Explosive stripping of a material's surface

An intense, ultrashort pulse of laser light can blast away a solid's surface. Known as laser ablation, this process is used industrially and surgically for removing thin layers of material.

Now, researchers have caught a glimpse of the radical restructuring that takes place on a surface in the brief interval between a laser pulse's arrival and the subsequent explosive boiling away of the material's atoms.

The solid's top layer initially turns into a dense, high-temperature, high-pressure liquid, says Klaus Sokolowski-Tinten of the University of Essen in Germany. The hot, pressurized liquid then expands very rapidly, forming bubbles and breaking up into a transparent, liquid-gas mixture.

Sokolowski-Tinten and his collaborators report their findings in the July 6 PHYSICAL REVIEW LETTERS.

The researchers studied the effect of 120-femtosecond pulses of laser light at a wavelength of 620 nanometers on a variety of metals and semiconductors, including silicon, gallium arsenide, gold, and aluminum.

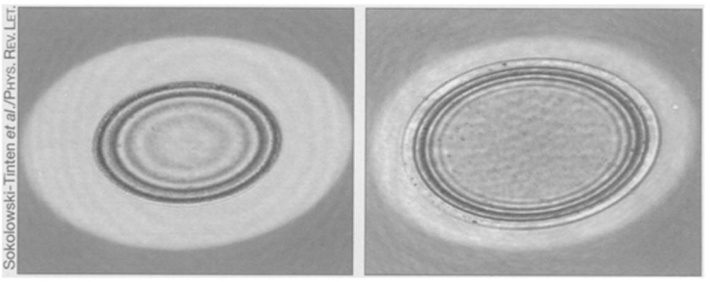
Using time-resolved microscopy, they observed an optical pattern known as Newton rings, which coincided precisely with the surface area heated by the laser pulse. Such a pattern is produced when light rays reflecting from the top of the ablating material interfere with light rays reflecting from the solid material that remains intact beneath the cloud, which is rapidly expanding upward.

The observations suggest that the ablating material is in a transparent state with a distinct front that typically moves upward at a few hundred meters per second.

Moreover, because different metals and semiconductors exhibit similar interference patterns when blasted by a laser pulse, the same physical mechanism appears to be at work in all these cases. "It is just boiling, but under very exotic conditions," Sokolowski-Tinten remarks.

"It's very accurate work using a rather clever technique," says Peter Pronko of the University of Michigan in Ann Arbor. However, the conclusion that a liquid—rather than a dense plasma of electrically charged particles—forms during the transition requires independent confirmation, he adds.

In one such effort, Ralph Jimenez and his coworkers at the University of California, San Diego are using X-ray diffraction techniques to measure changes in the spacing of atoms in laser-blasted gallium arsenide. However, Jimenez comments, it's too early in the data analysis to tell whether the lattice goes through a liquid state. *—I. Peterson*



Sokolowski-Tinten et al./Phys. Rev. Lt.

When heated by a short, powerful laser pulse, silicon (left), gallium arsenide (right), and other metals and semiconductors display an optical interference pattern called Newton rings.

Cloned cows provide company for Dolly

In the two years since she was born, Dolly probably has never worried about being the only mammal ever cloned from the DNA of an adult cell. But for some scientists, trained to accept no result unless it can be duplicated, the sheep's singular life has been disquieting.

News from the Ishikawa Prefectural Livestock Research Center in Ishikawa Ken, Japan should cause such skeptical souls to sigh in relief. Scientists there announced this week the birth of two calves created by the cloning of cow cells.

In a process called nuclear transplantation, which was also used to create Dolly (SN: 4/5/97, p. 214), the researchers reportedly fused cells from an adult cow's uterus to cow eggs whose own DNA had been removed. The substitute DNA from the uterine cells guided the eggs as they developed into embryos, which were then implanted into five surrogate mothers. The mothers, each harboring two embryos, were due in mid-August but one gave birth prematurely on Sunday, the Japanese group announced.

"This would be the first confirmation of adult donor cells working," says George E. Seidel Jr. of the Animal Reproduction and Biotechnology Laboratory at Colorado State University in Fort Collins.

Seidel and other scientists note that it's difficult to judge the legitimacy of the new cloning work given the few details released so far. The Japanese group has not yet publicly described the genetic tests conducted to confirm that their newborn calves are indeed clones, and it has not published a report on the experiment.

"I hope it's correct. It's exciting if it is, but we need more information before making any definitive conclusions," notes cloning researcher James M. Robl of the University of Massachusetts in Amherst.

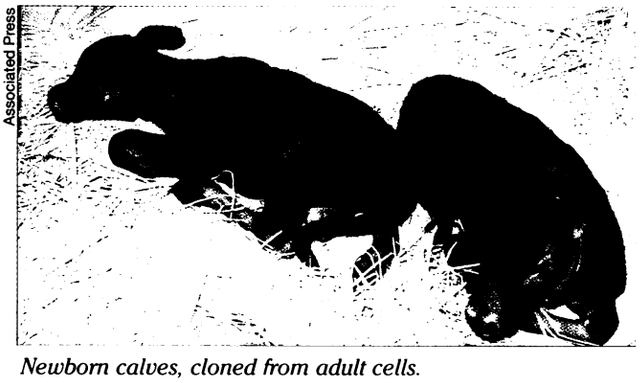
This week's announcement from Japan may have stolen thunder from another cloning effort, if the scientific rumor mill is to be believed. For several months, gossip has circulated among scientists that a research team headed by Ryuzo Yanagimachi of the University of Hawaii School of Medicine in Honolulu has cloned mice from adult mouse cells.

According to media reports, Yanagimachi hinted at the accomplishment at a recent meeting but did not provide details. When contacted by SCIENCE NEWS, Yanagimachi declined to comment other than to note that a paper describing his group's research would appear this month in a scientific journal.

New cloning reports may not put to rest all doubts about Dolly—some investigators have speculated that she was inadvertently cloned from a fetal rather than adult cell. They should, however, resolve the issue of whether cloning from adult cells is possible.

Still, the practical significance of this type of cloning remains unclear. Researchers can develop many of cloning's applications, such as the addition of human genes to animals, without the use of adult cells.

Last year, the investigators who created Dolly unveiled Polly, a lamb cloned from fetal sheep cells to which a human gene had been added (SN: 8/23/97, p. 127). And in the May 22 SCIENCE, Robl and his colleagues describe genetically altered calves similarly cloned from fetal cow cells. *—J. Travis*



Associated Press

Newborn calves, cloned from adult cells.