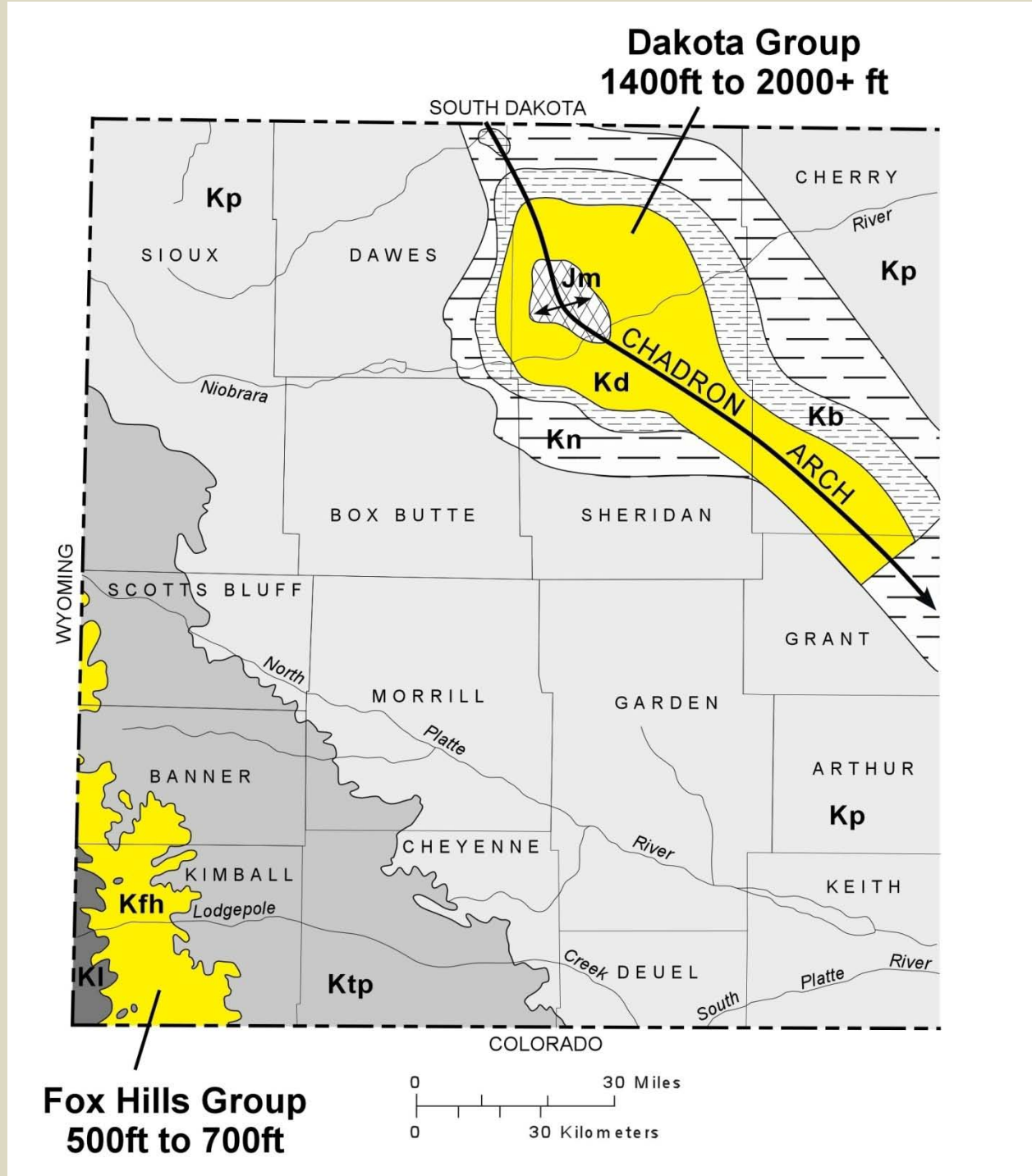
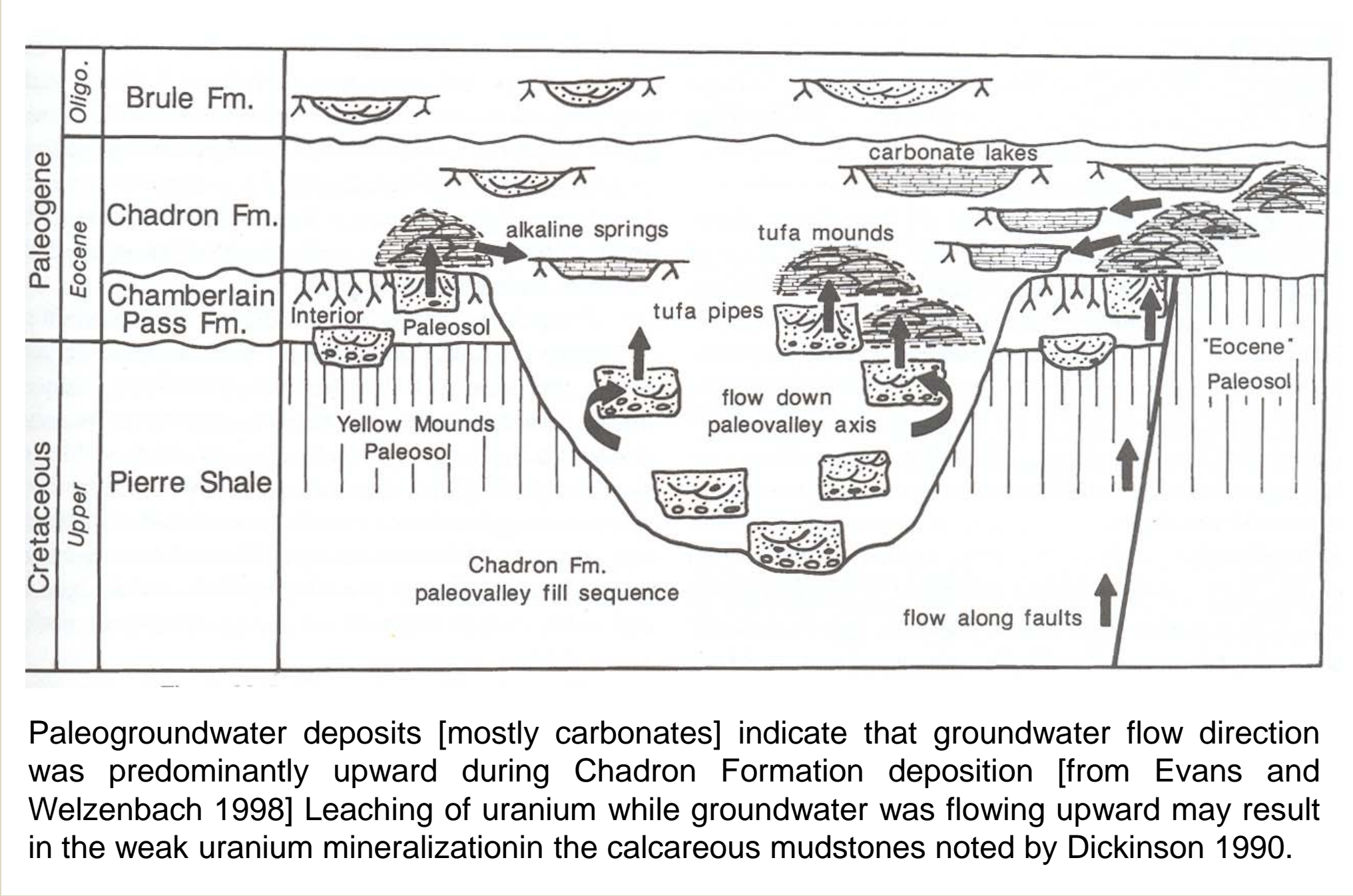
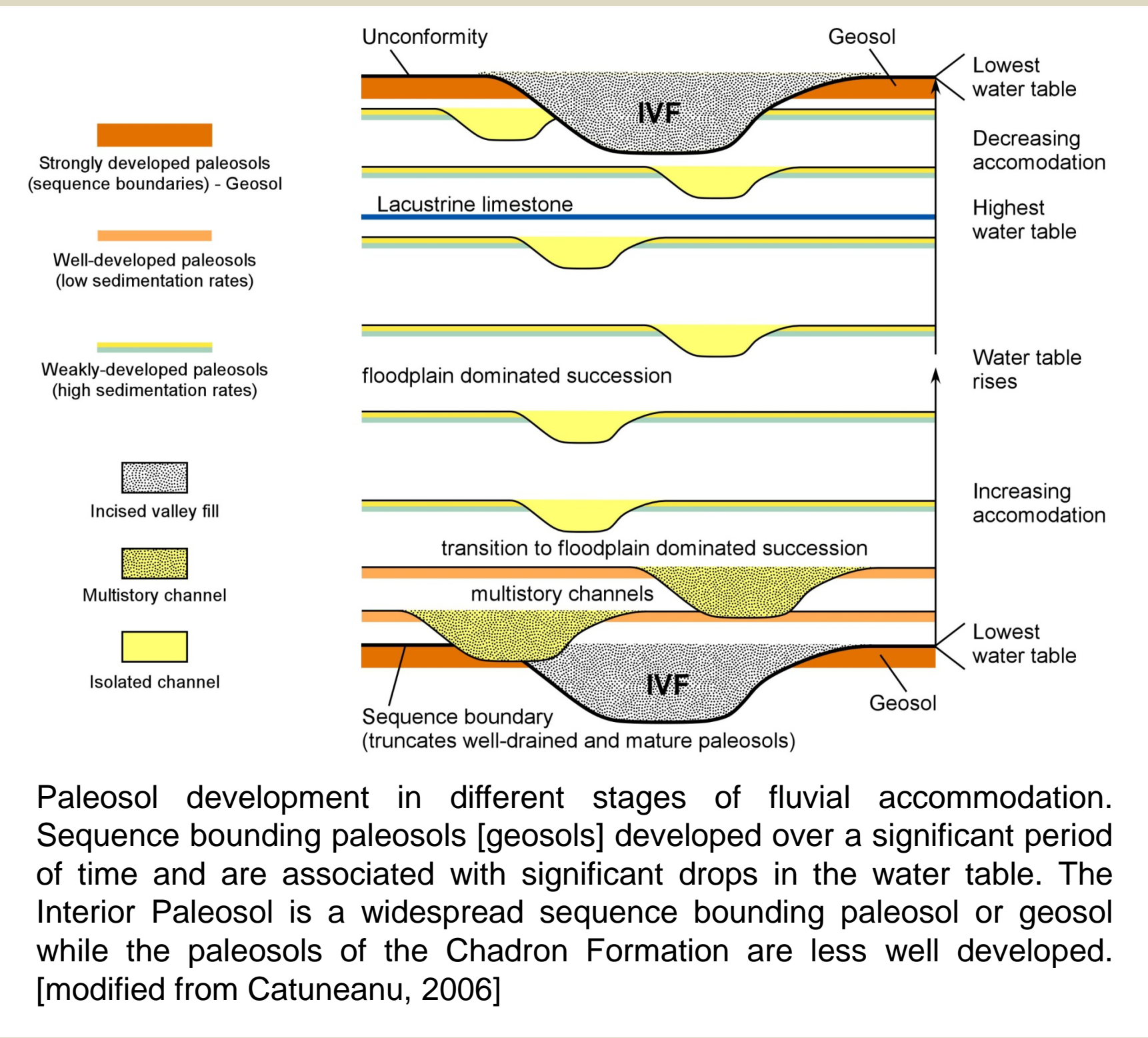
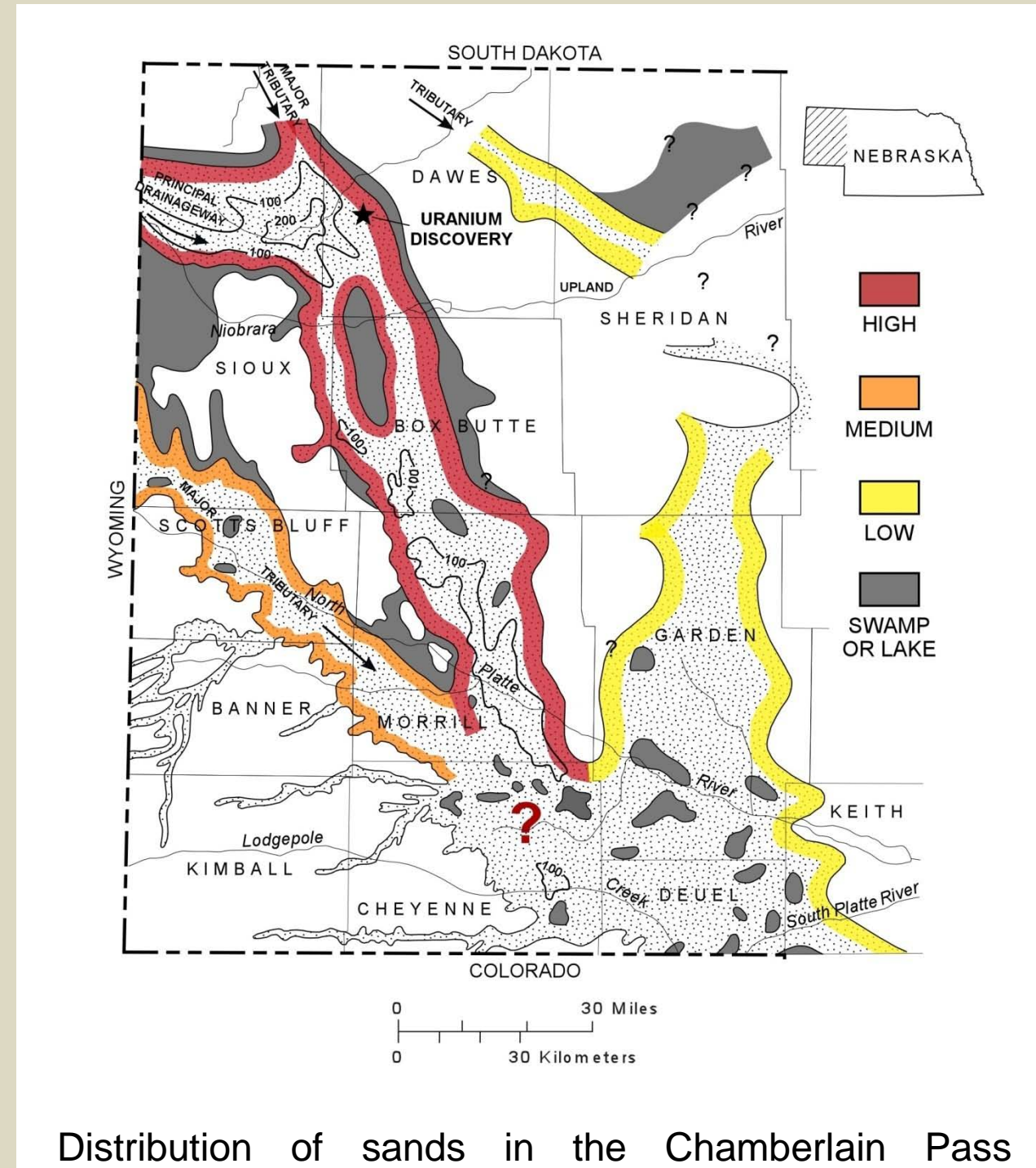


HYDROSTRATIGRAPHY AND MINERALIZATION

POTENTIAL URANIUM EXPLORATION TARGETS



Subcrop map of the geology underlying the White River Group in the Nebraska Panhandle. Permeable units are colored yellow. During the 1970's, Ferret Exploration found mineralization in the Fox Hills in Kimball Co. Union Carbide found mineralization in the Dakota Group on the Chadron Arch in Sheridan Co. Both units are dominantly marine sandstones and permeability could limit the feasibility of ISR mining. Map from Swinehart et al. 1985



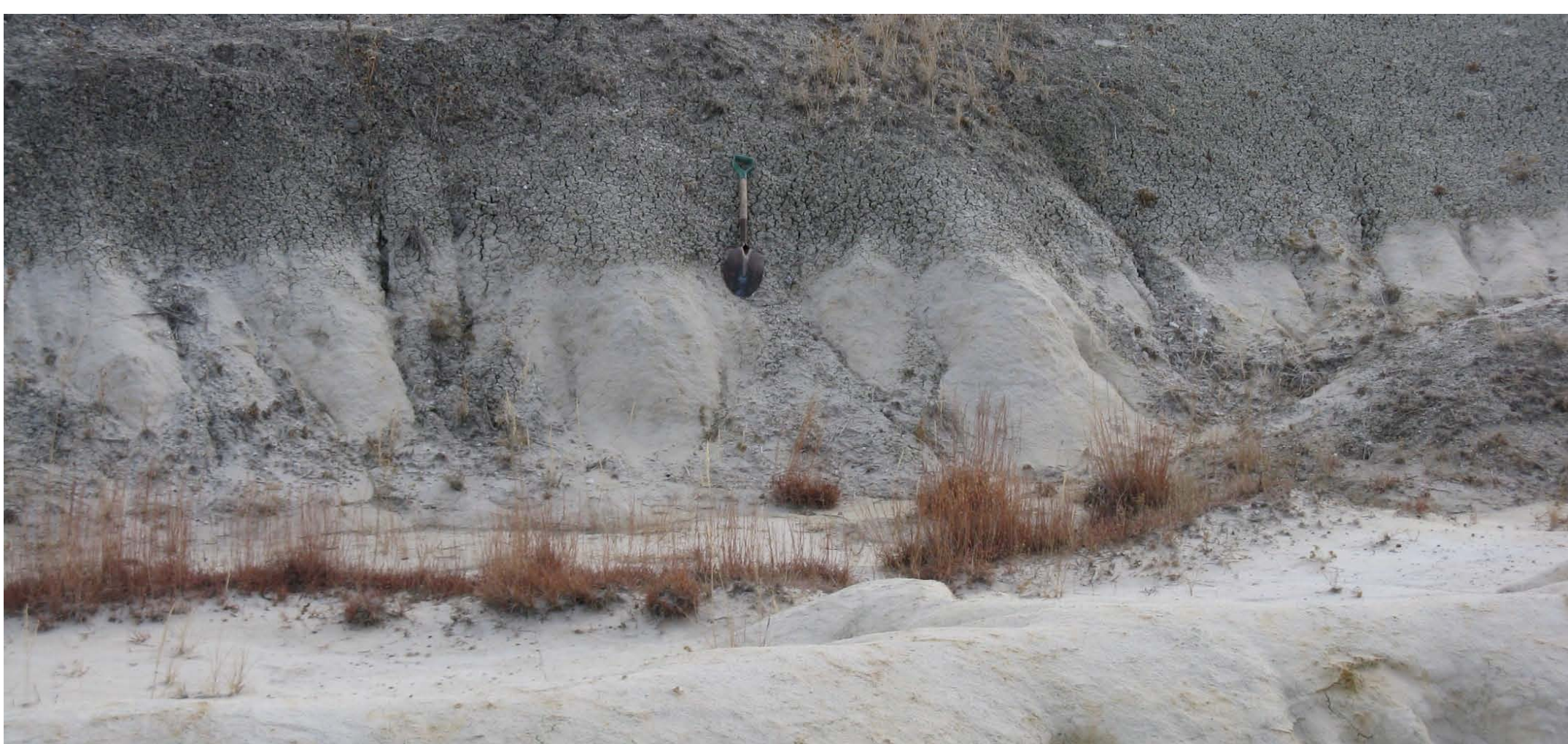
Carbonaceous material and Mn oxides at base of the Chamberlain Pass Formation. No uranium mineralization is present. This channel tributary is located near Whitehead Creek, Nebraska and flow direction is from north to south from South Dakota.



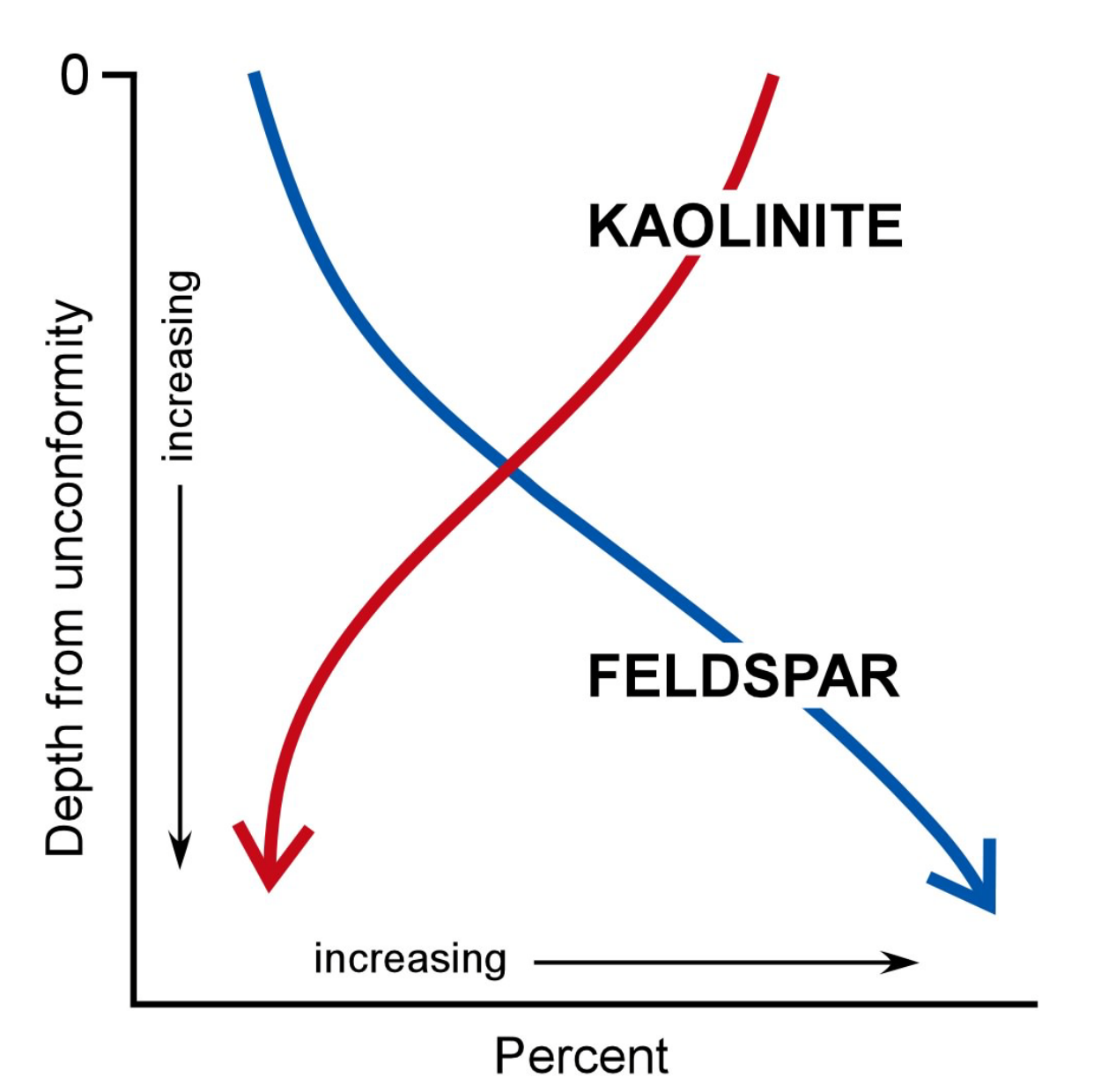
Tufa [nonpedogenic calcrete pinnacle] demonstrates groundwater flow was upward during carbonate deposition.

Interior Paleosol or Chadron Paleosol Series – Which is the Source of Uranium?

The Interior Paleosol developed over a significant period of time and is associated with a significant drop in the water table which would expose previously deposited tuffaceous sediments to leaching in the vadose zone. In contrast, the Chadron Formation paleosols are less well developed and there was a higher water table. Th/U ratios might be useful in determining which paleosols are depleted in uranium with respect to thorium. However, this might not tell us the fate of the uranium leached. Reconstructing the paleohydrogeology should be one of the criteria used when evaluating potential sources for uranium. If there is a high water table, any uranium leached may end up discharged into a stream or lake. In a low water table situation, any uranium leached is much more likely to end up in the underlying aquifer. It is for these reasons that the authors prefer the Interior Paleosol as a source for the uranium.



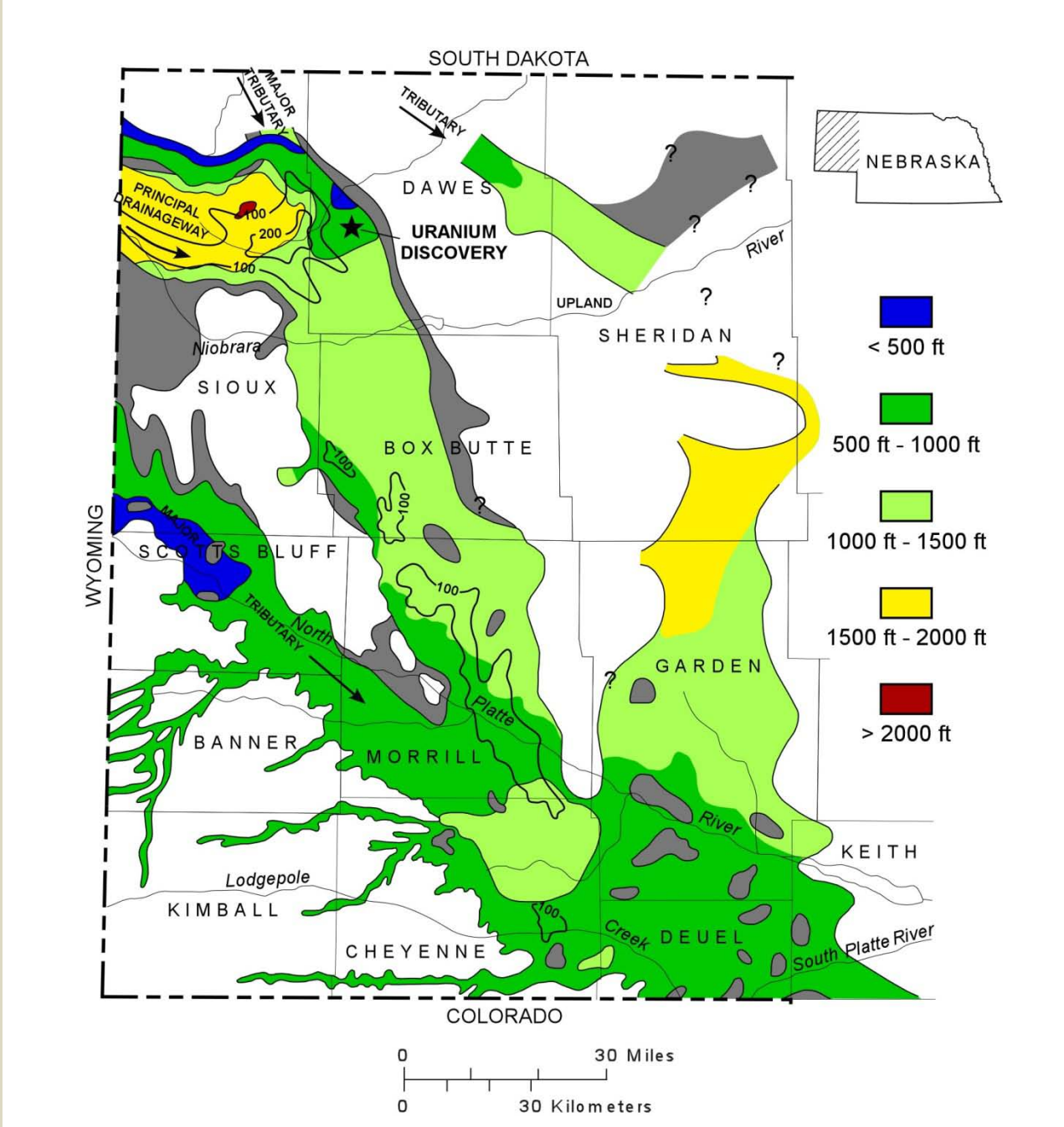
Chamberlain Pass Formation sand overlain by Peanut Peak Member of the Chadron Formation. Sand has been extensively weathered, feldspars have been altered to kaolinite and iron has been "bleached" or reduced prior to Chadron Formation deposition. Removal of iron oxides or precipitation of pyrite by reduction reactions can obscure the original oxidation event that formed the uranium roll front and make exploration difficult. The paleosols developed within the upper part of the Chamberlain Pass Formation show both oxidizing and reducing conditions (Terry and Evans, 1994). Methane, which is present locally, can also react and reduce iron oxides.



An inverse relationship between feldspar and kaolinite is seen in this type of weathering profile. "Bleaching" was caused by low pH and low pe water.



Outcrop of Interior Paleosol [red] developed directly on top of Yellow Mounds Paleosol [yellow] west of Whitehead Creek, Nebraska. The previously weathered Cretaceous shale would not make a good source rock for uranium. This is typical of the relationship between the two paleosols seen in the northern Panhandle of Nebraska and South Dakota. In contrast, the red Interior Paleosol overlies the green mudstones of the Chamberlain Pass Formation in the subsurface in Nebraska.



SUMMARY

- Considering paleohydrogeology is an important step in evaluating uranium sources.
- The Interior Paleosol is the most likely source of uranium at Crow Butte.
- The best potential for uranium deposits is in the Chamberlain Pass Formation.
- The margins of the incised valleys entering from Wyoming have the best potential.
- Iron minerals may not always be an effective exploration tool due to "bleaching".
- High permeability of the Chamberlain Pass sands are ideal for ISR.

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