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Genetic model for roll-front uranium deposits in the Gulf Coast Uranium Province, Texas, USA

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The U.S. Geological Survey is re-assessing the undiscovered uranium resource potential of roll-front mineralization in thick sequences of Paleogene and Neogene siliciclastic strata deposited along the U.S. Texas Gulf Coast. In southern Texas, 249 roll-front sandstone-hosted uranium occurrences have been identified. Of these, 102 were mined producing 81 million lbs of U3O8. Fifty-nine known deposits remain containing reserves of an estimated 54 million lbs of U3O8. A genetic model describing the most probable source, transport mechanisms, and depositional controls of these deposits was developed to estimate undiscovered resources in the region.

Most evidence points to rhyolitic volcanic ash beds interbedded with host sandstones as the uranium source. These tuffs probably originated in the Trans-Pecos volcanic field, which is located in southwestern Texas and adjacent Mexico. The most active period of Trans-Pecos volcanism, 46 to 16 Ma, corresponds with uranium mineralized sequences in adjacent Tertiary strata. Uranium transport is hydrologically controlled by oxidation gradients established in coastward dipping sedimentary facies. Important deposit clusters are found within large, permeable paleochannel systems, and other deposits are controlled by facies variations in ancient barrier bar systems. There is localized association of uranium deposits with offlap sequences caused by lowered sea level that rejuvenated groundwater flow, and increased erosion and oxidations depths. The Duval mineral trend, which contains about 25% of the total uranium found in the region, formed along the axis of the major Rio Grande paleochannel system that was active from the Eocene through the Miocene. Thick tuffs interbedded with sediments in this paleochannel provided a source for uranium that locally remobilized to form deposits within the Catahoula Formation. This uranium was remobilized and further concentrated downdip into the overlying Miocene Oakville Sandstone and Pliocene Goliad Sand. This newly recognized recycling and enrichment of uranium into younger sandstones down gradient along paleochannels may be important throughout the basin, but it has not been adequately tested. Both intrinsic and extrinsic reductants control deposition of uranium in roll-fronts. Most deposits appear to be controlled by extrinsic reductants that seeped upward from underlying gas fields. These gasses, or dissolved H2S, or organics in oil field brines, may have migrated upward via faults as many deposits are found adjacent to fault zones. Other economic deposits are found associated with intrinsic reductants, in the form of organic-rich reduced sediments that interfingered with the paleochannel and barrier bar systems. In east Texas, where more humid conditions resulted in greater amounts of organic matter in sediments, uranium is found associated with humates and rarely forms economic deposits. Almost all the roll-front deposits in Texas have been identified in western Texas, where arid conditions predominated and organic facies are less common than in eastern

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