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## **PS Hydrostratigraphic Controls from Uranium Mineralization - Example: The Nebraska Panhandle\***

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### **Abstract**

The Nebraska Panhandle is arguably one of the most overlooked uranium provinces in the US. Since 1991, the Crow Butte mine in Northwest Nebraska has produced a little over 13 million pounds of U<sub>3</sub>O<sub>8</sub> utilizing ISR technology. Demand and price increases indicate the possibility for additional exploration, exploration that may be enhanced by an improved understanding of the hydrostratigraphic controls on the uranium deposits. Uranium at the Crow Butte deposit occurs in the basal sandstone of the Chamberlain Pass Formation (CPF). New stratigraphic models can be used to reconstruct the paleohydrogeology of the White River Group (WRG) and provide direction for exploration.

The CPF consists of a basal white to greenish white sandstone composed of coarse grains of quartz, quartzite and chert. Extensive chemical weathering including the removal of iron and kaolinization give the sandstone a “bleached” appearance. The sandstone thickness varies from 0 to 350 feet and unconformably overlies the Cretaceous Pierre Shale or the Yellow Mounds Paleosol. The uppermost part of the CPF is the bright red Interior Paleosol Series and the laterally equivalent light green Weta Paleosol Series. The Chadron Formation unconformably overlies these paleosols and consists of bluish green mudstones; thin, interbedded, lacustrine limestone beds and localized channel sandstone deposits. The Chadron Formation sandstones are arkosic and contain more weatherable minerals than the CPF. Differentiation of the two sandstones is likely a critical factor in exploring for uranium.

The tuffaceous WRG rocks have long been considered the source of uranium in the Tertiary basins of Wyoming. Although the overlaying Chadron Formation bentonitic mudstones might be considered a source of uranium, evidence from paleohydrogeology [tufas, lacustrine limestone, reducing paleosols] suggests that groundwater table was high and groundwater discharge was largely local. In contrast, groundwater during the development of the Interior-Weta Paleosol Series was largely oxidizing and groundwater flow was downward into the underlying aquifers [CPF and older units]. Thus the initial uranium mineralization at Crow Butte probably occurred during the development of the Interior-Weta Paleosol Series at the CPF-Chadron Formation unconformity. Exploration efforts in Nebraska should consider these hydrostratigraphic relationships and be directed to permeable formations underlying the Interior-Weta Paleosol Series.

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