Astronomy

Ron Cowen reports from San Antonio at a meeting of the American Astronomical Society

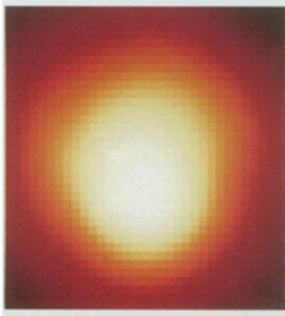
Spotlight on Betelgeuse

Stars in the night sky—at least bright, nearby ones—need no longer appear as fuzzy points of lights in a heavenly picture. Taking advantage of the superior optics of the repaired Hubble Space Telescope, astronomers have for the first time directly imaged the face of a star other than our sun. Previous attempts to image stars have required intricate manipulation of multiple exposures.

Researchers used Hubble's Faint Object Camera to zero in on the red supergiant Betelgeuse, a swollen star whose brightness and girth—1,000 times the diameter of the sun—have made it a favorite target for telescopes on the ground. The ultraviolet image taken with Hubble highlights the extended atmosphere of Betelgeuse and reveals a single large hot spot in the star's southwest quadrant. The spot has a diameter about 10 times that of Earth and a temperature of roughly 7,000 kelvins, 2,000 kelvins higher than its surroundings.

In addition, there are smaller hot spots that speckle the sun "like German measles," says codiscoverer Andrea K. Dupree of the Harvard-Smithsonian Center for Astrophysics in Cambridge, Mass.

She and Ronald L. Gilliland of the Space Telescope Science Institute in Baltimore suggest two explanations for the hot spot on Betelgeuse. As in a bubbling cauldron, pulsations of the star may have carried hot gas to the surface and caused hot spots to appear and vanish. Alternatively, energetic magnetic fields within the star may have generated the heat that produced the spot. Images taken over the next few years to show the spot's motion may help determine the correct explanation.



Dupree, Gilliland/NASA, Eur. Space Agency

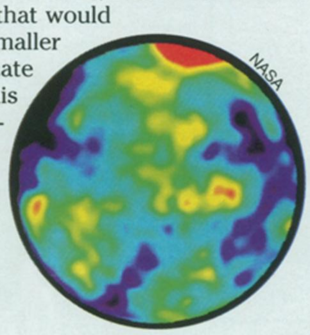
Ultraviolet image of Betelgeuse.

COBE's swan song: A final sky map

Two years after the Cosmic Background Explorer (COBE) Satellite completed its 4-year survey of the microwave background, the faint radiation left over from the Big Bang, researchers have finally finished analyzing all the data.

In 1992, COBE researchers discovered tiny fluctuations in the temperature of the otherwise remarkably uniform distribution of the microwave background (SN: 5/2/92, p. 292). Astronomers believe that these fluctuations correspond to the slightly higher and lower densities of some regions in the primordial universe. These variations ultimately gave rise to today's lumpy collection of stars and galaxies. But the 1992 map could not pinpoint the fluctuations because the data contained about as much noise as actual signal.

A newly released map contains twice as much signal as noise and gives the true location of temperature variations in the microwave background, says Charles L. Bennett of NASA's Goddard Space Flight Center in Greenbelt, Md. NASA is now considering a follow-up mission that would measure the fluctuations over smaller patches of sky, in an effort to locate the variations more precisely. This feat would further test the validity of the myriad theories about the evolution of the cosmos.



NASA

COBE's final map of the south galactic hemisphere, showing hot (red) and cold (blue) spots in the microwave background.

Earth Science

Recycled crust hails a glittering taxi

The ride dragged on for millions of years. But when the passenger finally arrived, it was in high style, ensconced in the heart of a diamond.

This first-class voyager was a speck of continental crust that traveled deep into the fiery innards of Earth and then made a return trip to the surface inside a South African diamond. The discovery of this unusual occupant provides the best evidence yet that continental rock gets recycled into the planet's interior, according to a report in the Jan. 11 NATURE by Leon R.M. Daniels of the University of Cape Town in South Africa and his coworkers.

Geophysicists know that Earth's dense oceanic crust can sink into the mantle through a process called subduction. They have long suspected that subduction also carries pieces of the continents into the mantle. Until now, though, they have lacked definitive evidence.

Diamonds form in the mantle at depths of more than 120 kilometers, where intense pressure squeezes carbon atoms into their most compact form. Mantle minerals often get trapped inside the growing gemstones. When volcanic eruptions carry those diamonds to the surface, they include the mantle rocks in the ride upward.

Daniels' group, however, found an inclusion that apparently did not come from the mantle. The researchers identified a speck of the mineral staurolite in a South African diamond. Staurolite is a common metamorphic mineral in continental crust, but no one had ever seen it before in mantle rock. "It seems most likely that this staurolite crystal formed within metamorphosed crustal rocks, which were subsequently carried into the mantle through subduction," comments William M. White of Cornell University in the same issue of NATURE.

If a substantial amount of continental rock has been subducted over the eons, the process will have limited the continental area existing today.

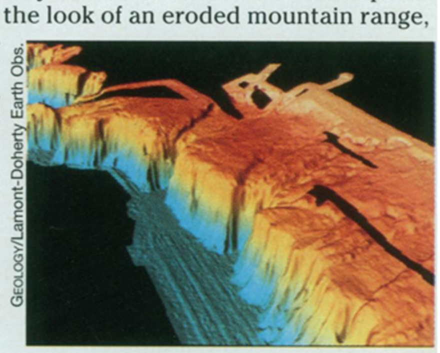
How steep is the continental slope?

Walk far enough out on the ocean floor and you eventually reach an incline known as the continental slope—the boundary between the shallow continental shelf and the deep ocean. Now, a study in the January GEOLOGY depicts a striking variation in the steepness and shape of the continental slope around the United States.

Lincoln F. Pratson and William F. Haxby of the Lamont-Doherty Earth Observatory in Palisades, N.Y., analyzed surveys of seafloor depth conducted from the mid-1980s through the early 1990s. The surveys covered regions off the mid-Atlantic states, western Florida, Louisiana, California, and Oregon.

The steepest of the slopes, off western Florida, has an escarpment that reaches a grade of 45°, says Haxby. The seafloor has such an extreme incline because groundwater percolates down to the base of the continental slope and erodes the rock there, causing collapse at the bottom.

In contrast, narrow canyons cut into the side of the slope off New Jersey, giving it the look of an eroded mountain range, and the Louisiana seafloor bears marks of numerous craters, created by the eruption of buried salt deposits.



GEOLOGY/Lamont-Doherty Earth Obs.

Western Florida's continental slope shown with the vertical dimension exaggerated four times.