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.

STEELE-MALLORY, BRENDA A., U.S. Geol. Survey, Denver, CO

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.

STEPHENS, DANIEL B., and JOEL SIEGEL, New Mexico Tech, Socorro, NM

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.

STUCKLESS, J. S., C. E. HEDGE, I. T. NKOMO, U.S. Geol. Survey, Denver, CO, and B. TROENG, Geol. Survey Sweden, Lulea, Sweden

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.

SUMMERS, W. K., W. K. Summers and Associates, Inc., Socorro, NM

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