

PS Stratigraphic and Structural Relations of the Birdbear Formation (Devonian) Western North Dakota*

Jeffrey W. Bader¹

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¹North Dakota Geological Survey, 2835 Campus Rd., Stop 8156, Grand Forks, North Dakota (jwbader@nd.gov)

Abstract

The Birdbear (Nisku) Formation has produced significant amounts of oil in the Williston Basin. Three of the four requirements (source, reservoir, and seal) for a petroleum accumulation in the Birdbear have been documented in western North Dakota. However, the fourth requirement, a trapping mechanism, remains enigmatic. Recent studies indicate that numerous subtle structural complexities are present in the basin. Future exploration must account for these structural relations.

The Birdbear has two packages (A- and B-zones) consisting of a transgressive-regressive cycle of limestone and dolostone, capped by thick anhydrites interbedded with dolostone. The lower portion of the Birdbear, up into the B-zone, defines the transgressive systems tract (TST). Basinal facies of the TST are overlain by bank facies and dolomitic shallow water anhydrites of platform/sabkha facies, defining the regressive, highstand systems tract (HST). The Upper Birdbear is composed of three, thin, carbonate/evaporite packages that represent 4th-order progradational parasequences of the HST. Several subtle anticlinal features trending northwest, oblique to the north-northeast regional dip, were mapped. They are en échelon, terminate along a north-northeast linear trend, and are the locus of Birdbear producing wells. The Birdbear A-zone is thickest across this zone of deformation. Bank facies of the B-zone are thicker to the northeast across the Nesson Anticline. Porosity data also indicate that structurally elevated areas may have controlled sedimentation, diagenesis, and oil accumulation in the A-zone. These structures likely formed from Phanerozoic movement on basement-rooted faults. These basement-rooted faults are likely present across the entire Williston Basin, some of which have yet to be identified.

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Stratigraphic and Structural Relations of the Birdbear Formation Implications for Petroleum Potential in Western North Dakota

Jeffrey W. Bader

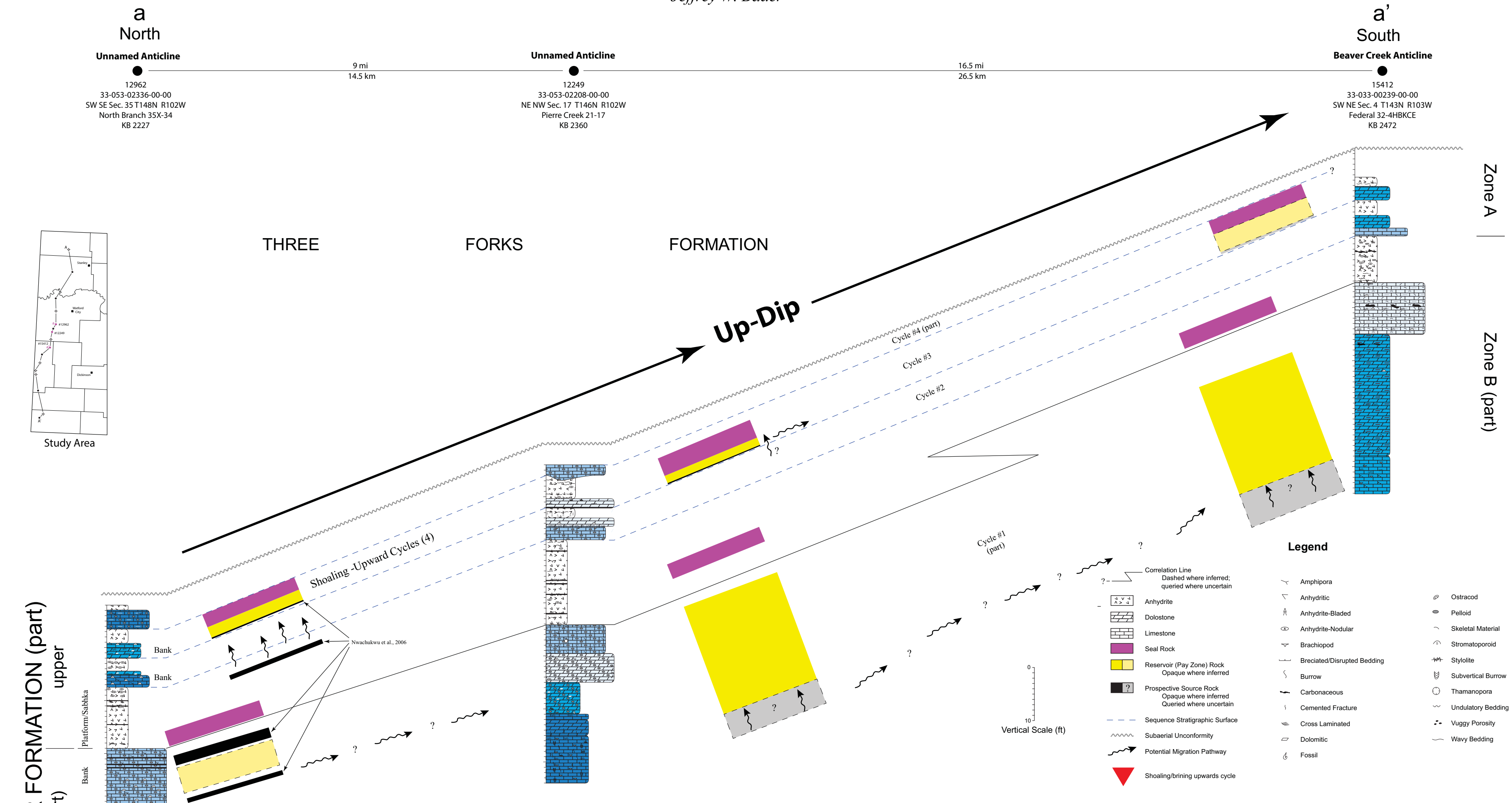
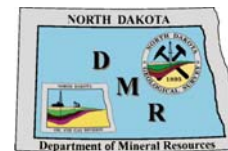


Figure 1. Cross-section a-a' showing lithology, correlations, and sequence stratigraphic relations for Birdbear Formation cores within the study area. See Plate 2, Figure 3 for cross-section location.

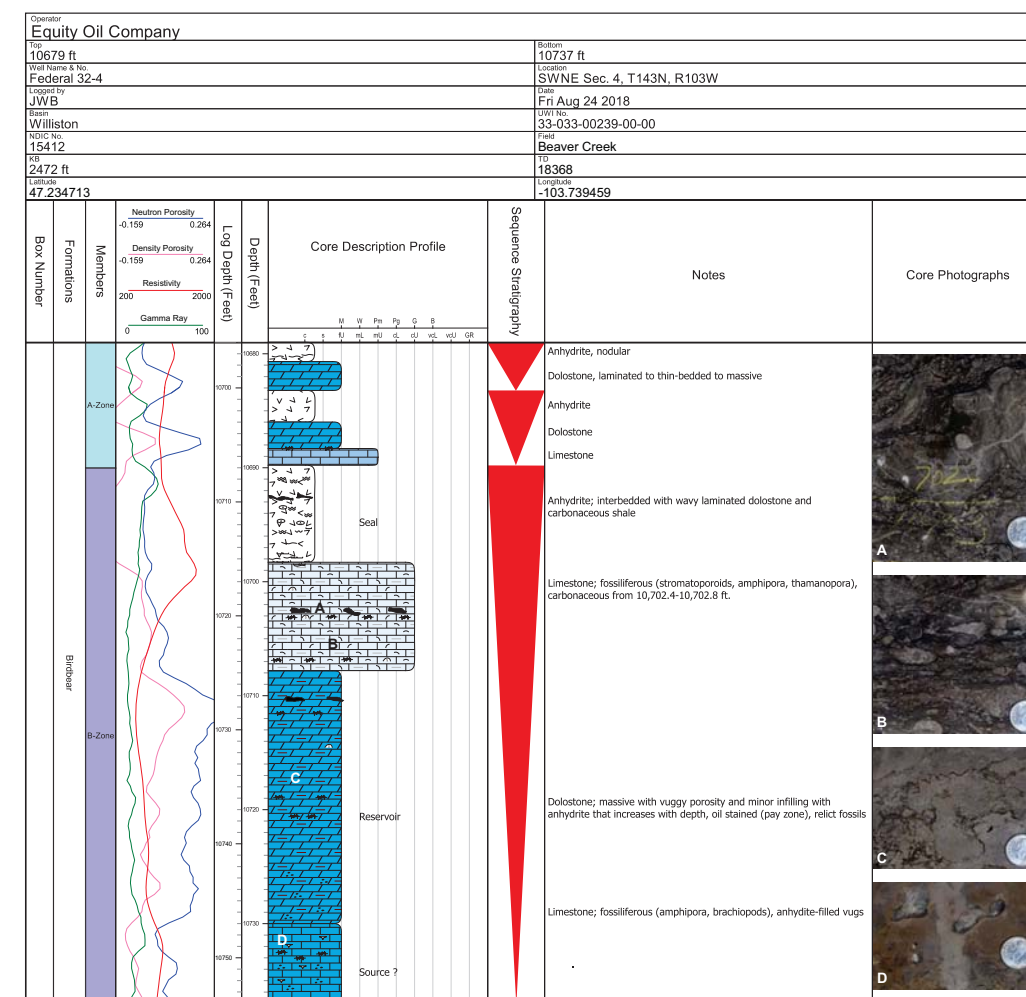
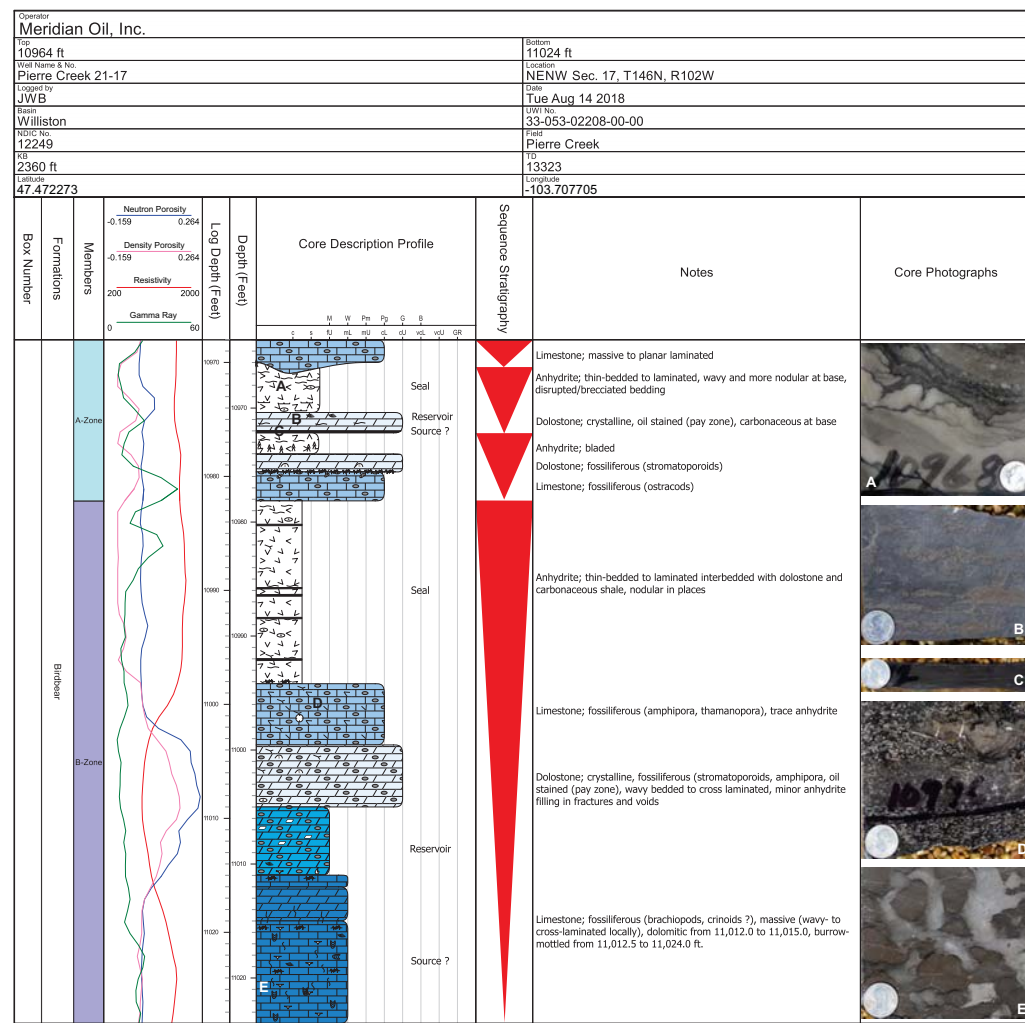
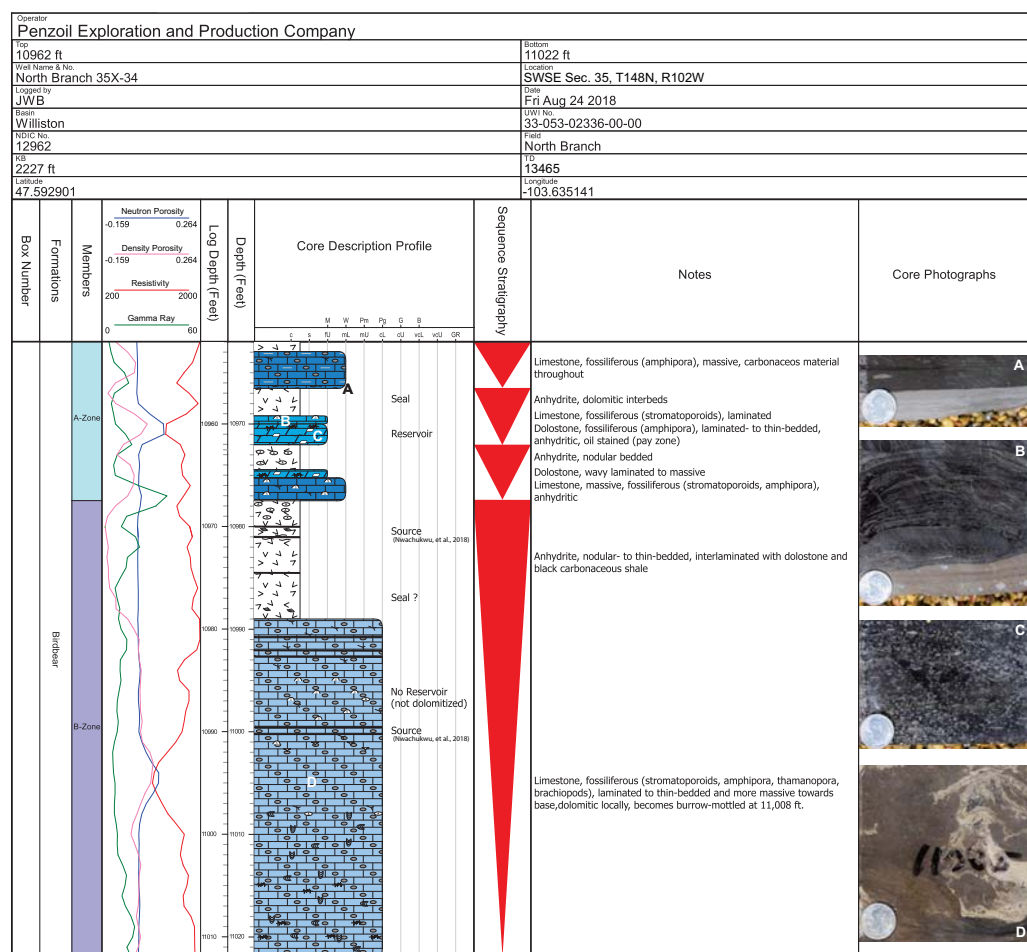
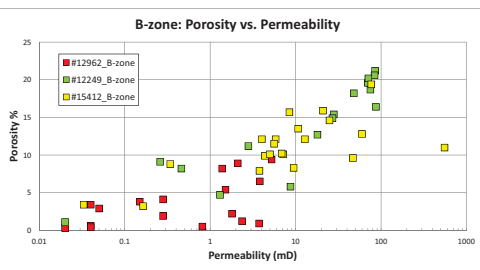
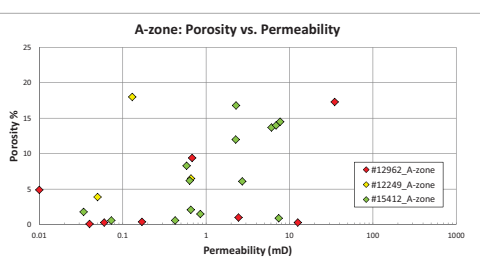


Figure 2. Lithologic descriptions, geophysical logs, photographs, and porosity/permeability cross-plots for A-zone/B-zone cores within the study area. Photographs and corresponding core location labeled with alpha characters.



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