physical sciences

Deuterium on Jupiter

The ratios of various isotopes of the same chemical element in astronomical bodies can tell a good deal about the nucleosynthetic processes that produced them. This in turn gives a better idea of the history and evolution of the bodies where they are found. Especially interesting from this point of view is the ratio between deuterium and hydrogen.

A start on the way to determining the H/D ratio for the planet Jupiter has been made by the discovery of deuterium there in the compound deuterated methane (CH_3D). The observation was done at the McDonald Observatory of the University of Texas and is reported in the March 24 SCIENCE by Reinhard Beer, Crofton B. Farmer and Robert H. Norton of the Jet Propulsion Laboratory and John V. Martonchik and Thomas G. Barnes of the University of Texas. Because of technical problems involving the Jovian and terrestrial atmospheres much more work is necessary before either a CH_3D/methane ratio or a hydrogen-deuterium ratio can be determined, they say.

Fusion of heavy ions not so easy

Nuclear physicists are very interested in seeing whether atomic nuclei of significantly greater atomic number and atomic weight than those now known can be produced.

One possible way of making such nuclei is by fusion of two relatively heavy nuclei. To do this one of the nuclei has to be accelerated so it can overcome the Coulomb barrier, the mutual repulsion of the two nuclei caused by their both having positive electric charge.

The accelerator called Alice at the Saclay Laboratory in France has done experiments in which krypton 84 ions were struck against targets of cadmium 116 and germanium 72. In the March 13 PHYSICAL REVIEW LETTERS H. Gauvin, Y. Le Beyec, M. Lefort and C. Deprun report that fusion was more difficult to achieve than had been expected in the light of experiments with lighter projectiles. A possible explanation is that the high charge of the krypton caused a distortion of the shape of the target nuclei and that this raised the Coulomb barrier.

Cyanogen and the three-degree blackbody

Optical observations of interstellar clouds of cyanogen (CN) were the first confirmation of the radioastronomical discovery that blackbody radiation at a temperature of three degree K. pervades the universe. Much of the CN appeared in an energy state that can be reached by absorption of three-degree radiation, but there are other ways to reach that state and controversy continues.

The way to settle the question, say A. A. Penzias, K. B. Jefferts and R. W. Wilson of Bell Telephone Laboratories, is to look for evidence of temperature difference between the CN and the background in the form of 2.64-millimeter radio emission. If both CN and background are at three degrees (the absorption interpretation) the CN will not emit this line. If the CN is at three degrees for some other reason and the background at zero (no blackbody), the CN will emit the line as it descends to zero. A search found no 2.64-millimeter line, they report in the March 20 PHYSICAL REVIEW LETTERS, and they conclude the absorption interpretation is correct.

earth sciences

Populating a rubber reef

While some scientists on the Florida Aquanaut Research Expedition were finding that human pollution had endangered a living reef (SN: 3/18/72, p. 185), others found that an artificial reef is rapidly becoming a healthy new reef community.

Early in February, a manmade reef of about 500 old tires was installed on the sea floor off the upper Florida Keys. Within a month, report Harold L. Pratt, Kenneth Pecci and Clifford Newell of the National Oceanic and Atmospheric Administration, the reef had become populated by many species of young reef fish and a film of algae covered the tires.

The young fish had apparently migrated to the artificial reef from a nearby natural reef. Because the mature fish on an established reef are jealous of their territorial rights, youngsters are often crowded into tiny areas, and mortality is high. The tires provided a place for young fish to start a new community. In the next phase of the study, the nature and behavior of fish in the new community will be compared to those on a natural reef.

Where was Madagascar

Reconstructions of the former supercontinent Gondwanaland have often hinged on the pre-drift position of Madagascar. Some theories place Madagascar in its present position; others fit it into one of the depressions in the east coast of Africa (SN: 11/20/71, p. 344).

In the March 13 NATURE PHYSICAL SCIENCE A. G. Green of the University of Newcastle upon Tyne suggests yet another possible position. Magnetic profiles, he says, suggest that Madagascar, during the Permian period (230 to 280 million years ago), occupied a position adjacent to southern Africa with the southwest part of the island fitted against South Africa and Mozambique. A more detailed fit, he says, will have to await more information on the pre-drift shape of the continental edge of southern Africa. He suggests that the Mozambique Ridge was the probable spreading center by which Madagascar drifted eastward from Africa until about 65 million years ago. Thereafter, the region was affected by the development of the Indian Ocean ridge system, which caused Madagascar to move northward relative to Africa.

Origins of terrestrial craters

Both Mars and the moon are dotted with surface craters, mostly created by impact. Some scientists believe the terrestrial craters that most closely resemble lunar and Martian craters are a class called cryptoexplosion structures. There are some 60 such craters known and they occur in a wide variety of geologic environments, but their origin is debated.

In the March 17 SCIENCE D. J. Milton of the U.S. Geological Survey and nine other U.S. and Australian researchers report the results of geologic, seismic, gravity and magnetic surveys of a cryptoexplosion crater at Gosses Bluff, Australia. They conclude that the structures must have been caused by a single impact that occurred about 133 million years ago. From the crater diameter (about 5 kilometers) they estimate that the cause could have been a low-density, high-velocity comet or a high-density, low-velocity iron meteorite, each with a diameter of about 600 meters.