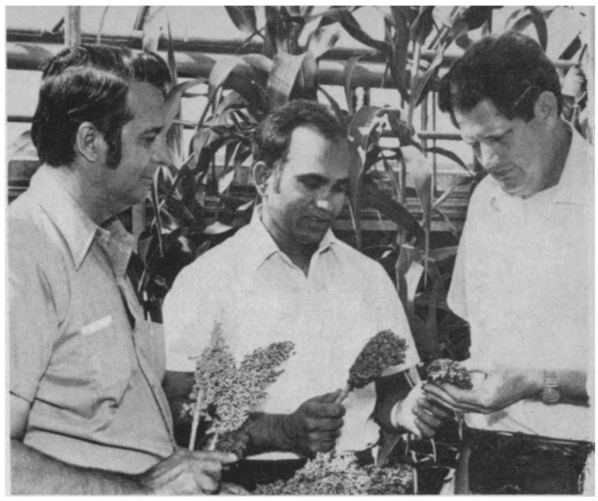
New, improved sorghum: 'Scientific achievement of the first magnitude'



AID

Oswalt, Singh and Axtell with their sorghum.

Purdue scientists have identified a high-protein variety of a grain that is a staple for millions

Throughout the world the scene was similar. Stalks of bitter green sorghum were yanked from the field, bought in the marketplace, plucked from grain elevators or other likely places. The samples of sorghum had a common destination—Purdue University and screening by plant geneticists and biochemists. . . .

After seven years of screening 9,000 samples of sorghum, Purdue scientists have found two strains, from a remote valley in Ethiopia, that have a protein quality and quantity far superior to that of other sorghums. Since the superior protein quality appears to be controlled by one gene, or possibly two, it can be bred into other strains of sorghum with relative ease.

The discovery was announced last week by J. D. Axtell, one of the Purdue investigators, at a press conference at the State Department in Washington. The Agency for International Development, part of the State Department, funded most of the Purdue research on sorghum. The actual identification of the two superior sorghum strains was made by Rameshwar Singh, an Indian graduate student at Purdue. Singh has since returned to India.

Discovering the superior sorghum strains, John A. Hannah, administrator of AID declared, "is of great significance." In fact, it is probably one of the most significant findings yet to emerge from the so-called Green Revolution—the name given the scientific effort to come up with more nutritious cereals and legumes for peoples in the developing countries (SN: 7/21/73, p. 42). Sorghum, a kind of cereal, is the dietary mainstay of 300 million of the world's poorest and hungriest people, particularly in Africa and Asia. They eke out an existence on arid, infertile lands. After they grow sorghum, they turn it into flour or mush. The upgraded sorghum also holds potential for feeding livestock more economically, especially in Latin America, where sorghum is common livestock feed.

"It is a scientific achievement of the first magnitude," says Woods Thomas, director of international education and research at Purdue.

The superior sorghum strains contain 30 to 40 percent more protein than conventional sorghums do, and about 75 percent the protein value of milk. The superior strains also have about twice as much of the amino acid lysine as do other sorghums. As a result, the lysine is brought more into line with the other amino acids in sorghum. High-protein content and amino-acid balance in a food are crucial if people depend almost entirely on it for nutrition. People need so much protein each day to be healthy. And if the protein is to be absorbed by their bodies, it must contain a reasonable balance of the essential amino acids.

Axtell estimates it will probably be three to five years before improved sorghum strains will be available for human consumption. Whether the improved strains will be accepted by peoples in developing countries is a crucial question. An important consideration is yield. Will the improved strains have a yield comparable to conventional strains? The Purdue team is now testing the strains for yield in Puerto Rico and Brazil, and it looks as if their yield is comparable. Another vital consideration is taste. The improved strains have a texture that is somewhat different from conventional sorghums. The Purdue scientists do not think the texture difference will be critical, but if it is, it can probably be altered genetically. Nor does it look as if the superior strains will be vulnerable to diseases, since they have weathered indigenous selection in Ethiopia over hundreds, even thousands, of years.

There is one problem, though, that may not be easy to overcome. Sorghums contain bitter pigments called tannins. Tannins keep birds from eating sorghum while it is growing in the field. Yet tannins limit the release of protein in the digestive tract, Purdue scientist Dallas Leon Oswalt discovered. So if the superior protein sorghums are to benefit people, their tannins must be removed somewhere along the way. The Purdue scientists are working on several approaches to this problem. □

Jupiter's satellite Ganymede has an atmosphere

Up to now there was one satellite in the solar system definitely known to possess an atmosphere: Saturn's Titan. In the Oct. 5 SCIENCE evidence is presented for an atmosphere on Jupiter's largest satellite, Ganymede.

The evidence comes from the occultation by Ganymede of the star SAO 186-800 on June 7, 1972. The occultation—the passage of the satellite in front of the star—was predicted by G. E. Taylor of the Royal Greenwich Observatory.

This occultation was expected to be visible from south Asia and northern Australia. It was actually seen at the Bosscha Observatory in Indonesia and at the Kodaikanal Observatory in India. Observers stationed at Darwin, Australia, found themselves too far south to observe the event. R. W. Carlson of the University of Southern California and eight other planetary scientists from five U.S. and three foreign institutions submitted the report.

The evidence for an atmosphere on Ganymede was the gradual extinction of the star's light as the satellite passed in front of the star. A sharp solid edge would give an abrupt cut-off; the gradual decline is interpreted as evidence that an atmosphere of gradually increasing thickness passed before the star.

The observations indicate that the surface pressure of Ganymede's atmos-

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. □

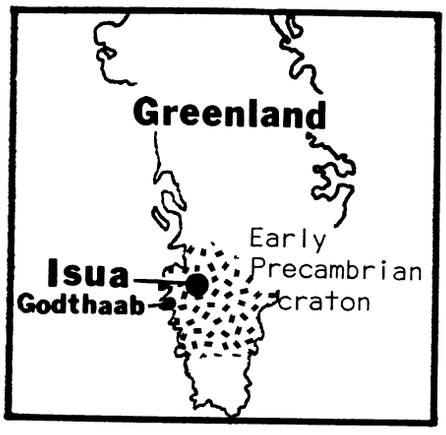
Greenland now yields oldest sedimentary rocks

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 ± 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. □