ore-reserve correction factors have been assigned, one to each of three longitudinal zones. This use of multiple correction factors will optimize mine planning and uranium recovery.

Vertical profiles of radiometric and assay data through ore zones show dispersion of daughter isotopes away from uranium concentrations. Horizontal data plots show removal of daughter isotopes from the northeastern edge of the deposit and fixation of daughter isotopes in the central and southwestern parts of the deposit. Local loss of uranium is also suggested in the central and southwestern parts of the deposit. It is hypothesized that recent groundwater flow from east to west has redistributed the isotopic species. This flow system caused both the local vertical migration of daughter isotopes and also the transport of daughter isotopes and uranium in the direction of the hydrologic gradient. These conclusions are based wholly on chemical and gamma-equivalent uranium assays.

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Mineralogy and Geochemistry of Mariano Lake Uranium Deposit, Smith Lake District, New Mexico

The Mariano Lake uranium deposit is located on the west side of the Smith Lake district of the Grants mineral belt. Mineralization is restricted to a basal arkosic sandstone of the Brushy Basin Member of the (Jurassic) Morrison Formation. This sandstone, called the Poison Canyon sandstone (economic usage), consists of a sequence of paleochannels in which mineralization has been deposited in a roll-type tabular deposit. This roll front is directly related to an oxidation-reduction interface.

Chemically, the deposit is somewhat different from other Grants mineral belt deposits. Calcium and CO_3 content are low, but V, Ba, and S are relatively abundant. Sulfur found in pyrite is also possibly associated with uranium sulfates. Titanium is found as a secondary oxide, derived from titanomagnetites of the originally deposited mineral assemblage. Molybdenum, arsenic, and other trace elements show a regular zoning across the deposit, but cerium is slightly depleted.

The mineralogy of the Mariano Lake deposit includes abundant disseminated pyrite in mineralized reduced areas and hematite in the oxidized barren areas. Calcite, barite, gypsum, and jordisite are rare. Clay mineralogy includes kaolinite, chlorite, illite, and mixed layer illite-montmorillonite. Contrary to what has been found in other deposits of the Grants mineral belt, zonation of the clays is reversed, with kaolinite being more abundant in the downdip reduced sediments. The phenomenon is thought to be the result of backwash off the south-dipping flank of the Mariano anticline.

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Uranium in Todilto Limestone—Sabkha-Like Deposit

The Todilto Limestone was deposited in or near a large lake that at times became restricted and evaporated to dryness. The formation has two members: a lower limestone and an upper gypsum member. The limestone member has been divided informally into three zones: the lower "platy" zone, a middle "crinkly" zone, and an upper "recrystallized" zone. The platy zone is interpreted to have been deposited below wave base under anoxic conditions. The crinkly zone has thin stromatolitic laminations and may form algal domes. The upper recrystallized zone appears in part to be a collapsed breccia caused by the removal of interbedded gypsum. Uranium ore is restricted primarily to the "crinkly" and recrystallized zones. These two zones may have been formed in a sabkha-like environment.

A. R. Renfro has proposed a sabkha origin for some stratiform copper deposits. The same conditions that cause copper to precipitate would also cause uranium to precipitate. Groundwater bearing U^{+6} could be drawn upward by evaporative pumping through the decaying algal-mat zone where the uranium would be reduced to U^{+4} and precipitated. Carbonate materials lithify early destroying permeability so that uranium emplacement must occur before lithification. Radioisotope dates on uraninite in the Todilto Limestone indicate ore emplacement shortly after deposition. Uranium-bearing groundwater moved basinward in the underlying Entrada Sandstone and was drawn upward through the stromatolitic zones along the southwest margins of Lake Todilto and uranium was precipitated.

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Roll-Type Uranium Occurrence at Dennison-Bunn Claim and Possibility of Uranium Deposits in Eastern Part of San Juan Basin, New Mexico

Uranium at the Dennison-Bunn claim, south of Cuba, New Mexico, along the east margin of the San Juan basin, occurs in stacked fluvial-channel sandstones interbedded with gray-green mudstones of the Westwater Canyon Sandstone Member of the Morrison Formation of Jurassic age. Although all the sandstone units are mineralized, the greatest concentration of uranium occurs in the uppermost sandstone unit. The uranium deposits are low to medium grade, range from 0.001 to 0.07% U_3O_8, and are irregularly distributed along the margins of intertonguing oxidized and unoxidized sandstone. The configuration indicates that these are roll-type uranium deposits and that they formed at the interface between oxidizing and reducing solutions.

The host rocks dip 45° west into the basin. Reconstruction of the tectonic and sedimentologic history along the eastern margin of the basin suggests that conditions favorable for the solution, transportation, and deposition of uranium probably occurred from Late Cretaceous into Eocene time. Uranium in the mineralizing solutions may have originated from within the Morrison Formation or may have been leached from the Paleocene Ojo Alamo Sandstone or Nacimiento Formation, or from the Eocene San Jose Formation which once covered the area.

Similar uranium deposits occur in the Morrison Formation at the Goodner lease, north of Cachana Spring. The presence of oxidized sandstone in the Morrison