fine grained (2.96 phi, 0.129 mm). In Buck Draw field, the fluvial (phi 2.79) and estuarine (phi 2.84) have the same average grain size, but deltaic sandstones are significantly finer grained (phi 3.60). Sorting (phi standard deviation) is 0.36, 0.38, and 0.40 for the fluvial, estuarine, and deltaic sandstones.

Alteration: "In Buck Draw field, Fall River sandstones were buried to 2.5 km during the Cretaceous and then continued to subside during the Tertiary, when they reached a depth of 4 km and a maximum temperature of 140 degrees C. From petrographic evidence, the relative order of occurrence of the major events in the diagenetic history of Fall River sandstone in Buck Draw field was interpreted to be (1) precipitation of pyrite, siderite nodules, and chlorite and illite rims around detrital grains, (2) mechanical compaction, (3) quartz cementation, (4) Fe-calcite cementation, (5) dissolution of feldspars and Fe-calcite cement and (6) precipitation of kaolinite, (7) stylolitization and precipitation of additional quartz cement, and (8) emplacement of reservoir bitumen."

Controls on permeability: A statistical analysis (excluding porosity) found that quartz-cement volume, ductile-grain volume, and grain size account for 49% of the measured variation in permeability. T-tests indicate that none of the other variables (sorting, volume of illite, chlorite, or carbonate cement) makes a statistically significant contribution to permeability at the 95% confidence level.

Production: oil production in the Powder River basin.

Core measurement conditions: Standard core analysis techniques using plug samples (porosity by helium method).

Data entry: manual entry from Figure 10 of the referenced paper.