Wattenberg Field: A Giant in Our Own Backyard[1]

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1. Manuscript received April 20, 2006; Accepted June 6, 2006
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ABSTRACT

Colorado's Wattenberg Field is a giant natural gas field by all measures. Discovered in 1970, it ranks as the seventh largest domestic U.S. natural gas field, with cumulative production exceeding 3.4 TCFE from six Cretaceous reservoirs including the Dakota, J, Codell, Niobrara, Hygiene (Shannon), and Terry (Sussex). The majority of Wattenberg's production comes from two reservoir systems: the deeper J Sandstone and the shallower Codell/Niobrara sandstone and marlstone. The J and Codell/Niobrara reservoirs are blanket-like, laterally extensive sands and marls deposited under marine deltaic, sub-aqueous bar, bar-margin, shelf, and valley-fill processes. All reservoirs are classified as tight gas sands, exhibiting porosities of 9 to 20%+ and corresponding permeabilities below 0.1 md. Accordingly, hydraulic fracturing is necessary to extract commercial volumes from these tight reservoir packages.

Earliest production efforts centered on the J Sandstone, followed by the Sussex and Shannon, and finally by the

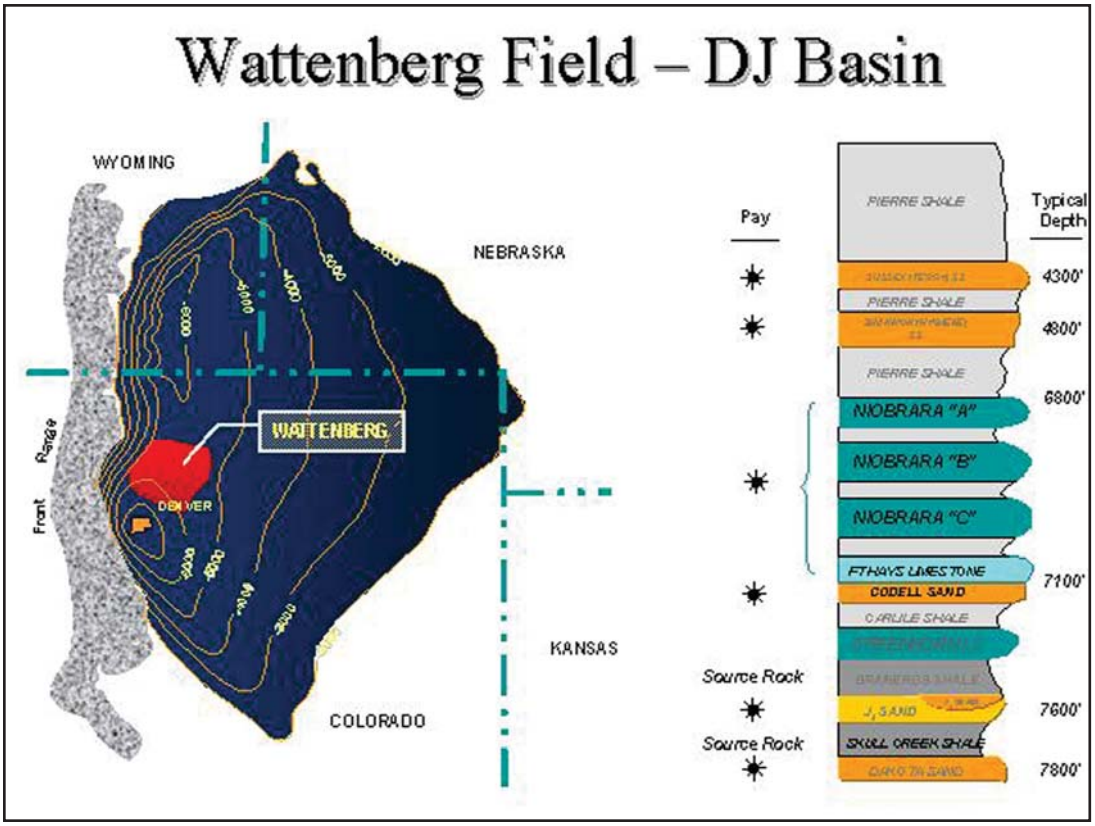

Figure 1. Location of Wattenberg Field and stratigraphic column for the productive interval in the field. Adapted from Sonnenberg (2002).

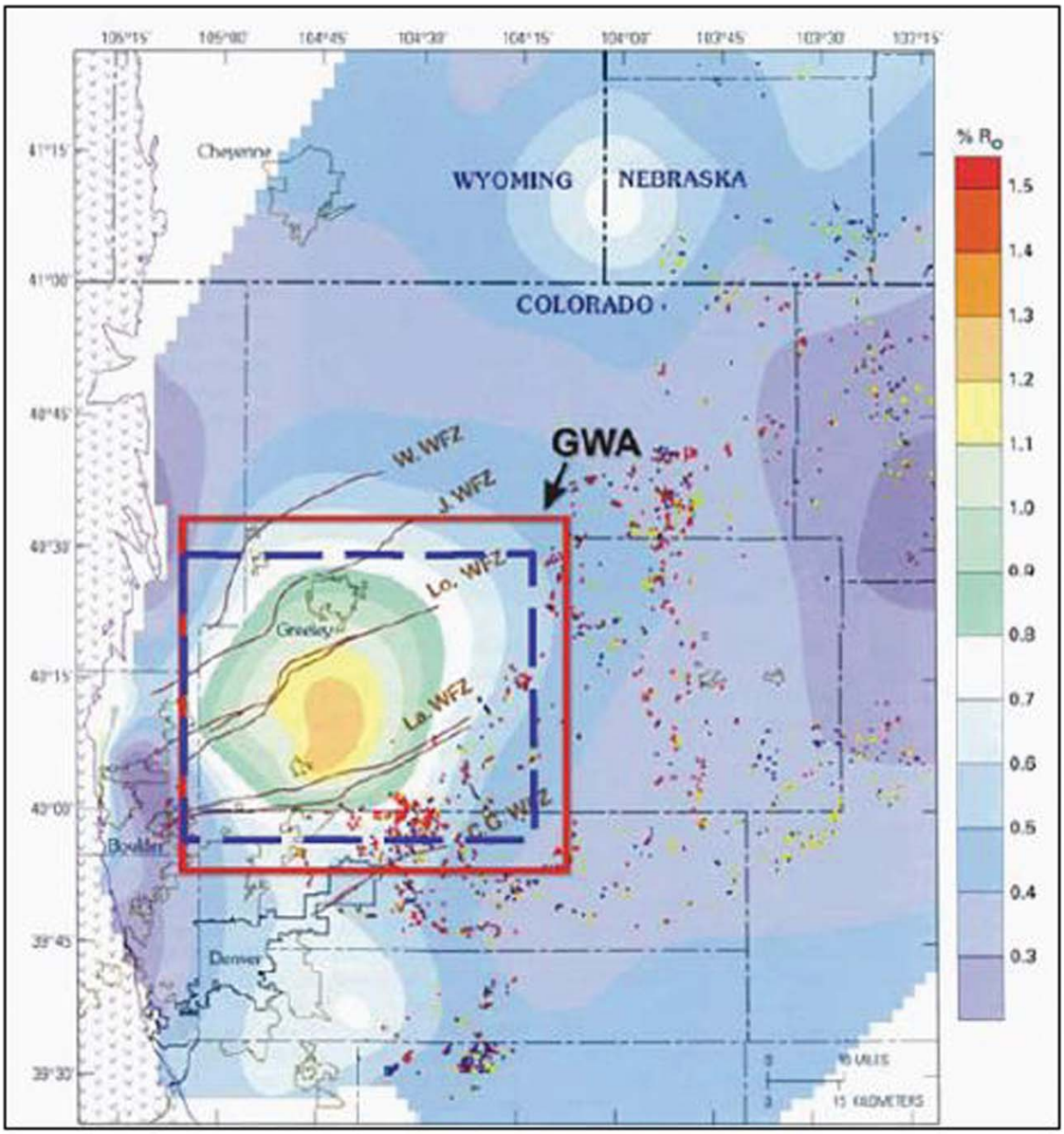

Figure 2. Wattenberg thermal anomaly reflected by vitrinite reflectance data in percent. Adapted from Higley and Cox (2005).

Codell/Niobrara and Dakota. The J and Codell/Niobrara reservoirs are mutually present over the entire Wattenberg Field area. Discrete sand bar accumulations in both the Sussex and Shannon, and marine bar and valley fill systems within the Dakota allow for a more localized overlap with the former reservoirs.

All pay zones yield production streams with variable gas-to-oil ratios that are enhanced by: 1) thick, mature Cretaceous source beds (7000 ft); 2) proximity to the geothermal "hot spot"; 3) structural position; and 4) vertical and lateral permeability and fault barriers.

These relationships, illustrated in Figures 1 to 4, combined with laterally extensive reservoir development, created maximum oil and gas generation, water expulsion, and localized containment. The result is water-free oil and gas production over most of the field area.

Multiple enhanced recovery programs have been conducted on Wattenberg's producing reservoirs. Infill drilling, restimulations (re-fracs, tri-fracs) and constant evolution in fracture stimulation technology have all assisted in maximizing the ongoing recovery from this giant field. Many wells have been producing for more than 30 years. Considering the added production from future activity, Wattenberg Field will continue to provide a strong, dependable natural gas and oil source for years to come.

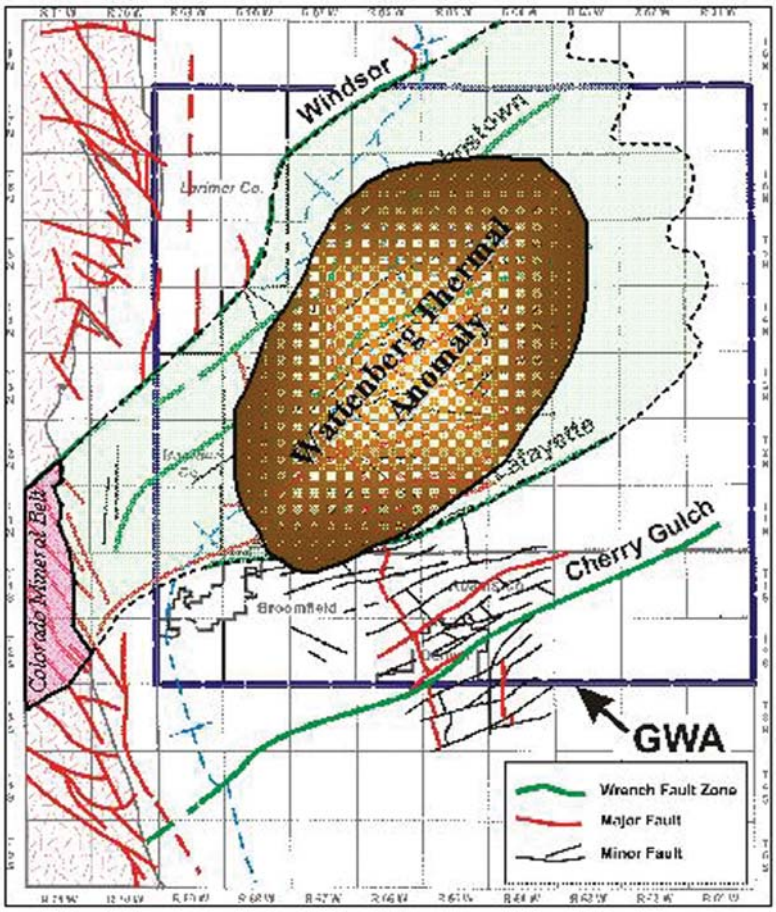

Figure 3. Wattenberg thermal anomaly and position relative to the Colorado Mineral Belt. Major wrench faults and other fault systems are also shown.

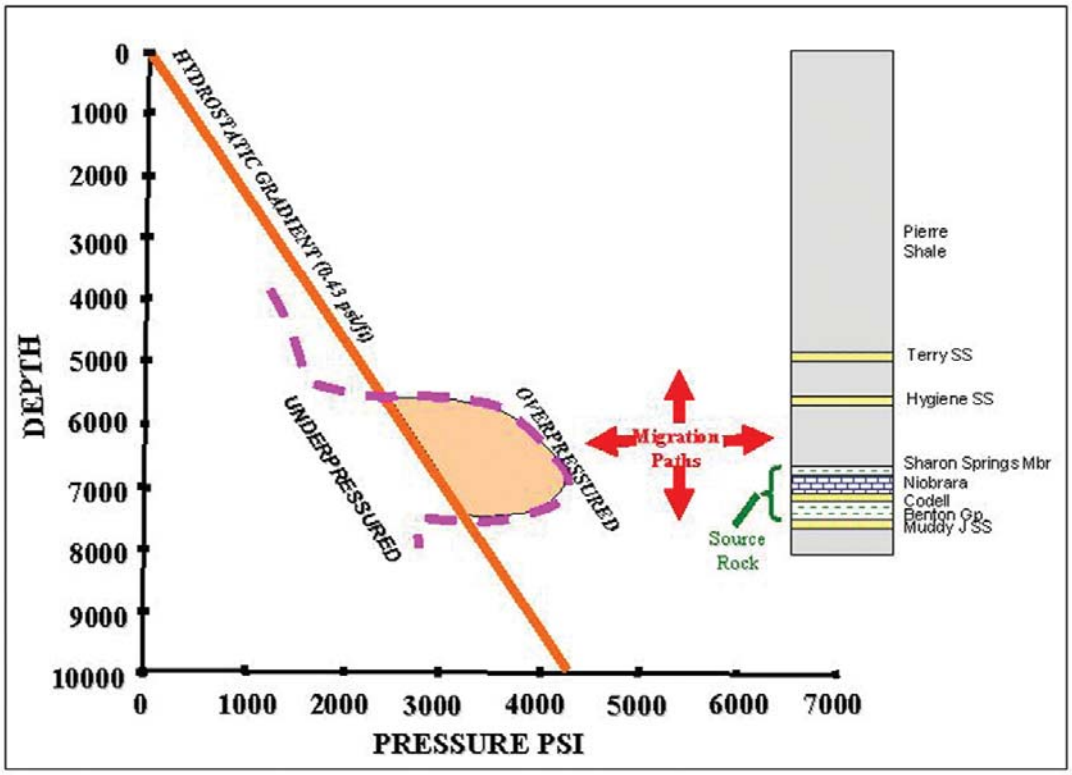

Figure 4. Wattenberg Field pressure/depth profile. Adapted from Weimer (1996).

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