

Sequence Stratigraphy and Paleopedology: New Tools for Exploring for Sandstone Uranium Deposits

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Research in the genesis of sandstone uranium deposits has suffered due to a lack of interest as the result of the bear market for uranium that started in 1980. During the last 30 years, sequence stratigraphy and paleopedology (study of fossil soils) have greatly improved the ability of geologists to decipher the stratigraphic record and have the potential to aid the exploration geologist in the search for economic sandstone uranium deposits. Studies in the late 1970's and early 1980's by the Texas Bureau of Economic Geology identified paleosols with abnormally low concentrations of uranium in the Tertiary volcanoclastic sediments of the Texas Gulf Coast. These paleosols are considered to be the source rocks of the uranium roll front deposits found in South Texas. More recently, paleosols have been used to identify unconformities, reconstruct ancient landscapes, estimate climatic conditions and to determine approximate depth of the water table during soil formation.

Sequence stratigraphy is a method of stratigraphic analysis that evaluates the sedimentary response to changes in base level. Base level is a surface of equilibrium between erosion and deposition. Base level can shift with changes in sea level, tectonism and climate. The initial incursion of high Eh uranium rich ground water into a reducing (low Eh) environment to form sandstone uranium deposits may occur due to lowering of base level. Lowering of base level can be expressed in the sedimentary record by the presence of a very well developed soil associated with an unconformity or diastem. This well-developed paleosol is a "sequence bounding paleosol" and may be a source rock for uranium deposits given the right type of parent material (i.e., rhyolitic glass) and under the right environmental conditions.

Since 1980, the Triassic, Jurassic and Tertiary volcanoclastic sediments of the Rocky Mountains have been intensely studied by academic geologists and paleontologists who have identified new unconformities and sequence bounding paleosols. A review of the literature suggests some of these sequence bounding paleosols could possibly be source rocks for sandstone uranium deposits. The Interior Paleosol Equivalent of the White River Group is a possible source rock for uranium in the Chamberlain Pass Formation in Nebraska. The middle Morrison paleosol could be the source rock for the uranium deposits found in the underlying Salt Wash Member of the Morrison Formation as well as the Todilto limestone. Additional research utilizing sequence stratigraphy and paleopedology can be used to identify uranium source rocks and to reconstruct the paleohydrogeology which resulted in the formation of sandstone uranium deposits.