A step toward remote mineralogy

An experimental instrument carried by the Space Shuttle Columbia has demonstrated for the first time that it is possible to identify a range of different minerals and clays from space. The actual minerals detected, such as clays and limestone in Egypt and clays and iron oxide minerals in Baja California, may or may not indicate sites that are suitable for mining. But the finding that an instrument in space can identify minerals by measuring the amount of light that the earth reflects is certain to affect global mapping and the ways geologists glean information about the locations of mineral deposits.

"The significance of the experiment is that it opens a door to a whole new approach to geological remote sensing which will allow us to do mineralogy from space," says James V. Taranik, formerly with the National Aeronautics and Space Administration's Office of Space Science and Applications and now dean of the Mackay School of Mines at the University of Nevada. He anticipates that the measurements from space will lead to better geological maps, especially in remote areas where extensive field work is difficult, and to a more thorough assessment of the world's mineral resources.

The instrument, called the Shuttle Multispectral Infrared Radiometer, or SMIRR, was carried aboard the shuttle during November 1981 on its second flight. The findings were described at the recent International Symposium on Remote Sensing for Exploration Geology by Lawrence C. Rowan of the U.S. Geological Survey in Reston, Va., and Alexander F.H. Goetz of the Jet Propulsion Laboratory in Pasadena, Calif.

Based on earlier measurements taken from the ground and from aircraft, the researchers calibrated the instrument to measure 10 bands of light in the visible and infrared, or invisible, parts of the light spectrum. It was known that the structures of various minerals cause them to absorb light in specific ways. Consequently, clays and other minerals reflect light of different wavelengths that then can be measured within narrow bands in the spectrum. Limonite, a common group of iron-bearing minerals, had been identified previously by instruments in orbit, but the SMIRR results mark the first time that carbonate rocks and different types of clay minerals have been noted from space. Until recently identification of clay minerals required laboratory techniques.

"The shuttle experiment was just that—an experiment," Rowan says. "We weren't attempting to collect data on a worldwide basis to do mineral exploration. We were trying to determine whether these bands that we had found to be useful from aircraft and on the ground could be useful from orbit. It looks like they are."

The spectrometer will be a useful tool because "if you can identify particular kinds of clay, you can begin to categorize different kinds of mineral deposits" with which the clay is associated, Taranik says. For example, it is not yet known if the Baja California site is minable. However, the previously unprospected area is similar to ore-rich deposits in southern Nevada and Utah that, like the Mexico site, were formed millions of years ago when volcanic rocks were altered by superheated hydrothermal fluids.

The experimental data are not in a form easily usable by most geologists. Taranik says researchers have recommended a follow-up experiment using an instrument to be called a shuttle imaging spectrometer. The device, yet to be designed, would measure 30 different wavelengths of reflected radiation over swaths on the ground 10 kilometers wide. It would produce images similar to those compiled from Landsat D's data (SN: 7/3/82, p.4) and probably would not be ready for use until 1987 or 1988. —*C. Simon*

and gravity's lens

lieved to be two images of one and the same quasar that are formed by the bending of its light rays by the gravitational field of a cluster of galaxies lying between the quasar and us. The galaxy cluster is relatively transparent, so theory says there should be a third image, and one of the places it may be is in line with the cluster of galaxies. Using Mark III on the Effelsberg antenna, deep space tracking antennas at Goldstone, Calif., and Madrid, Spain, and three smaller ones, Gorenstein et al. found a very small, very faint source (0.02 seconds of arc across with a flux level only 0.6 millijansky) coincident with the galaxy cluster. But they cannot be sure whether it is the third image of the quasar or the core of one of the galaxies. They believe it will take observations with even more sensitive recorders to tell.

—*D. E. Thomsen*

Tokamak Test Reactor

The largest example in the United States of the type of thermonuclear experiment called a tokamak went into operation on Dec. 24. The Princeton Plasma Physics Laboratory of Princeton University announced that its Tokamak Fusion Test Reactor successfully confined its first plasma on that date. A tokamak is a doughnut-shaped vacuum chamber in which magnetic fields confine an ionized gas or plasma that is heated until the nuclei in it begin to fuse. TFTR is expected to be the first to reach ignition or "scientific breakeven," the condition of getting as much energy from fusions as is put in to confine and heat the plasma. □

Watt yields on wilderness leasing

Interior Secretary James Watt has encountered stiff opposition in his efforts to open up federal lands — especially designated wilderness areas — to mineral leasing and exploration. It now appears that opposition was effective. In an informal briefing with reporters on Dec. 30, Watt announced he will issue no more mineral-exploration or -development leases for wilderness lands or for areas under consideration for wilderness designation.

The announcement — a 180-degree departure from Watt's previously advocated posture — brought a generally guarded round of applause from the environmental community. "It looks like Watt's thrown in the towel and finally given up his one-man crusade to open up the wilderness system to mineral leasing," said Peter Coppelman of the Wilderness Society. However, he added, the society will reserve judgment on Watt's turnabout in policy until it sees "how he's going to implement that decision."

Coppelman noted that the society's continuing suspicions about whether Watt was acting in good faith had been fueled by what Coppelman described as the Interior Secretary's post-Christmas "midnight raid on the wilderness system." Coppelman was referring to Watt's Dec. 27 decision to remove 800,000 acres from study as potential wilderness areas and to reexamine whether another 5 million acres might not also be eliminated from a list of potential wilderness candidates.

Watt's decision had been prompted by three legal rulings by agency judges on the Interior Board of Land Appeals (IBLA) involving the eligibility of various categories of land for consideration as wilderness. One ruling excluded from wilderness consideration all non-island property less than 5,000 acres in size, saying that the agency lacked authority to protect parcels so small. A second ruling exempted any "split estates" — parcels where surface and subsurface mineral rights were owned by different governing bodies. Finally, on the judges' recommendation, Watt decided to review whether individual wilderness candidates had been evaluated for suitability based on their own merit (as opposed to the merit of important adjoining property).

That Watt issued these decisions after Congress finished its lame-duck session—something he had specifically been instructed not to do by the chairman of the House subcommittee on public lands — can only be viewed as underhanded, Coppelman says. Moreover, he added, "We think these decisions are not legally sound." As a result, "We and other groups will be challenging them in court," he said.

—*J. Raloff*