

# Buried in

In the spring of 1845 Sir John Franklin and a crew of 128 men set off to complete the Northwest Passage, a long-sought route from Europe to the Orient via the frigid waterways north of mainland Canada. Most of the passage had already been charted and the British Admiralty expected that Franklin, a veteran Arctic explorer, would handily chart the rest. But no one from the Franklin Expedition ever returned from the maze of ice and islands above the Arctic Circle, where temperatures can drop to  $-40^{\circ}\text{C}$  ( $-40^{\circ}\text{F}$ ) and winters are dark nearly 24 hours a day.

The Franklin Expedition was the 58th that the British Admiralty had commissioned to chart the Northwest Passage. But it was the first one with no survivors to come home and tell their tale. When two winters had passed without word of Franklin, the British were not alarmed. It was not

**“It’s as if he’s just unconscious,”** whispered anthropologist Owen Beattie, when the body of Petty Officer John Torrington was uncovered in 1984. The Arctic permafrost had preserved his body almost perfectly for 140 years.

uncommon for ships to become locked in ice throughout the long Arctic winter, and Franklin’s ships, the *Terror* and the *Erebus*, had been stocked with enough canned food to last at least three years.

By the expedition’s third winter in the Arctic, however, people at home

began to get uneasy, and the search for Franklin and his crew began in late 1847. The Admiralty offered a reward of 20,000 pounds sterling (the equivalent of \$100,000 today) for information leading to the *Terror* and the *Erebus*. In addition, Franklin’s wife, Lady Jane, financed extensive private search parties. Even so, there was no sign of the Franklin Expedition until 1850, when searchers discovered the graves of three Franklin Expedition crewmen on Beechey Island, which lies more than 500 kilometers (about 300 miles) north of mainland Canada. The searchers also found the remains of a camp on the island, including tent sites, a large storehouse, and a cairn (heap of stones) enclosing more than 700 gravel-filled tin cans—evidence that the expedition had wintered on Beechey Island. The next four years of searching were fruitless and the British Admiralty abandoned the effort in 1854, declaring Franklin dead after having sent more than 40 ships to search for him.

The private expeditions that Lady Jane Franklin continued to finance were also fruitless until 1859, when Captain Francis Leopold M’Clintock made a major discovery on King William Island, which lies southwest of Beechey Island just above the Canadian mainland. Following up reports that the Inuit had seen white men “who fell down and died as they walked” on King William Island, M’Clintock found a bleached skeleton dressed in the remnants of a steward’s uniform on the southern coast of the island.

Traveling north, M’Clintock’s group found a cairn containing two notes that Franklin Expedition members had written on a single piece of paper. The first note,



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# Ice

by Robin Meadows

dated 28 May 1847, confirmed that the Franklin Expedition had spent the first winter (1845–46) on Beechey Island. The second note, written around the margin of the first and dated nearly a year later, reported that the ships had become trapped in ice 24 kilometers (15 miles) off the north-west coast of King William Island in September 1846. The ships spent the winter of 1846 there and were still locked in the ice in June 1847, when Franklin died at the age of 61. The ice failed to melt during the short Arctic summer, keeping the ships there for another winter—the third winter of the expedition.

By the spring of 1848, a total of 24 men had died, and the 105 survivors decided to desert the ships and walk across the ice to King William Island. Their goal was to walk the 150-odd kilometers to the south coast of the island and then row up the Back River, which is in mainland Canada, to the nearest fur trade fort.

While M'Clintock answered some of the questions about the Franklin Expedition, he made a subsequent discovery that raised a new and very puzzling problem. South of the cairn, M'Clintock found skeletons of two more crewmen in a lifeboat that was mounted on sledges and crammed with button polish, silk handkerchiefs, curtain rods, a writing desk and other items useless to survival in the Arctic. The cargo was "a mere accumulation of dead weight, of little use," commented M'Clintock, who estimated the weight of the 8.5-meter (28-foot) boat and sledge to be 635 kilograms (nearly 1400 pounds).

Why did Franklin's crew choose such



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**Owen Beattie and his associates worked in a tent shelter to exhume the bodies of three sailors who were among the first members of the Franklin expedition to die. They took X-rays, conducted autopsies, and took small samples of hair, bone, and other tissues for later laboratory analysis.**

strange supplies for their last-ditch gamble to return home? This question had gone unanswered for more than a century, when physical anthropologist Owen Beattie of the University of Alberta began investigating the Franklin Expedition during the 1980s. Suspecting that the mystery of what had happened to the expedition could be solved by learning why Franklin and 23 of his men had died there, Beattie went to King William Island in 1981 looking for bones of Franklin Expedition members. Beattie and his colleagues found a Caucasian skull and bones on the south coast of the island and had them analyzed for trace elements [see box "Testing for lead in the body"], hoping to learn about the crewman's health and diet.

Beattie originally believed that a combination of scurvy (an illness caused by a deficiency of vitamin C) and starvation had doomed the expedition. To his surprise, trace element analysis showed that the bones contained very high levels of lead—228 ppm (parts per million), which is more than 10 times higher than typically found in bones. If the crewman had taken in this much lead during the expedition, he would have suffered severe lead poisoning. If the rest of the crew had also had lead poisoning, that might explain the enigma of the lifeboat's capricious cargo.

In addition to causing anorexia (loss of appetite), anemia, extreme weakness, and other debilitating physical symptoms [see box "Lead Poisoning: effects and treatment"], lead poisoning has devastating psychological effects. "A person can actually go mad from the effects of lead," wrote Beattie and journalist John Geiger in their 1992 book *Buried in Ice*. Lead poisoning can make people paranoid, impairing their judgment and rendering them incapable of making sound decisions—such as what supplies to load into a lifeboat when trying to survive in the Arctic.

To be sure that lead poisoning had contributed to the expedition's failure, however, Beattie needed more evidence. Bones accumulate lead over time, and so reflect a person's lifetime exposure. However, hair and soft tissue reflect recent exposure to lead. Beattie knew he could get the answers he needed from the three bodies buried on Beechey Island. In August 1984 Beattie and a team of researchers went to the island to collect samples from the body of one of Franklin's crewmen, Petty Officer John Torrington of the *Terror*. Beattie found that the body had been amazingly well preserved by the permafrost (permanently frozen ground) underlying the island's surface layer of loose limestone gravel. Analysis of



PHOTOS COURTESY OF OWEN BEATTIE,  
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**Above:** The cold, hard ground that preserved the bodies so well also made exhumation difficult. It took days of work with pick ax and shovel to break through the permafrost. When the coffins were finally uncovered, they were carefully thawed with bucket after bucket of warm water.

During the excavation, the scientists took photographs and made careful measurements from a grid system so they could replace the bodies, coffins, rocks and gravel precisely. They left the gravesites exactly as they found them.

**Right:** An autopsy performed on the body of William Braine showed that he suffered from tuberculosis and possibly died from pneumonia. Later laboratory analysis suggested that lead poisoning probably weakened him and contributed to his death.

Torrington's hair showed that it contained more than 600 ppm lead—120 times the maximum of 5 ppm lead typically found in hair and proof that Torrington had indeed suffered lead poisoning during the expedition.

Beattie returned to Beechey Island in June 1986 to take samples from the bodies of Able-bodied Seaman John Hartnell and Royal

Marine Private William Braine, both of the *Erebus*. Analysis showed that Hartnell's hair contained up to 313 ppm lead and Braine's hair contained up to 280 ppm lead, proving that

## Testing for lead in the body

Lead in the Franklin Expedition bone and hair samples was analyzed by a type of atomic absorption spectroscopy. The technique involves dissolving the samples in nitric acid and heating them to temperatures as high as 3000 °C. The vaporized sample then passes through a spectrometer, which measures the wavelengths of light absorbed by the sample. Lead absorbs particular wavelengths, and the absorption pattern allows researchers to identify and quantify the lead that was in the sample.



## Lead poisoning: Effects and treatment

As levels of lead in the blood increase, symptoms progress from fatigue and nervousness to colic (agonizing abdominal cramps), vomiting, and diarrhea to paralysis, convulsions and, ultimately, death. In children, lead also stunts growth and impairs intelligence. Today, sources of exposure to lead include glazes used on some ceramic dishes and a white lead-containing paint that was used in most homes before being banned in the 1950s. Unfortunately, small children eat chips of this paint because it tastes sweet. Lead has no normal function in the body and the mechanism of its effects is unclear. However, studies have shown that lead, like other heavy metals, inactivates enzymes (proteins that catalyze biochemical reactions). Many enzymes require calcium, iron, or other divalent cations (which have two positive charges). Lead is also a divalent cation and so may replace those that normally bind to these enzymes, thus reducing their activities. The current treatment for lead poisoning involves injections of EDTA (ethylenediaminetetraacetic acid), a chelator that binds lead ions. The EDTA-lead complexes are then excreted in the urine. However, EDTA is not ideal because it also binds essential divalent cations such as calcium and zinc. Researchers are now testing another lead chelator, DMSA (*meso*-2,3-dimercaptosuccinic acid), which can be taken orally and has the advantage of being more specific for lead.



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**Franklin's ships carried 8,000 tin cans of food. The scientists recovered some of the empty cans and found that many had defective seams. Anthropologist Owen Beattie remarked, "In some cases there was so much solder that it had dripped and hardened like candle wax. While the can was full, lethal doses of lead would have dissolved into the food."**

both of these men had also suffered lead poisoning during the expedition.

The probable source of the lead was obvious to Beattie. While examining the tin cans from the waste heap on Beechey Island, Beattie had observed that their inside seams had large lumps of the solder that had been used to seal the tins. The solder used until the late 1800s was 50% lead (and 50% tin), which meant that the food in the tins was in direct contact with lead. Given the canning method of the time, the Franklin Expedition was probably not the only one with lead-contaminated provisions. "These tins were particularly poorly made," says Beattie, "but [from looking at records of illnesses] we believe that other expeditions also got lead poisoning from tinned food." If the Franklin Expedition had not been icebound for the second and third winters but instead had completed its mission and returned to England and uncontaminated food, the crew probably would have survived the lead poisoning, he says.

Beattie showed that the lead in the solder and the lead in the crewmen's hair were the same by isotope analysis. Isotopes of an element have the same chemical properties but different atomic weights, and lead from a given source contains characteristic amounts

of the various isotopes. "It's almost like having a fingerprint," says Walter Kowal, the doctoral student in Beattie's laboratory who did the analysis. "It's extremely unlikely that the lead [in the hair] came from another source."

Although devastating, lead poisoning was not the only reason the Franklin Expedition failed. Rather, Beattie believes that lead poisoning weakened the men to the point that they succumbed to diseases that they otherwise might have survived. The bones found on King William Island bore pits and scales characteristic of scurvy, which also causes bleeding, weight loss, exhaustion, and other symptoms. Moreover, the three crewmen buried on Beechey Island had all been afflicted with tuberculosis, and their immediate cause of death was probably pneumonia, according to pathologist Roger Amy of the University Hospital in Edmonton, who autopsied the bodies.

The search for Franklin and the other lost men, as well as for the *Terror* and the *Erebus*, continues to this day. The latest twist in the story is that two men claim to have found new traces of Franklin's ill-fated expedition. Lieutenant E. C. Coleman of the British Royal Navy has found what he believed were burial mounds of Franklin

Expedition men on the northwest tip of King William Island; the mounds were about 30 m long and 5 m high (about 100 feet long and 15 feet high). However, it was recently shown that these mounds were not gravesites, but natural features of the landscape. Canadian weather forecaster Wayne Davidson says he has found a previously unknown European campsite. Although he is not saying much else, he has let out a big tease: "I believe Franklin is dead in his ship," he told the *London Sun*. "He was left in it. The ship is the biggest, the toughest mystery. I think we've found it." If the team of researchers currently investigating this find determines that it is authentic, the remaining questions of what happened to the Franklin Expedition may be answered at long last.

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