Titanic wreckage still tells a riveting tale

Eighty-six years after the RMS *Titanic* scraped against an iceberg and sank to the bottom of the Atlantic Ocean, researchers are still trying to unravel the mystery of what happened on that fateful night. The iceberg sliced several long slits, each no more than an inch wide, into the side of the ship. Yet the supposedly unsinkable vessel went down after no more than 3 hours.

Now, a panel of naval engineers and scientists has concluded that the *Titanic* owed its rapid demise in large part to the failure of the rivets that fastened its hull together. According to a metallurgical analysis of samples retrieved from the wreckage this summer, the inconsistent quality of the wrought iron rivets weakened them, allowing the ship's steel panels to rip apart at the seams.

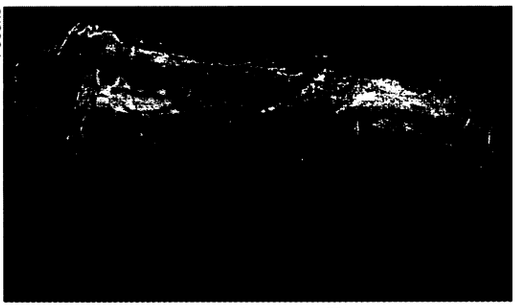
Tim Foecke of the National Institute of Standards and Technology (NIST) in Gaithersburg, Md., presented results of the analysis this week in Boston at a meeting of the Materials Research Society.

The panel's conclusion contradicts conventional wisdom, which holds that in the icy ocean water, the ship's steel hull turned exceptionally brittle and cracked apart. In 1991, a team of Canadian researchers tested a steel plate fragment from the ship and found that it was indeed brittle—not only when cold but even at room temperature.

"We believe that brittle steel didn't have much to do with the sinking of the *Titanic*," Foecke says. "[We are] willing to declare the brittle steel theory dead."

The Canadian researchers aren't convinced, though. "I would say—barring a miracle—the rivets have absolutely nothing to do with the sinking of the *Titanic*," says James Matthews, an engineer and materials specialist at the Defence Research Establishment–Atlantic in Halifax, Nova Scotia.

In 1996, the Marine Forensics Panel of the Society of Naval Architects and Marine Engineers began investigating the *Titanic* disaster. Panel chair William A. Garzke Jr., a naval architect at Gibbs & Cox in Arlington, Va., suspected that the rivets played an important role. Foecke, a panel member, then analyzed two rivets retrieved during a 1996 expedition to the wreck.


Foecke

Cross-section of a rivet from the Titanic.

He found that the rivets contained three times the expected amount of silicate slag, an impurity that strengthens the metal at concentrations of 2 to 3 percent but tends to weaken it at higher concentrations.

Moreover, the slag ordinarily forms long fibers that run along the length of the rivets, reinforcing them. At the ends of the rivets, however, Foecke found the fibers turned to a horizontal orientation. Aligned that way, the layers of iron and slag easily peel apart.

Last August, another expedition brought back more rivets for testing. Foecke found slag problems in 14 out of 30 samples. The additional data, Foecke says, confirm the rivet theory, first published in a NIST report issued in February.

Matthews counters, "A lot of things draw interpretations, but they are not indicative of performance." He adds that the huge forces suffered by the ship when it snapped in two and hit the ocean bottom could have mangled the rivets.

To bolster their respective theories, both Foecke and Matthews cite the RMS *Olympic*, a ship almost identical to the *Titanic* that was hit by a British warship in 1911. Foecke says that rivets popped out as far as 15 feet away from the point of impact. Matthews, on the other hand, focuses on the cracks, characteristic of brittle steel fracture, that propagated through the hull.

The steel in both ships, and in ships built today, is of a poor grade, Matthews says. "There are no riveted ships anymore, yet 40 to 50 a year are lost," he reports. "Ships are sinking now for the same reason," he says—brittle fracture.

The panel now plans to explore a third ship of *Titanic*'s design, the HMHS *Britannic*, which rests beneath the Aegean Sea. With more rivet samples, the researchers can get a better statistical analysis of the material, he explains.

"What sank the *Titanic*?" Foecke asks. "It hit an iceberg." The question is how it might have stayed afloat longer, giving time for help to arrive. Instead, more than 1,500 people perished, memorialized by the riveted steel hull that lies 12,000 feet beneath the waves. —*C. Wu*

Gulf War syndrome may signal mental ills

A mysterious and controversial illness said to afflict many veterans of the 1991 Persian Gulf War may often stem from mood and anxiety disorders rather than wartime exposure to infectious agents or toxins, a new study finds.

On closer examination, diagnoses of Gulf War syndrome are often replaced by findings of depression, stress reactions, and related disturbances, reports a team led by internist Michael J. Roy of the Uniformed Services University of the Health Sciences in Bethesda, Md.

"Many patients with [Gulf War syndrome] may in fact have treatable mood or anxiety disorders rather than mystery illnesses," Roy and his coworkers contend in the November/December PSYCHOSOMATIC MEDICINE. Their study, however, does not exclude the possibility that some Gulf War veterans suffer from an illness sparked by exposure to toxic substances.

Symptoms linked with Gulf War syndrome include fatigue, headaches, sleep disorders, and memory loss. There are no clear guidelines for diagnosing this condition, although veterans need an illness diagnosis to qualify for government medical benefits (SN: 10/15/94, p. 252).

Roy's group reviewed data from comprehensive medical examinations of 21,579 Persian Gulf veterans who had complained of health problems. Of that number, 17 percent exhibited one or more symptoms that can be related to Gulf War syndrome, which include evidence of infection; another 25 percent displayed signs of Gulf War syndrome and also of a separate health problem.

The 2,306 veterans who had the most pronounced symptoms of Gulf War syndrome received further exams by internists, psychiatrists, and infectious disease specialists. These close evaluations yielded large drops in the proportion of diagnosed symptoms that the clinicians attributed to Gulf War syndrome. The physicians assigned just 18 percent of all diagnosed symptoms to the syndrome in these follow-up exams, compared with 30 percent in the initial assessments of all veterans with any signs of Gulf War syndrome.

After these intensive evaluations—particularly those conducted at Walter Reed Army Medical Center in Washington, D.C., which convenes weekly meetings of physicians and mental health workers to discuss diagnoses—the physicians often noted the presence of mood disorders or post-traumatic stress disorder.

Symptoms of Gulf War syndrome may often arise as part of mood and anxiety disturbances, the scientists conclude. These mental disorders are often accompanied by the exact same problems—fatigue, headaches, sleep disturbances, and memory loss.

The new study raises concerns about the inappropriate labeling of psychiatric ailments such as Gulf War syndrome, comment psychiatrist Allen J. Frances and psychologist Jean C. Beckham, both of Duke University Medical Center in Durham, N.C., in an accompanying editorial. Long-term investigations, however, will be required to address whether some Gulf War veterans indeed suffer from a distinct illness caused by toxic exposure, they say. —*B. Bower*