phere is at least 10^{-3} millibar (about a millionth of the earth's) but no more than 1 millibar. Further analysis of the data may narrow these limits. The satellite's diameter was determined to be 5,720 kilometers and its density 2.0 grams per cubic centimeter.

"The discovery of an atmosphere on Ganymede together with previous negative results for Io [another satellite of Jupiter] suggest that Ganymede should receive first priority for radio occultation or other atmospheric experiments on the Pioneers and other Jupiter spacecraft," say the scientists. Pioneer 10 will reach the vicinity of Jupiter on Dec. 3. It and Pioneer 11, a year later, may shed additional light on Ganymede's atmosphere. □

Radio stars by the half dozen

Radio stars have been a fairly rare phenomenon. Only a handful of stars have been found with radio emanations strong enough to be detected from earth with present equipment.

Now there are six new radio stars, and their discovery has opened up the possibility of finding many more. For the six new ones were found, not by chance or by random search, but by a theoretically suggested look at a particular class of objects.

The objects involved are early-type stars with emission lines in their spectra. These stars show an abnormally large infrared component in their emissions, and in some cases some of this infrared has been attributed to emission from an envelope of gas surrounding the star. If the gas in these cases is largely transparent at centimeter wavelengths, theorists reasoned, some of these stars should be detectable as radio sources. Using the 46-meter radio telescope of the Algonquin Radio Observatory at Lake Traverse, Ontario, C. R. Purton, P. A. Feldman and K. A. Marsh of York University in Toronto looked at a series of these early-type stars.

In the last few weeks they have reported radio detection of six. (The latest report appears in the Sept. 17 NATURE PHYSICAL SCIENCE.) The stars are V1016 Cygni, HD167362, Vy2—2, M1—11, HD37806 and MWC957.

Since theory predicted this discovery, the information gained from the actual measurements will help refine the theory to give a better picture of early-type stars with infrared excess. There are a large number of such stars around the sky. The Toronto astronomers were working with a radio telescope that is not one of the largest in the world. If the largest telescopes are put to the job, they should be able to pick up quite a few such stars. □

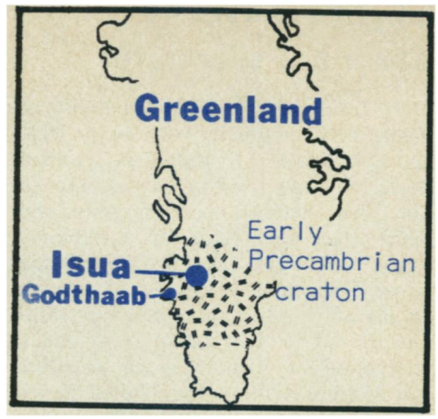
Greenland now yields oldest sedimentary rocks

The western edge of Greenland is a window into the earth's ancient geological past. Last year geologists reported that granitic rocks found in the Godthaab region of southwestern Greenland were the oldest rocks on earth. Laboratory analysis indicated they were between 3.70 billion and 3.75 billion years old (SN: 12/9/72, p. 374).

Now three members of the original research team, Stephen Moorbath, R. K. O'Nions and R. J. Pankhurst, all of the University of Oxford, have dated similarly aged rocks found at Isua, on the edge of the inland ice cap about 150 kilometers northeast of Godthaab. They are about the same age as the other rocks studied at Godthaab and Isua, 3.76 billion years, give or take 70 million years. But there is one big difference: The previously dated material consisted of igneous rocks, produced by heat and pressure in the earth's interior. The newly dated rocks are iron-rich sediments, deposited from some ancient body of water. They are the oldest sedimentary rocks ever discovered.

"The value of $3{,}760 \pm 70$ million years is by far the oldest date ever reported for an undoubted water-deposited sediment, or, indeed, for any sediment," the Oxford group reports in the Sept. 21 NATURE.

The ironstone sediments were dated by the lead-isotope method, thought to be the first time this technique has been used to date ancient sediments. It



Science News

Isua's ironstones are 3.76 b.y. old.

agrees within analytical error with a date of 3.70 billion ± 140 million years for granitic gneisses (igneous rocks) in the Isua area determined by strontium-rubidium dating.

The Oxford geologists believe the 3.76-billion-year date for the Isua sediments may be the date of a metamorphic event sometime after their deposition. Thus their date of deposit may be even older. At any rate, the Isua area is obviously going to be a crucial site for studies of the earth's distant past. "The high degree of exposure and freshness of the rocks, as well as the great variety of rock types exposed," say Moorbath, O'Nions and Pankhurst, "combine to make Isua one of the most interesting and critical areas in the world for future study of the geological relationships between contrasted rock formations of Early Precambrian age." □

Three-dimensional view of matter's inner world

IBM

This is the edge of a layer of silicon dioxide on the surface of a silicon wafer. The picture is an electron micrograph taken by a new method of using a scanning electron microscope developed at IBM. The new method allows resolution of surface details at least three times as fine as previously obtainable with a scanning microscope. The silicon dioxide layer here is about 3,000 angstroms thick; the enlargement is 200,000 times. Details less than 50 angstroms apart are resolved. By comparison, the wire in a paper clip is about 10 million angstroms thick.

A scanning electron microscope uses electrons ejected from the surface of a specimen when it is struck by a beam of high-energy electrons to make an image with a strikingly three-dimensional quality. The ejected secondary electrons are focused by a magnetic lens. The older style used a lens with a long focal length and therefore greater aberration in focusing than a short focal length would give. The new technique, developed by Oliver C. Wells, Alec N. Broers and Conrad G. Bremer, places the specimen inside the lens so that a short focal length can be used. Ultimate resolution attainable with the new technique should be about 10 angstroms. The best resolution obtained by the older technique is about 50 angstroms. □