SCIENCE NEWS of the week

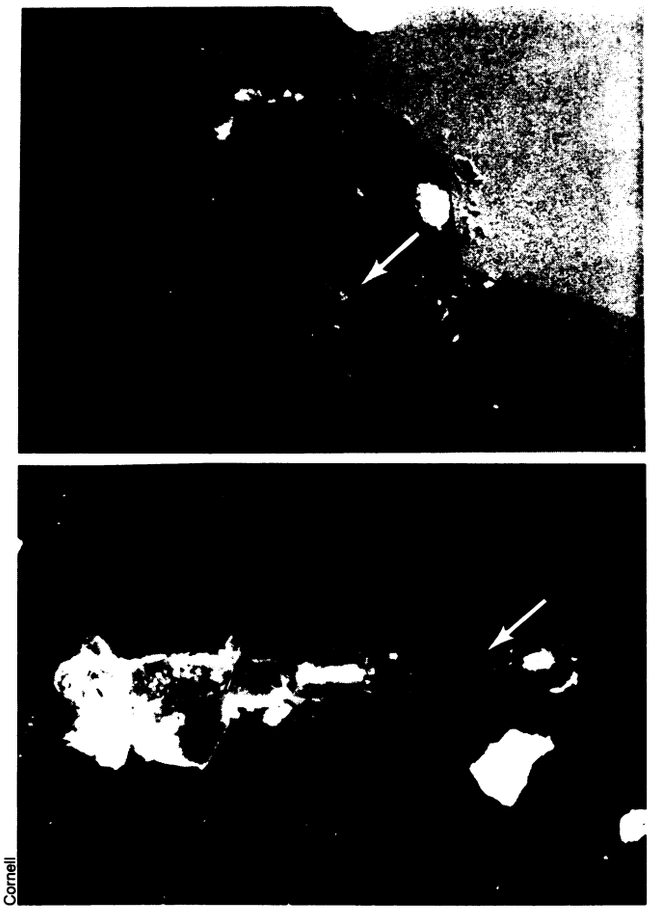
Liquid Carbon: The Melting of a Diamond

A serendipitous laboratory accident has allowed a team of geologists to show that a powerful infrared laser beam can melt the face of a diamond subjected to a crushing pressure. In the experiment, geology graduate student Jon S. Gold of Cornell University in Ithaca, N.Y., was heating a mixture of graphite and potassium bromide between two diamond "anvils," which generate pressures up to 450,000 times that of the atmosphere. He inadvertently set the focused laser beam, used for heating the sample, at a higher power than planned. The laser pulses not only converted the graphite to diamond but also damaged a diamond-anvil face by melting a furrow about one-tenth of a millimeter long across the diamond's surface.

"To our knowledge, this is the first time that experimental evidence has been produced to show melting of carbon at high pressure when diamond is used as a starting material," report Gold and his colleagues in the Aug. 31 SCIENCE. Previous research by others had shown that melting may occur when graphite is the starting material. Under high pressure, heated graphite turns into diamond, which sometimes melts and recrystallizes—all within milliseconds.

The best evidence that melting had occurred in the Cornell experiment was the presence of microscopic droplets of potassium bromide trapped within the melted and resolidified diamond, says William A. Bassett, one of the paper's authors. "I don't know how else you could do that."

When the experiment was repeated without graphite present, melting also occurred, but a much higher laser power was needed. "Graphite may play an important role in absorbing energy from the laser and in initiating melting," the researchers report.



Cornell

This scanning electron microscope image (top) shows the furrow, 0.1 millimeter long, melted across the face of a diamond anvil. A closer look at the groove (bottom) reveals the rounded, glassy ridges produced by the laser as it melted the diamond. White spots are due to residual particles of graphite and potassium bromide. The smooth, curved surfaces observed within the groove and on the ridges suggest that the material was molten, say the Cornell researchers.

In both cases, the melting took place at a pressure greater than 120,000 times that of the atmosphere. Although the researchers suspect that the melting temperature was close to 4,000°C, they had no way to measure it. "Our next step will be to set up equipment that can make a direct, independent measurement of temperature," says Bassett.

These temperature and pressure data would provide important information about the behavior of carbon at the high pressures and temperatures that exist within the earth. The group's main objective is to determine the effect of pressure on the melting point of diamond. Says Bassett, "If there's liquid carbon within the earth,... then that may play an important role in the dynamics of the earth's mantle and in volcanism."

The researchers also believe that they have created a new material. The melted carbon appears to be a mixture of very fine diamond crystals and a glassy solid that has no particular crystal form. Says Bassett, "We're producing a material that's never been produced before. But we don't make very much. If it turns out to have some fantastic electronic property, it's going to be very frustrating because the samples are so small." —*I. Peterson*

Genes of AIDS-linked virus cloned

A California biotechnology firm reached a second milestone this week in the long race to develop a screening test and, potentially, a vaccine against a virus thought to cause acquired immune deficiency syndrome (AIDS).

Scientists at Chiron Corporation in Emeryville, Calif., announced they have cloned the entire genome — the genetic skeleton — of a virus isolated from AIDS victims last spring by Jay A. Levy of the University of California at San Francisco. But other companies working toward the same goal caution that the race is far from won.

"Cloning the genome is an important step, but it isn't all that difficult," Anne Bodner of Biotech Research Laboratories Inc., of Rockville, Md., told SCIENCE NEWS. "The game isn't over until it [the genome] is expressed." Inducing cultures of mammalian, bacterial or yeast cells to accept the viral genes as their own and churn out or "express" viral proteins in quantities sufficient to be tested for commercial use is a formidable next step that could take months or even longer to achieve, she says.

Meanwhile, Biotech and several other firms are using their own versions of the virus to achieve the same end (SN: 5/5/84, p. 285). Nearly identical viruses named HTLV-III and LAV have each been nominated by separate research teams as the infectious agent most likely to cause AIDS (SN: 7/7/84, p. 6). Pending a close comparison with the other two viruses, Levy is calling his isolates ARV, for AIDS-associated retroviruses.

—*D. Franklin*