are largely buried by more recent, lower-magnesium basalt flows that followed. Such material is vital to an understanding of the lunar interior, but, she says, "if we're correct in our interpretation, the surface basalts are a misleading sample."

Charting such uncertainties is often cited as a reason for the U.S. Lunar Polar Orbiter, which is not exactly waiting in the wings. A Soviet version was asserted to be due "within five years" by a Soviet official at last year's "rockfest," but the prevailing opinion among U.S. scientists at last week's meeting was that it is no likelier to fly. The best hope seems to lie with POLO, a Polar-Orbiting Lunar Observatory now being studied by the European Space Agency as a joint project for its member nations. POLO is no shoo-in either, however, and European scientists at a special session during the rockfest discussed with some concern the possibilities of getting the proposal past the preliminary scientific assessment that has been done.

One of POLO's problems, like the LPO's, is that it is competing with possible missions to less-visited parts of the solar system (such as a multiple asteroid "fly-by"). A factor in such competition is the diversity of planetary surface types revealed by recent missions to non-lunar targets. Given the parched nature of the moon, Mercury and probably Venus, a particularly tempting category is those surfaces either made of, or strongly influenced by, water. The presumably ice-rich crusts of Ganymede and Callisto and the variety of possibly water-formed features on Mars showed signs at the conference of drawing a widening range of interest.

Studies of impacts into ice, says Mark J. Cintala of Brown University, suggest, for example, that craters made on icy bodies may often be characterized by "pits" at their centers rather than by the central peaks seen in many craters on, say, the moon. The rebound splash of the impact that hardens into a peak on a rocky world may just fly apart, leaving a hole, when the rebounding surface is as weak as ice, Cintala says, and such central-pit craters seem to show in Voyager 1's photos of Ganymede and Callisto. If the difference is really due to ice, the presence of similar features in Viking's Mars images may now be additional evidence of the presence of permafrost on that planet. Except that they also exist on the moon. Still, certain ridges seen on Mars resemble ridges thrust up through ice in Iceland, and, according to Charles Simonds of Northrop Services, Inc., of Houston, a Martian water reservoir vaporized and redistributed around the planet by impacts might help account for the clay-like nature of the surface material inferred from Viking data. Some Martian geologic features such as table mountains, in fact, says C. C. Allen of the University of Arizona, seem to suggest water-related formation processes requiring nearly 10 times the water invoked by current atmospheric history models. □

SYNROC—a better way to store rad wastes?

How to store high-level radioactive wastes safely and permanently is a thorny problem. Whether or not one buys the argument that nuclear power is both necessary and safe, there are already growing stores of radioactive wastes from power plants and nuclear-weapons plants that must be dealt with. Encapsulating wastes in borosilicate glass and burying them in geologically stable graves of rock or salt is one potential solution that appears to be gaining favor. A. E. Ringwood, a geochemist at the Australian National University's Institute of Advanced Studies in Canberra, offers another in the March 15 NATURE; he calls it SYNROC.

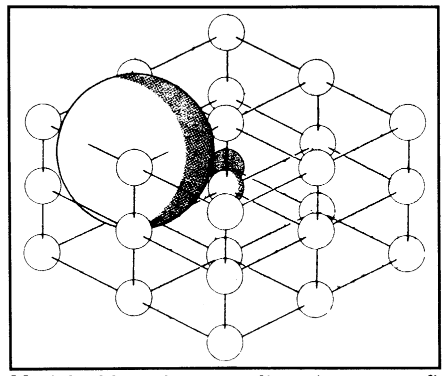
The idea is to bond atoms of the radioactive waste into the crystalline structure of a stable, synthetic host rock composed primarily of three minerals: perovskite, hollandite, and celsian — at least two of which are highly insoluble. The mixture of minerals and the radioactive wastes would be melted separately and then combined in a ratio of nine parts melted rock to one part waste. The igneous blend would then be poured into a thick-walled nickel canister and uniaxially cold-pressed to about 70 percent of its theoretical density. After being sealed with a thick copper and nickel lid, the entire assembly should be hot-pressed at 1,200° C to 1,300°C into a mechanically strong package "close to its theoretical density."

Ringwood and his ANU colleagues claim that aside from the benefits of simplicity, encapsulating and sealing wastes in a single process tend to reduce the loss of substantial amounts of cesium, ruthenium and other volatile elements that occurs in the production of borosilicate glasses, for instance.

More important, since the mineral components of SYNROC constitute 90 percent of the final product, they will determine its atomic structure and geochemical properties, Ringwood says. Atoms of the radioactive-waste elements simply substitute, in low concentrations, for the atoms that otherwise determine SYNROC's structure. This means chemists have a greater opportunity to predictably engineer the bonding—and as far as radioactive wastes are concerned, the immobilizing—structure of SYNROC, Ringwood claims.

In tests at high temperatures and pressures, SYNROC outperformed borosilicate glass for maintaining its integrity. It also degraded far less than glass when subjected to pure water.

The more dangerous and long-lived radioactive elements must be safely contained for thousands or millions of years. Ringwood feels SYNROC will be able to do this better than currently competing technologies; it should react less with the rock in which it's buried because it can be made to resemble the rock in which it's buried, he says. An account of Ringwood's work in the September 1978 SCIENTIFIC AUSTRALIAN describes a waste-storage scheme where bore holes drilled into granite to depths of 3,000 meters would be filled with nickel-covered SYNROC capsules to within 1,000 meters of the surface. Spaces between capsules and in the top 1,000 meters of each hole would be sealed with impermeable clay and mudstone. □



Scientific Australian

Model of how large, radioactive atoms fit into the spaces (lattice) of SYNROC.

Anticancer proteins

Protein complexes have been isolated from mouse blood that, when injected into other mice with tumors, killed their cancers quickly, sometimes within 24 hours. So reported Saul Green of New York's Memorial Sloan-Kettering Cancer Center at an American Cancer Society seminar in Daytona Beach, Fla.

The protein complexes can also sabotage human cancers, preliminary evidence from Green and his colleagues suggests. The complexes killed cancer cells taken from patients with cancer of the large intestine and skin, slowed the growth of a human tumor called a neuroblastoma and caused human melanoma tumors growing in mice to shrink. What's more, Green and his co-workers have isolated similar protein complexes from the blood of humans. These complexes are called "normal human globulins" (NHG's).

Both because of their apparent effectiveness against human tumors and because they are substances natural to the body (and therefore purportedly safe), the protein complexes might eventually be used to treat cancer patients. First, though, scientists must learn more about how they work against tumors and whether the human proteins are as effective as the animal ones. Then they must obtain enough proteins for widespread testing.

Green suspects that the proteins may constitute vital natural defenses against cancer, both among animals and humans. They may help explain, he conjectures, why three out of four persons do not get cancer. □