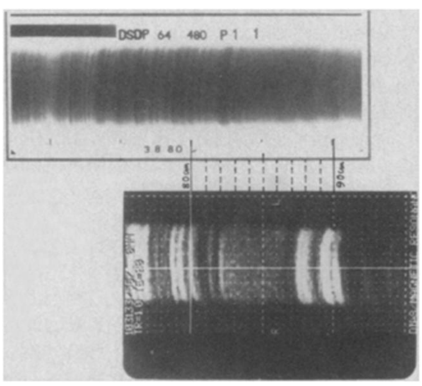
# 'New window' on earth's climatic record

Nuclear magnetic resonance imaging, the technology that allows physicians to look at cancer cells and brain lesions, has for the first time been used to examine core samples taken from the ocean floor. The images produced so far show new details in the sedimentary record — details that may help scientists assemble a 200,000-year record of changes in the earth's climate, according to Madeleine Briskin, who pioneered the application of the technique.

"This is opening a whole new window for us," says Briskin, a geologist at the University of Cincinnati, who used the technique on sediments from the Gulf of California. Her report is to appear in the August GEOPHYSICAL RESEARCH LETTERS.

The primary advantage of nuclear magnetic resonance imaging, or MRI (until recently called NMR), is that it reveals differences between layers that are rich in organic material and those that contain few organic remains, Briskin says. The richly organic layers show up as light bands, and the layers lacking in organic material appear dark. X-rays, the usual technique for studying core samples, do not make this differentiation.

The ability to distinguish the two kinds of layers makes it possible, for the first time, to tell where one year's worth of sediment ends and the next begins, because each year's deposit contains one richly organic layer (laid down in summer) and one layer with relatively little organic material (deposited in winter), Briskin explains.




Briskin

*MRI compared with X-rays of an ocean core sample: MRI (bottom) distinguishes between richly organic layers (light bands) and layers that contain little organic material (dark bands).*

Each annual layer, known as a varve, contains organic evidence of the earth's climate and ocean temperatures for the year it was deposited, Briskin says. A long sequence of varves, in turn, records cycles in the earth's climate. "It is a measure of what has gone on at the surface of the planet," Briskin says.

Scientists customarily look at tree rings for evidence of climatic cycles, but the record in ocean sediments stretches back much farther — to about 200,000 years ago, Briskin says.

This sedimentary record, in turn, can be correlated with cycles that are believed to influence climate — such as sunspot activity, changes in the earth's orbit, El Niños and cycles of the moon, Briskin told SCIENCE NEWS. "The implications for this are remarkable," she says.

George Kukla of the Lamont-Doherty Geological Observatory in Palisades, N.Y., says he intends to follow Briskin's example by using MRI on lake sediments. "It's a really great new prospective method," Kukla says. "We are pretty excited by [Briskin's] results."

To make her images, Briskin borrowed MRI equipment used by physicians at the Magnetic Resonance Center of San Diego. It uses both radio waves and magnetic fields to make images. The radio waves excite the hydrogen atoms in the substance to be imaged. When the beam is turned off, the magnetic fields pull the atoms into alignment. The equipment reads the various movement rates of the hydrogen atoms of different materials and, with that information, creates an image of the internal structure.

Because the equipment uses a number of nonuniform magnetic fields superimposed over a background static field, it is able to create a very detailed image. By making a series of such images, MRI also makes it possible to put together a three-dimensional picture of the core sample, Briskin says, which would give researchers more information about the annual constituents of a particular sediment sample. An additional advantage is that researchers can make the images without cutting into the core sample.

X-rays, which are fuzzier, come in only two dimensions and require that the core sample be cut into pieces, Briskin says.

But Briskin does not suggest that MRI should replace X-rays altogether. X-rays can delineate some very fine layers that do not show up as well with MRI. These layers may represent seasonal deposits within varves. By relating the seasonal layers on X-rays to the varves on MRI images, scientists can get a very detailed picture, Briskin says.

One major drawback of MRI is its expense, however. One set of MRI equipment runs about $2 million. Briskin spent $960 an hour, for a total of about 15 hours, to use the equipment in San Diego.

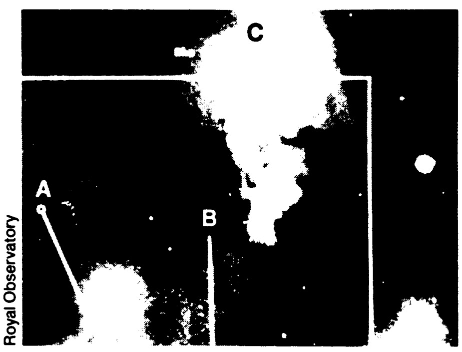
*— M. Murray*

# A star is born in the Milky Way

Birth is an exciting process, especially when no one has ever seen it happen before.

The developing embryo lies wrapped in clouds of gas and dust 500 light-years away, near the bright star Antares. The mother, the constellation Ophiuchus in the Milky Way galaxy, will endure birth pangs for another 100,000 years before delivering a star about the size of our sun. Anxiously observing the event — the first one ever seen by humans — are astronomers from the University of Arizona at Tucson and the University of Missouri at St. Louis, assisted by the 12-meter radiotelescope of the National Radio Astronomy Observatory near Tucson.

First detected in the galactic womb by the Infrared Astronomical Satellite in 1983, the embryo contains about one-fourth the mass of our sun but lies at the center of a cloud of gas and dust 10 times the size of our solar system. For the first time, astronomers can see that the inner cloud is falling into the star, adding to the embryonic star's size and mass and making it glow 20 times brighter than the sun. Erick Young, a researcher at the University of Arizona, explains: "When [cloud] material falls in, it eventually crashes onto a surface, releasing gravitational energy in the form of photons," the subatomic particles that make up light. The surrounding outer cloud, however, absorbs the light and reemits the energy as infrared and radio radiation.




Royal Observatory

*The developing star (A) and interstellar clouds of gas and dust (B) lie in the star-forming region near the star Rho Ophiuchi (C).*

Astronomers discovered the developing star while looking at radio waves emanating from the cloud in Ophiuchus. Radio waves detected from the inner cloud were slightly shifted away from their expected values, indicating the cloud is collapsing.

Astronomers don't know what mechanisms trigger the collapse of galactic clouds to form stars (SN:8/25/84,p.125), but they know that this collapse will end in about 100,000 years, when the embryo will have collected most of the matter in the immediate area. The infant star will then emerge from its surrounding clouds, and future astronomers can pass around cigars.

According to astronomer Charles Lada