were deposited by a system of aggrading braided streams, possibly at the distal end of coalescing alluvial fans. The Poison Canyon sandstone was probably the result of deposition in a complex environment of meandering and braided streams. Paleocurrent direction indicators, such as fossilized-log orientation, foreset azimuths, and the axis of cross-beds and channel scours, suggest that the local paleostream flow was to the east and southeast.

The uranium mineralization is closely associated with (1) local accumulations of carbonaceous (humate) matter derived from the decay of organic material, such as trees and plants; and (2) paleostream channels preserved in the rocks. The ore elements were derived from the leaching of volcanic air-fall tuffs and ash, which were introduced into the fluvial system during volcanic activity in the western United States. The mobile ore element ions were reduced and concentrated by humic acids and bacteria present in the fluvial system, and ultimately remobilized in the system into the forms present today. The uranium is thus envisioned as forming either essentially on the surface as the sediments were being deposited or at very shallow (20 ft; 6 m) depth.

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Exploration for Uranium Deposits in Grants Mineral Belt, New Mexico

Uranium ore deposits in the Grants Mineral Belt, New Mexico, occur in fluvial sandstones in the Jurassic Morrison Formation.

Uranium mineralization is concentrated by a dark-gray to black substance that has been identified as humate derived from decaying vegetation. Black ore is truncated by overlying sandstone in at least two ore deposits, documenting an early age of mineralization. Ore deposits in the Grants Mineral Belt vary greatly in size and shape, generally occur in clusters, and often are difficult targets for drilling.

Current exploration is largely a process of drilling in stages to (1) delineate favorable from unfavorable ground on a wide-spacing, (2) seek mineralization in favorable ground, and (3) conduct closely spaced drilling in mineralized areas. Criteria for favorability differ among exploration groups but generally includes (1) the presence of a host sandstone, (2) anomalous mineralization, (3) color of host rock, (4) presence of carbonaceous matter, and (5) position of area with respect to mineralized trends.

A description of the sequence of drilling, from ore discovery to a mine on a one-square mile area at the Johnny M uranium deposit located in the east part of the Ambrosia Lake District, provides an example of the problem of predicting ahead of discovery where in a certain area, orebodies may occur. A study of the drill data at the Johnny M indicates the uranium ore is not related to specific features other than the presence of humate which is commonly associated with coalified plant fragments in mudstone-rich parts of the host sandstone.

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Radon Emanation Over Orebody: Has Long-Distance Transport of Radon Been Observed?

A major hope for discovering subsurface uranium ore is that measurable concentrations of the radioactive gas ^{222}Rn can be recognized near the surface of the earth. Integrated measurements, made over several weeks, show promise of giving greater reproducibility than short-term measurements, which are more subject to meteorologic variability.

The use of improved methods of integrated radon measurements—free of ^{220}Rn, of thermal-track fading, and of moisture-condensation effects—allow readings to be made that generally are highly stable over time. At a site 16 km north of Thoreau, New Mexico, readings at a depth of 60 cm, taken over a 9-month interval for a set of 55 positions, give different but nearly constant monthly readings at each position, the typical standard deviation being 14%. Superimposed on that stable pattern have been two periods during which spatially grouped radon readings increased by a factor of two or more over their normal values. The simplest tenable description of the source of the increases is sporadic puffs of upflowing gas, originating at as yet unknown depths. The measurements are consistent with an upward velocity of flow of $\sim 10^{-3}$cm/sec.

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Anomalous Orebody Within Ambrosia Lake Trend at Sandstone Mine

At the Sandstone mine, there is an anomalous orebody that lacks the characteristic coloring and gamma counts associated with known uranium ore at Ambrosia Lake. The orebody occurs along the downdip edge of a tongue of hematitic sand in the basal sand unit of the Westwater Canyon Member.

The orebody is white to light gray, most likely because of a lack of indigenous humic material. The abundance of pyrite indicates the uranium is in the tetravalent state, probably coffinite. Preliminary analysis also indicates the presence of uranophane evidently altered from the coffinite. Equivalent U_3O_8 by gamma determination is usually 30 to 60% of actual U_3O_8, indicating that this orebody is relatively recent.

Oxidizing meteoric water, forming a geochemical cell, remobilized the uranium minerals in the preexisting trend orebodies and deposited them downdip from the farthest extent of this cell. Post-Dakota deformation influenced the course of the migrating meteoric water and the extent of the redox interface controlling the orebody.

As lower grades of U_3O_8 become economical, the potential for unknown reserves adjacent to the redox interface should not be overlooked. Areas of low-grade ore should be sampled to become aware of any equilibrium imbalances. An established sampling program coupled with more sophisticated beta-gamma instrumentation should remedy the inaccuracy of present-day gamma evaluations.