

## A Shipwreck Frozen in Time

### THIS WEEK

Northernmost known shipwreck probed	179
Proposed relaxation of DNA rules	180
<i>Legionella</i> danger at Mt. St. Helens	181
An ounce of hydrocephalus prevention	181
Saturn: The invisible electromagnetic	182

### RESEARCH NOTES

Chemistry	183
Behavior	183
Environment	189
Space Sciences	189

### ARTICLES

Lasers meet many challenges	184
Oscillating chemical systems	188

**COVER:** Quartz "windows" (central area) — used in developing advanced electro-optics — are checked for cleanliness by a laser beam at RCA Laboratories. It is just one example of the growing list of commercial, industrial, medical and military applications for lasers. See p. 184. (Cover photograph courtesy of RCA)

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For the first time, cameras have probed subfreezing Arctic waters to unveil the northernmost known shipwreck, a remarkably preserved vessel lying undisturbed for 128 years since it was crushed by ice and sank. The photographic survey is the first step in a planned study of the biology and geology of a high-Arctic ocean environment.

A color television camera revealed hull timbers that show little sign of decay, two of the three masts still standing and pointing toward the surface, and greenish copper plates that once protected the hull from barnacles and ship worms. A thick cover of orange-pink sea growth, not yet identified, makes the ship look as if it were billowing with fire.

In 1853, the 125-foot sailing vessel, *H. M. S. Breadalbane*, went down in 330 feet of water off Beechey Island in the Canadian Arctic. The island is almost 600 miles north of the Arctic Circle and about 100 miles from the north magnetic pole. The ship belonged to one of many expeditions that looked for traces of Sir John

vehicle. Emory Kristof, a National Geographic photographer who has specialized in underwater photography, developed the camera and lighting system. "This camera system is unusual in its capacity to float like a helicopter," says MacInnis. "It can hover and turn at will."

The cameras, both still and video, also peeked into the huge, ice-torn hole in the ship's starboard side and into the *Breadalbane's* wheelhouse. Clearly visible was the ship's spoked wheel, and nearby, the ship's compass and a signal lantern, still ready in the instrument chest on the wheelhouse bulkhead.

"It's the first time that we are dealing with a shipwreck in such excellent condition," MacInnis says. "The state of preservation, because of the  $-1.6^{\circ}\text{C}$  water, is remarkable. Most shipwrecks usually crumble and fall to a pile of rubble within years due to ship worms or the action of the sea."

Next spring, this shipwreck will become the first to be studied through the ice. A team of 20 to 30 scientists will camp for



Fluffy growth covers the *Breadalbane's* spoked wheel, 128 years after the ship sank.

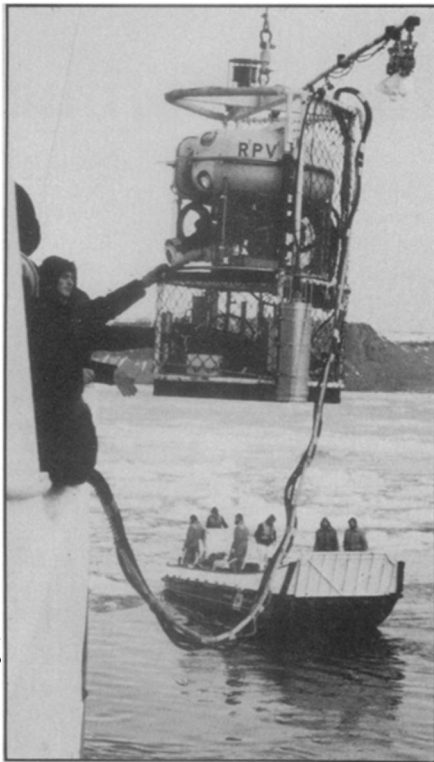
Franklin and his men after they disappeared during their search for the Northwest Passage.

"The video and still photographs were an essential part of our preparation for a major scientific study of the wreck next spring," says Joseph MacInnis, a Toronto physician and expert in diving medicine who led the exploration. "The *Breadalbane* is a time capsule at the bottom of Lancaster Sound. Also, we know almost nothing from direct observation of that hidden part of the world."

The survey, conducted in iceless conditions during the first week of September, was made possible by the development of a maneuverable underwater vehicle that carried an array of cameras and lights. Chris Nicholson of Benthos, Inc., Falmouth, Mass., designed and operated the

four to six weeks on the ice floating above the wreck. They expect the ice to be solidly frozen, about six feet thick, and to work at temperatures of about  $-30^{\circ}\text{C}$  and in 24-hour daylight. The team plans to cut a hole through the ice and to conduct a series of both manned and unmanned dives to study the marine life, geology, sediments and sea ice of the wreck site.

For scientists who are not divers or who prefer more comfortable working conditions, the team plans to send television pictures from the underwater camera vehicle by satellite to scientists at the Ontario Science Centre in Toronto and possibly at the National Geographic's Explorers' Hall in Washington, D.C. The scientists will be able to control and conduct the equipment from their remote locations, says Kristof, just as scientists con-



MaInnis and underwater camera vehicle on location in the Canadian high arctic.

trolled Voyager 2 when it photographed Saturn as it passed by.

MaInnis says the research is significant because the Arctic is on the threshold of opening up for oil and gas. Oil and gas taken from Alaska's north coast and the Beaufort Sea will be carried right over the shipwreck in giant tankers before the end of this century, he said. Just to the east of where the ship was found, at the mouth of Lancaster Sound, oil exploration is beginning. "We are looking at the future seaway to the north, so we are trying to use the shipwreck as a scientific opportunity to learn more about the biology, geology, and sea ice of the region," says MaInnis.

The researchers have already discovered, not far from the ship, a trench as wide as a street and about 10 feet deep, made by the foot of an iceberg as it dragged along the ocean bottom. "No human eye has ever seen, face to face, that particular geological entity," says MaInnis. "These are the kinds of things that we will be studying in next year's scientific program, in addition to the archaeology of the ship."

The research is also part of a continuing program to develop the capacity for human beings and unmanned systems to explore beneath the polar ice cap. "It's really something to be sitting drinking coffee in comfortable surroundings, knowing that a system is making a dive into sub-freezing waters," says MaInnis. "At  $-1.6^{\circ}\text{C}$ , if we wore ordinary clothes, the water would incapacitate us within seconds and kill most of us within minutes. What we have here is an extension of the human eye into the Arctic region." □

## Proposal to remove penalties in DNA rules

In a proposal hastily spliced together at the Sept. 10 meeting, the Recombinant DNA Advisory Committee gave preliminary approval to eliminating "regulatory" aspects of the guidelines that currently apply to research with recombinant DNA. The proposal, approved 16 to 3, will be open for public comment until the final vote of the National Institutes of Health committee, expected in January.

"There is no justification left, if there ever was any, on scientific grounds for imposing guidelines other than the code of accepted laboratory practice," says David Baltimore, the MIT scientist who introduced the proposal.

As a voice of dissent, Richard Goldstein of Harvard Medical School insists, "Some members still have some concerns on the scientific level."

Under the newly proposed guidelines, adherence to standards would only be "recommended" to laboratories using recombinant DNA, including those receiving government funding. The proposal includes no sanctions to be applied against laboratories that disregard the suggestions. Baltimore says, "The proposal merely puts recombinant DNA in the same bag with other experimentation."

The proposal replaces the complicated system of assigning levels of appropriate safety measures in the current guidelines. The new suggestion is that scientists in general look to safety measures appropriate for the organisms they are employing. If they are transferring genes into disease-causing bacteria or using disease-causing viruses as carriers, they should employ at least the precautions recommended for work with those organisms by the Centers for Disease Control or the Department of Agriculture. If the scientists expect the transferred DNA to make the host more virulent, they should take that into consideration in deciding on precautions. Otherwise, experiments using organisms that do not cause disease may be carried out under the conditions, known as PI (or in industry, PI-large-scale), of standard microbiological practice.

In support of this simplification, Kenneth Berns of the University of Florida College of Medicine says, "There is genius in having a simple set of guidelines. They can be more inclusive than the telephone book we now have."

While the new proposal does not prohibit any experiments, it does flag two areas in which experiments should not be performed except under unusual circumstances. Included in this "exhortation" section, are experiments that introduce new drug resistance factors into disease-causing organisms and those that transfer genes for certain toxins.

The Recombinant DNA Advisory Committee (RAC) is retained under the new proposal (as a place for people to go with

questions, Baltimore says), but no mention is made of the local institutional biosafety committees, which are required by current guidelines. The proposal leaves to each institution the decision of how it will monitor its recombinant DNA research. Only "unusual events" will be reported to the National Institutes of Health.

A background document prepared by a working group of the committee summarizes why most of the members believe the time has come for a major revision of the guidelines. Experience with the limits and possibilities of the recombinant DNA technique, seven years of explicit discussion of danger potential and some specific risk assessment studies have provided scientists with somewhat better parameters for discussing the dangers, the working group says. It also points out that the guidelines have evolved into an extremely complicated, piecemeal document in response to modifications initiated by specific requests and that administration and revision of the guidelines requires scientists to spend "considerable time" on committees and on obtaining approval for experiments.

Working group chairman Susan Gottesman summarizes the group's conclusions on hazards: Most random and intentional combinations of genes produced in recombinant DNA experiments will not create a special danger. The gene combinations are not likely to be unique in nature; they are not likely to survive in the environment and they are not likely to be harmful.

The working group presented a proposal that included the simplification of safety specifications, but it recommended that following the guidelines still be mandatory for laboratories receiving funding from the National Institutes of Health. It would also require that investigators get permission of the local institutional biosafety committee before doing certain experiments. Gottesman says, "In my judgment, there are still scientific reasons for having someone besides the principal investigator look at some of the experiments before they proceed."

Baltimore combined parts of the working group proposal with parts of a proposal he had previously presented with Allan Campbell of Stanford University. The Baltimore-Campbell proposal revoked the mandatory nature of the guidelines and reduced the suggested safety measures for most experiments to the PI level.

The Baltimore-Campbell proposal was published in the FEDERAL REGISTER on March 20 and evoked a mixed response. Francine Simring of the New York-based Coalition for Responsible Genetic Research says, "Given the intensely competitive nature of the research and its development, this proposal would facilitate lower safety standards and less careful