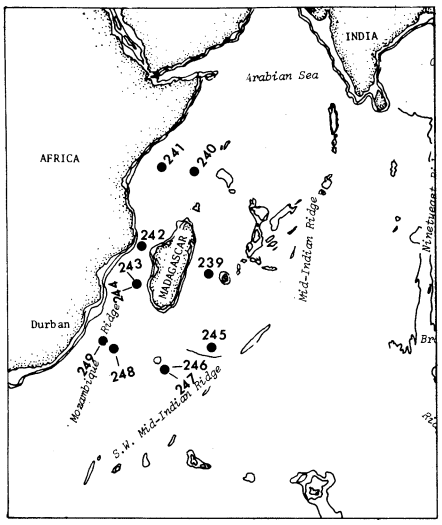

Scripps

Leg 25 sites: New clues, questions.

complete supply of scientific surprises.

The expedition, led by E. S. W. Simpson of the University of Cape Town, South Africa, and Roland Schlich of France's Geophysical Observatory, drilled at 11 sites in the southwest Indian Ocean. The 55-day cruise began July 28 at the island of Mauritius and ended Aug. 22 at Durban, South Africa. Among the findings issued last week:

- Sediments spanning "vast intervals of geologic time"—as much as 50 million years—are completely missing from many areas of the Indian Ocean. In seven of the eight deepest holes, there was a gap in the sediments between 40 million and 20 million years old. A gap of about the same age and duration had been found by Leg 21 scientists off the east coast of Australia. "Why these accumulations are missing is at present a mystery," report Simpson and Schlich. There may have been changes in oceanic circulation that scoured away existing sediments or prevented new sediments from being deposited. Or there may have been changes in temperature or decreases in the amount of nutrients in the water that caused a decline in the population of the tiny animals whose skeletons comprise much of ocean sediments.
- The large amounts of gravel, sand and silt deposited in Indian Ocean basins over the past 15 million years indicate that during that period there has been intensive erosion of Africa and Madagascar, probably related to uplifts of large parts of these land masses. Madagascar Ridge, a submarine extension of the island, has subsided more than a mile over the past 20 million years.
- In the Mascarene Basin east of Madagascar, paleontologists on the cruise got a big surprise. They found shells of foraminifera more than 60 million years old that are very similar to those found in rocks of the same age on the west coasts of South and Central America, but are different from foraminifera from that period off Madagascar. The find generated a good deal of excitement, but no one is yet willing to venture an explanation. □

Showing in the lab how molecules form in space

Radioastronomers have discovered several dozen chemical compounds in the gas and dust clouds of interstellar space. Theorists trying to figure out how the compounds were made have generally ruled out any suggestion that individual atoms of the different elements might have simply collided with each other and formed the compounds. The densities are much too low.

The usual theory makes use of an intermediary, the dust particles. The dust is believed to be carbon, mostly in the graphite form, and the theory supposes that when gas atoms collide with the dust, they stick. The dust acts as a collector of atoms and facilitates their combination.

Laboratory experiments that would check this theory are hampered because the conditions of interstellar space are difficult if not impossible to reproduce in the laboratory. The temperatures can be reproduced, however, and experiments done by Kenrick L. Day at Ohio State University show that under the supposed temperature regime of interstellar space the combination of hydrogen atoms into hydrogen molecules ($H + H$ yields H_2) can occur using graphite as an intermediary. (The work was done in furtherance of Day's doctoral dissertation; since receiving his degree, he has moved to the University of Arizona.)

The temperature differences between the gases and the graphite dust in interstellar space have been one of the serious questions in the theory. The gas is typically at about 100 degrees K.; the graphite dust around 10 degress K. At 100 degrees hydrogen atoms are too hot to combine with each other. Astronomers have assumed that collision with dust grains cools the gas atoms sufficiently to allow them to stick to the dust and combine. If enough molecular hydrogen is made this way, it could solve the universe's missing mass problem (SN: 2/26/72, p. 140).

Day's experiment used a supercooled graphite rod in a vacuum chamber. Atomic hydrogen was introduced at various temperatures. He found that hydrogen atoms would combine on the graphite rod at a temperature no higher than 11.6 degrees K., if the initial temperature of the atomic hydrogen were 100 degrees. In space, says Day, the graphite would radiate the heat it absorbed from the molecules as infrared radiation and thus maintain its own temperature equilibrium and preserve itself as a heat sink for the gases.

OSU

Day inspects his vacuum chamber.

Other substances might form in a similar fashion, Day says, especially methane, oxygen and carbon dioxide. Day has measured the efficiency of the graphite in absorbing heat for some other gases: methane (80 percent), carbon dioxide (90 percent), molecular oxygen (95 percent). Thus it appears that graphite grains in interstellar space could collect a variety of atoms and compounds, and that they can indeed serve as the chemical factories they are supposed to be. □

Learning to read syllables before letters

Learning to speak comes naturally. Learning to read does not. This, says psychologist Paul Rozin of the University of Pennsylvania, is because humans developed the ability to speak much earlier in their evolution than the ability to read. The ability to pronounce phonemes (the basic sounds of letters of the alphabet) is a capacity evolution has made available in learning to speak but not in learning to read. Children, for example, can pronounce strings of phonemes easily as part of normal speech but they have difficulty in explicitly recognizing these individual sounds in spoken words.

Even so, in most reading systems, children are taught to sound out the phonemes of a word rather than the syllables or the entire word. This may be a mistake, says Rozin, because some children may never be able to grasp the essential fact that sound is involved in reading.

To demonstrate that sound reproduction is the difficult step in learning