the secondary ore than in the primary ore. Barren rocks adjacent to the ore are enriched in Ca, Ba, Cu(?), Sr, V, U, Na, Se, and carbonate C, compared with barren rock farther from the deposits. Both the enrichment of these elements in the vicinity of the deposits, and the better correlation of them (except for U) with eU than with U, suggest that these elements are mobile and form haloes that may be useful exploration guides. The data also suggest that Ga is depleted in and around the ore. Thus, a decrease in Ga might be an indication of proximity to a deposit.

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Permian White Rim Sandstone Member of Cutler Formation: Coastal Dune Field, Utah

The White Rim Sandstone Member of the Permian Cutler Formation in Canyonlands National Park, Utah, was deposited in a coastal eolian environment. This conclusion is based on sedimentary structures, petrologic features, and stratigraphic relations. The White Rim consists of two major genetic units. These units may represent a coastal dune field and related interdune ponds. Distinctive sedimentary structures of the coastal dune unit include large to medium-scale, unidirectional, tabular planar cross-bedding; high-index ripples paralleling dip direction of the foresets; raindrop impressions; slump marks; and coarse-grained lag layers. Also, a predominant northwest to southeast orientation of the cross-bedding agrees with the paleowind direction proposed in this area for Permian time. Distinctive sedimentary structures of the interdune pond unit include wavy, horizontally laminated bedding, adhesion ripples, and desiccation(?) polygons. These features may have been produced by water-table fluctuations.

Petrologic characteristics of the White Rim help to define the depositional environment as coastal. A crinoid fragment was identified at one location; heavy minerals are present in both units; and small amounts of well rounded, reworked glauconite are present throughout the study area.

The White Rim Sandstone Member was deposited during a period of changing sea level and migrating strandlines. Continental sedimentation was dominant in eastern Utah, along the ancestral Uncompahgre Mountains; and marine deposition was prevalent in western Utah. Rocks deposited in the two environments interfinger in the Canyonlands area. Previous authors have proposed that the White Rim represents either a shallow-marine or eolian facies equivalent to both the upper part of the Toroweap Formation and the Gamma Member of the Kaibab Limestone. Results from this study suggest that the White Rim more likely represents eolian deposition on a prograding shoreline characterized by a semiarid climate and predominantly onshore winds.

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Unsaturated Flow Conditions Beneath Lined Tailings Disposal Ponds

The uranium milling industry may soon dispose of substantial volumes of liquid waste in lined evaporation ponds. The potential for seepage through the low-permeable liner to contaminate ground water can only be assessed by analytic and numeric models. These models predict that, prior to reaching the water table, the liquid phase of the flow region will be unsaturated, except where perching may occur just above very low-permeable strata. None of the models actually simulate the effects of fractures in consolidated sediments.

Because seepage beneath the pond is predicted to occur under partly saturated conditions, piezometers usually employed in ground-water studies generally will not be effective monitoring tools. However, neutron moisture probes, suction lysimeters, and tensiometers well known to soil physicists could be used to monitor unsaturated flow. Unfortunately, none of these instruments is likely to be highly reliable in fractured-rock environments or in heterogeneous sound rock with a limited number of monitoring points. In fractured and nonfractured rock the primary means of detecting seepage losses exceeding model predictions should be from a mass balance of inflow rate minus evaporation.

Owing to unsaturated conditions beneath the pond, a well completed within the seepage zone could not produce water. This satisfies the NMEID mandate to protect future ground-water users after operations cease unless the seepage fluids contaminate the regional aquifer. Two- and three-dimensional numeric models show that seepage spreads beyond the perimeter of the pond; this may not be compatible with USEPA solid-waste-management regulations.

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Preliminary Report on Age of Uraniun-Ore Deposition and Host-Rock Formation at Lilljuthatten, Sweden

Analyses of 6 mineralized and 4 unmineralized samples from drill holes in the uranium ore deposit at Lilljuthatten, Sweden, yield an apparent Pb-Pb age of 425 ± 6 m.y. (errors at 95% confidence level). This age corresponds with the youngest phase of the Caledonian orogeny in central Sweden, indicating that the ore deposit probably formed during this event.

The age of the host granite has not been determined quantitatively because the Caledonian event has disturbed (and in some places completely reset) all the isotopic systems investigated thus far. Four new and 7 published Rb-Sr analyses approximate an isochron of 1,540 m.y., but two samples from near the ore zone have been reset to much younger apparent ages.

Isotope systematics in the Th-Pb and U-Pb systems are highly complex, but U-Pb data for a few samples suggest a host-rock age of approximately 1,500 m.y. If this age and thorium immobility are assumed, there is a suggestion that the host granite was extremely rich in uranium (30 to 50 ppm) at the time of intrusion and that the ore deposit may have formed by concentration of uranium from the host granite.

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Low-Temperature Geothermal Development and Monitoring at Gila Hot Springs, New Mexico

The combination of hot water (150°F; 65.5°C) from the Gila Hot Springs and cold water (50°F; 10°C) from the West Fork of the Gila River makes a 10-KW Rankine-Cycle turbine-generator feasible. Plans call for the installation of a generator during November 1980 and for the systematic monitoring for 1 year of both environmental parameters (water temperature, chemistry, streamflow, springflow, etc) and generator performance. The results of the monitoring program will become public information.

Institutional problems that have been addressed include water rights (both to hot and cold water) and effluent discharge. Electricity generated at the facility will be used locally and will constitute about 4% of the area's requirements.

If the generator lives up to its specifications, and if the institutional problems can be resolved, a deep (5,000 ft; 1,524 m) exploration well will be drilled to search for hotter water in larger volume.

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Mammalian Biochronology of Late Cenozoic Basins of New Mexico

The remains of fossil mammals have been collected from the late Cenozoic basins of New Mexico since the middle of the last century. Intensive work in the northern Albuquerque and Espanola basins in this country has resulted in large collections whose lithostratigraphic context has recently been published. Work on the biochronologic significance of these fossils has revealed that these thick basinal deposits preserve a record of the succession of mammalian faunas covering nearly the entire span of Miocene time. The record in each basin is not completely synchronous, but overlaps sufficiently so that the composite succession will eventually yield an important biostratigraphic standard for southwestern North America.

It is possible to correlate this faunal succession and many other scattered fossil mammal occurrences within New Mexico with the geochrons of the North American Mammal Ages. Such correlations can be calibrated with a maximum precision of 1-2 m.y. and are thus of significance to historical geology. Geochronologically important fossil mammal remains are known in most of the late Cenozoic basins of New Mexico, but many of these have either gone unrecorded or have not been critically examined. Examples are: late Miocene through early Pleistocene successions in basins drained by the Gila River; early Miocene mammals from the northern Black Range; the Pliocene and Pleistocene faunas of the basins drained by the Rio Grande from Albuquerque south to the border; and early Miocene mammals from pre-Santa Fe Group rocks in the Espanola basin.

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NOAA/DOE State Geothermal Mapping Program

The Data Mapping Group of the U.S. National Oceanic and Atmospheric Administration (NOAA), National Geophysical and Solar-Terrestrial Data Center, has been producing geothermal maps and other geothermal data products for the U.S. Department of Energy (DOE) under DOE's state geothermal resource assessment program. Under this program, DOE-funded state teams collect, analyze, and interpret the geothermal data in their respective states. These data are provided to the NOAA team which is responsible for making the state maps. The University of Utah Research Institute and Los Alamos Scientific Laboratory act as liaison between the state teams and NOAA.

For most states in the program, two maps will be produced. First is a "public usage" map which is designed to communicate the extent of a state's geothermal resources to legislators, land-use planners, environmentalists, entrepreneurs, and the general public. Geothermal data sets on these maps include location, temperature, flow rate, and total dissolved solids (TDS) of thermal wells and springs, depth of wells, heat flow data, known geothermal resource areas (KGRA), and areas considered to have a high probability of additional low-temperature geothermal resources. The second map will be more technical and emphasize the tectonic, geophysical, and geochemical parameters associated with the geothermal resource.

"Public usage" maps for California, New Mexico, Utah, Colorado, and Idaho have been printed as has "Thermal Springs List for the United States." Maps for 11 other states will follow.

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Dolostone Reservoirs in Horquilla Formation (Pennsylvanian-Permian), Big Hatchet Peak Section, Hidalgo County, New Mexico

Dolostone reservoirs with net thickness of 484 ft (148 m) in upper Horquilla, are exposed in the Big Hatchet Peak section of southwestern New Mexico and constitute the best petroleum objective demonstrated to date in the Pedregosa basin.

This shallow-marine carbonate section includes uppermost Paradise Formation (Chesterian) and 3,230 ft (985 m) of Horquilla (Morrowan-Wolfcampian). The lower member of the Horquilla consists of limestone and chert; a disconformity at the top formed during the Desmoinesian. The upper member is at least 1,867 ft (569 m) thick; limestones contain phylloid-algal biostromes and ancient solution cavities; alternating laterally extensive dolostones are 54 to 148 ft (16.5 to 45 m) thick and exhibit much vuggy porosity.

Petrographic evidence demonstrates that the limestones were stabilized within freshwater diagenetic environments, that they contained much primary or secondary porosity, and that practically all of it was occluded by marine or freshwater cements. Dolostones also contained much secondary intercrystalline and moldic porosity that was partly occluded by epitaxial cements and coarse recrystallization of initial neomorphic rhombs. Anhydrite porphyroblasts were emplaced by hypersaline waters and were dissolved later by fresh ground waters to form molds with distinctive stairstep outlines; this tertiary (third stage) porosity in dolostones was partly filled by gravitational cements, and some microstalactite tips were dolomitized paramorphically.

Dark Horquilla limestones are rated as fair petroleum-source units. Land-derived kerogens indicate sources of gas; alteration indices of 3 to 3+ indicate moderate thermal history. Dolostones in the upper member are rated as fair to good reservoir units. Matrix porosity and permeability are poor but should improve farther south along the shelf edge and on the slope into Alamo Hueco basin.

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Application of Lacustrine-Humate Model to New Mexico Grants Mineral Belt and Relation Between Ore Types and Hydrologic History of San Juan Basin

In the Grants mineral belt, greenish-gray lacustrine claystones and mudstones of the Brushy Basin Member and K