Revised White River Group Stratigraphy and Uranium Mineralization in the Nebraska Panhandle

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The Crow Butte in situ leach (ISL) uranium mine in Dawes County, Nebraska has produced over 13 million pounds of U_3O_8 since 1991. In January 1981, Wyoming Fuel Company announced the discovery of at least 25 million pounds of U_3O_8 at a grade of 0.25% or greater near Crawford, Nebraska. At the time of discovery, it was thought that the uranium mineralization was in the basal sands of the Oligocene Chadron Formation (CF) in the White River Group (WRG). Recent revision of the WRG stratigraphy places the Crow Butte deposit in the Eocene Chamberlain Pass Formation (CPF) which is unconformably overlain by the CF.

The uranium mineralization at Crow Butte occurs in roll-front deposits similar to the classic roll-front deposits found in the Tertiary basins of Wyoming. The CPF consists of interbedded subarkosic sands and green bentonitic mudstones overlain by the well developed red Interior Palesol equivalent (IPE). The IPE is a significant sequence-bounding paleosol associated with the CPF- CF unconformity. The CPF reaches a maximum thickness of 350 ft west of Crawford, Nebraska and thins to less than 80 ft in the mine area. The overlying CF consists of green bentonitic mudstones, minor lacustrine limestones, and localized basal arkosic sands and gravels.

The tuffaceous WRG has long been considered as the source of the uranium in the economically important Tertiary basins of Wyoming. Evidence from paleohydrogeology in Nebraska suggests that the initial uranium roll fronts formed during the development of the IPE. The water table was low at this time, exposing large areas of previously deposited tuffaceous material to extensive weathering and leaching. In contrast, ground water levels were higher during the deposition of the CF mudstones and limestones. Discharge was largely local and only small, low grade uranium mineralization is found associated with the CF mudstones and carbonates. Exploration efforts in Nebraska should be directed to the permeable units underlying the IPE. The arkosic sands of the CF are less likely to host uranium rollfront deposits because they are located above the IPE. Th/U ratios combined with stratigraphic and petrographic study of the WRG paleosols would be useful for testing the hypothesis that sequence-bounding paleosols provide a stratigraphic record of the formation of uranium roll-front deposits.