EARTH SCIENCES

Antarctica summer research

Antarctica seems to be a favorite wintering spot of some U.S. researchers; those months that bring snow and ice to the United States are the only months of relative warmth in the southernmost continent. This year, about 300 U.S. researchers will take advantage of the austral summer to conduct a variety of projects during the 25th year of the National Science Foundation-funded U.S. Antarctic Program.

The largest of the 80-odd investigations scheduled for the season is the first leg of a four-year study of the Ellsworth Mountains, a 220-mile long, 50-mile-wide north-south range located between the West Antarctica plateau and the Ronne Ice Shelf. The mountains mark a tectonic boundary between geologically younger West Antarctica and older East Antarctica. Under the direction of geologist Gerald F. Webers of Macalester College in St. Paul, Minn., the researchers will try to determine what role the mountains may have had in the break-up of the supercontinent Gondwanaland and the formation of Antarctica. To that end, the project will include a search for fossil plants and animals (which may furnish reliable dates for the geologic history of Antarctica and its relationship to other continents) and a survey for radioactive elements (part of an ongoing study by University of Kansas geologists, which may reveal something of the geologic structure).

Other projects include:

- A study of the sediments near Taylor Valley — one of the ice-free regions, located at the boundary of McMurdo Sound and the Transantarctic Mountains — in order to determine if those mountains are an active or inactive plate boundary between East and West Antarctica.
- A continuing study of the movements and behavior of marine animals, especially Weddell seals and the antarctic cod.
- An experiment in which researchers will generate very low frequency signals in order to study the relationship between such electromagnetic waves and the precipitation of charged particles from the earth's radiation belts.
- A study of antarctic sea ice by buoy and by ice thickness measurements in order to examine the interaction of sea ice, ocean circulation and atmospheric circulation.
- A commemorative flight of an LC-130 airplane using the same route taken by Admiral Richard E. Byrd and colleagues to mark the 50th anniversary of that first flight over the South Pole.

Underwater habitat starts research

Refurbished, refitted, reinspected and renamed, the nation's only underwater habitat — called NOAA's Underwater Laboratory System-1 — has begun its first round of research projects. The former Hydro Lab (SN: 5/10/75, p. 307) — one of only two underwater laboratories in the world — was purchased by the National Oceanic and Atmospheric Administration in 1976. Since then, its facelift has included increasing the head room, adding two more bunks and installing hot and cold running water, a hot water heater, microwave oven, trash compactor, work shelves and storage compartments in its 16-foot-long, 8-foot-diameter cylinder. Anchored on the sea floor off St. Croix, U.S. Virgin Islands, and linked to the surface world and fresh water and air by a life support boat, it affords scientists a unique view of underwater ecology.

Its first season as NULS-1 began in July, as a team of researchers, led by John Ogden of Fairleigh Dickinson University, built small "reefs" of cinder block near the habitat to observe fish settlement and colonization. Other completed studies include a look at sediment movements and research on fish parasites. Among future projects are a study of the growth and mortality rates of black coral and a survey of plankton-feeding fish.

Uranium mining à la Landsat

Among those earth features especially visible to the high-resolution eyes of the Landsat satellites are vegetation cover and geologic structures called lineaments, which are long, linear surface features. And, apparently — according to Gary Raines of the U.S. Geological Survey in Denver — that visionary ability may be a boon in locating mineral deposits — particularly uranium.

Based on studies of Landsat photos of the Powder River Basin in northeastern Wyoming and southeastern Montana, Raines and co-workers have found that medium vegetation cover and lineaments are indirect evidence of subsurface geologic conditions favorable to the accumulation of uranium. According to Raines, groundwater, which leaches uranium from the soil of the basin, flows slowly through sandy bedrock — marked by high vegetation — until it comes to less permeable rock — marked by medium vegetation such as sagebrush. In such areas of lower permeability, which are also associated with the presence of lineaments, uranium may precipitate out of the groundwater. During thousands of years, the uranium may build into a large deposit.

The widespread applicability and success of the still-experimental technique is yet to be proven, according to Raines, and, he stresses, it does not pinpoint uranium deposits but only targets areas with high mineral potential. In 1977, however, the technique was used successfully to map the deposits in a 5,000-square-mile area of the basin; a new study to be completed this year will concentrate on the remaining 50,000 square miles.

Playing the oil game

Ever wonder about the barrels of oil and cubic feet of gas that are repeatedly "found" just off the California coast/Eastern seaboard/Gulf of Mexico? Ever wonder where those firm-sounding estimates come from? Well you may wonder. "All too often," say N. Terence Edgar and Kenneth C. Bayer, "oil and gas resource estimates have been taken with too much faith and too little understanding of how they are generated and what they represent." In the fall 1979 issue of OCEANUS, Edgar and Bayer of the U.S. Geological Survey in Reston, Va., describe some of the pitfalls of resource estimates, using the Baltimore Canyon Trough as an example.

The Baltimore Canyon Trough is a 500-kilometer-long basin along the continental shelf from Long Island to Cape Hatteras. The BCT meets one of the fundamental conditions for the formation of oil and gas: The volume of sediment is sufficiently large — 122,000 cubic miles — to favor the presence of oil and gas. Seismic profiles of the BCT — a "cross section" of the basin obtained by sending sound waves into the rock that can show places where oil and gas might be trapped — had been made in 1974. By comparing the seismic record to analogous on- and offshore areas where drill holes had been made and analyzed, a "resource appraisal," stated in terms of a range of probabilities, was made. The BCT, because of its favorable geological structures — particularly one thick intrusion known as the Great Stone Dome — was predicted to be highly productive. (A high estimate for the area was around 4 billion barrels of crude oil.) Yet, despite all seismic promises and the encouraging results of later exploratory (but not deep enough for oil) drilling, the BCT has fallen short of its billing. After five dry holes over the Dome, only two discoveries, one of gas and one of oil, have been made in the BCT. "Clearly," say the authors, "more knowledge about the geologic history and the nature of the rocks in the basin is required to substantially improve the accuracy of resource assessments." In addition, they suggest, a resource assessment might be more meaningful if placed on an arbitrary logarithmic scale rather than stated as a figure.