HUMATE CONTROLLED ORE GENESIS AT A PLATEAU-TYPE URANIUM DEPOSIT, SAHARA MINE, UTAH

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Abstract

The uranium ore environment at the Sahara Mine, in channel sands of the Salt Wash Member, Jurassic Morrison Formation, Utah, is studied for characteristics in common with Grants-type (New Mexico) uranium deposits. Research by US Geological Survey (USGS) scientists, published as AAPG Studies in Geology 22 and elsewhere documents the characteristics of Grants-type deposits and proposes the genetic model used in this study.

Swamps that developed along braided stream systems in the Salt Wash experienced abundant volcanic ash-fall deposition during the late Jurassic. Humic-acid within these swamps leached uranium and other metals from ash. This reducing source fluid fell into surrounding channel sandstone "sieves" under gravity or during compaction of the swamp shales. A second, sulfate-rich, mineralizing fluid entered the aquifer during compact of evaporite units below the Salt Wash, setting up a two-fluid interface. At the interface, Ca cations and sulfate anions diffused across the boundary and combined with uranium–rich humic-acid, flocculating it into solid humate. Bacteria facilitated this process, feeding on sulfate, and precipitating framboidal pyrite.

Subsequently, burial heat augmented by warm alteration fluid from the deep Paradox basin entered the aquifer, heating it and causing solid humate to undergo methanogenesis to CO_2 and H_2. Uranium and other metals were left behind with an alteration assemblage including chlorite, pyrite, authigenic quartz, and depleted carbonate cement, which was enriched in upper aquifer sectors where acidic CO_2 and H_2 were buffered.

Methods original to this study and derived from previous USGS work are carried out to elucidate the genesis of the Sahara deposit.

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