

The Iceman Goeth

One June, a man climbed into the Ötztal Alps, on today's Austrian-Italian border.

Dressed in leather and fur, he was mid-40s and extremely fit. He carried a wooden bow, flint-tipped arrows, and a copper axe.

He had no way of knowing that in an hour he'd be dead.

5,300 years later, some hikers discovered his body, melting out of a glacier.

Local police called in forensic experts, and so began a 30-year investigation into the best-preserved mummy from pre-modern history.

They traced the minerals in his teeth to a nearby groundwater source, to determine where he lived.

They looked at food and pollen in his gut to re-create his last day of meals and where he ate them.

Ötzi the Iceman, as they called him, had walked from his mountain home to the valley floor. That night, judging from a telltale slash on his hand, he got into a knife fight.

The wound had begun to heal by the time he died, suggesting he won it.

What had not healed were a fatal arrow wound to his back and a cracked skull. Someone had tracked him into the mountains and ambushed him.

His valuable copper axe was not taken, suggesting a revenge killing. Perhaps the killers buried him in snow, beginning his mummification.

Today, Ötzi rests in a museum freezer near where he was discovered. A model of him in life stands in the same building, while 3D printings of his body are studied around the world.



Left: A reconstruction of the Iceman's axe made by ArchäoTechnik Wulf Hein, Dorn-Assenheim, Germany.

Credit: Bullenwächter (GFDL [<http://www.gnu.org/copyleft/fdl.html>] or CC BY 3.0 [<https://creativecommons.org/licenses/by/3.0/>]), via Wikimedia Commons

Right: A reconstruction of Ötzi the Iceman in the South Tyrol Museum of Archaeology in Bolzano, Italy.

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**BUREAU OF
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Background: The Iceman Goeth

Synopsis: In September 1991, two hikers near the border between Italy and Austria at the crest of the Ötztal Alps came across the head and shoulders of a mummy melting out of a glacier. The mummy, which turned out to be about 5,300 years old, was nicknamed Ötzi (ERT-zee) the Iceman. Scientists have used modern forensic science to study his life and death in amazing detail, making him one of the best-researched individuals in the world.

- Ötzi was found 100 yards from the Austrian border in the Ötztal Alps on the east ridge of Fineilspitze peak, at an elevation of 10,530 ft.
 - Thinking it was a climber who had recently died, the hikers notified police, who took 4 days to remove the corpse and some of his personal effects from the ice.
 - These remains were delivered to the Institute of Forensic Medicine in Innsbruck, Austria. When scientists saw the Copper Age tools of the man, they contacted an archaeologist, who confirmed the mummy was thousands of years old: radiocarbon dating then confirmed that he lived sometime during the period from 3350 to 3080 BC.
 - Ötzi is kept in a freezer at the South Tyrol Museum of Archaeology in Bolzano, Italy, near where he was found. His belongings are also on display there.
 - For years, little research was done, but then, 25 years after Ötzi was found, the director of the museum called a well-known forensics expert. She asked Detective Inspector Alexander Horn of the Munich Police if he could help solve a very cold case.
- Unlike mummies from dry climates, the organs, tissues, bones, and skin of this “wet mummy” were intact, right down to the contents of his stomach. Using modern forensic technology, Inspector Horn achieved amazing results, starting with what the Iceman would have looked like.
 - His thighbone tells us he was about 45 years old, at the long end of life expectancy for that time.
 - He was about 5’3”–5’5” (1.60–1.65 m) tall.
 - He probably weighed about 110 lb (50 kg) and had no subcutaneous fat, so he would have been athletic and wiry. He had especially strong legs.
- He had dark medium-length hair with traces of arsenic, suggesting he was present during metal smelting.
- He had deep-set brown eyes and probably had a beard.
- He had a gap between his two front teeth.
- The minerals in his teeth even tell us about the isotopic composition of the water near where he grew up: an area around a village now known as *Feldthurns*, about 30 miles south of where he was found.
- His clothing was practical, made from leather, fur, and braided grass to provide him with protection from the cold and wet.
 - He had a mat that was made of braided alpine swamp grass.
 - His knee-length coat, worn with the fur on the outside, was made of goat and sheep strips stitched together with animal sinew.
 - He wore two leggings made of goat and sheep hide, and a loincloth made of narrow strips of sheep hide. These all connected to a calfskin belt with a pouch for storing small tools and flint.
 - He had a bearskin hat and a deerskin quiver.
 - His right shoe was found on his foot. His shoes had bearskin soles and were made of tree-fiber netting stuffed with grass and covered by deer hide with the fur on the inside. Today, he would wear a men’s size 6 shoe (European size 38).
- Ötzi’s tools taught us about his everyday life.
 - He lived during the Copper Age, which was after the Stone Age and overlapping the beginning of the Bronze Age.

References: The Iceman Goeth

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- He had nets for catching small prey, and a leather and marble device for carrying them attached to his belt.
- He had birch-bark cylinders that were used to carry embers wrapped in moss so he could start fires quickly.
- He used some stone tools like a flint dagger and arrowheads.
- His bow was made from the wood of a yew tree.
- He had a copper-bladed axe, which was a new technology that required specialized skills in order to extract and process the metal.
 - High levels of copper particles and arsenic in his hair may indicate that he was involved in the smelting and working of copper.
 - Copper for his axe was 99.7 percent pure and originally came from hundreds of miles away in Tuscany, Italy, indicating that Neolithic travel occurred across the physical barrier of the high Alps—much farther than previously thought.
 - Another similar but smaller copper blade of the same age has been found even farther from the source of the Tuscan copper, in the northern foothills of the Swiss Alps.
- Ötzi had the oldest tattoos ever found, by about 2,000 years.
 - His 61 tattoos from head to foot were made by rubbing charcoal into fine cuts in the skin to produce lines and crosses.
 - Most of them are located over areas where joint and spinal degradation was noticed in his skeleton, leading to speculation that they may have been treatments for pain at acupuncture points.
- Life had been hard on Ötzi. On top of his aching joints and back, he had a lot of other health issues.
 - His lungs were blackened by soot from campfires.
 - An unusual growth on his little toe indicates he had frostbite during his life.
 - He had broken several ribs on his right side and his nose during his lifetime.
 - His teeth were decayed, and he had advanced gum disease. The teeth on his left side were especially badly worn, suggesting he may have used them to work leather.
 - He had gallstones.
 - His gut had whipworm eggs, an intestinal parasite that causes nausea, vomiting, and diarrhea. He was carrying a medicinal fungus in his pouch that would have been used to treat the whipworms.
 - He probably had Lyme disease, transmitted by ticks, that could have caused rashes, fatigue, achy joints, and cognitive decline.
 - Ridges on his fingernails tell us he had been sick three times in the 6 months before he died.
- Ötzi's genome has been sequenced, which tells us even more about him physically.
 - He was lactose intolerant and he had *H. pylori*, which cause stomach ulcers.
 - His intact blood cells are the oldest ever identified, and his genome tells us his blood type was O positive.
 - His genome indicates he was prone to arteriosclerosis, or hardening of the arteries.
 - It turns out that he has at least 19 living male relatives in Austria today.
 - His DNA is most similar to people living in isolated populations in Southern Europe, like the islands of Sardinia and Corsica.
- Forensic studies can even reconstruct the amazing story about what happened to him in the days before his death.
 - Thirty different kinds of pollen were found with three meals in his gut, providing a record of approximately the last 33 hours of his life.
 - Ötzi died in spring or early summer, probably June.
 - In the 2 days before he died, he had traveled from an elevation of 6,500 ft down to the valley floor at about 5,000 ft, and then back up into the mountains at 10,500 ft.

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- He had consumed ibex meat, einkorn wheat, fatty bacon or cheese, and flowering plants in one meal, and red deer meat and grass or cereal in another.
- His last meal was eaten about 30 minutes before he died, and the meal before that had been eaten 8 hours earlier.
- Ötzi had three injuries that he suffered in the last week of his life.
 - He had a deep wound down to the bone between his right thumb and forefinger that had been healed for a couple of days. This kind of injury would have happened if he had put his hands up to defend himself in a fight.
 - He had a skull fracture, so he had either fallen or been struck in the head. Protein analysis indicates that some healing had occurred before he died because blood clots had formed; however, he may have suffered brain damage from this injury. The fact that the delicate blood clots in his brain were still intact confirmed that he had not been moved from his campsite after death for more than 50 centuries.
 - In 2001, a CT scan revealed a flint arrowhead in his left shoulder, and a puncture at the same spot was found when his coat was examined. The shaft of the arrow had been broken off before he died. The arrowhead cut through the subclavian artery, which would have caused him to bleed to death in a few minutes.
- Forensic scientists used the clues they found to reconstruct a compelling Neolithic murder mystery! Here is what they believe happened that week in early June:
 - Ötzi was well outfitted for a long mountain trek, with warm clothes and a large wood-framed backpack.
 - He hiked from a location at about 6,500 ft down to the valley. There, he was involved in a violent fight, where he received the defensive wound to his hand. He did not have any other injuries from that fight, so he must have won it, possibly killing his adversary.
 - Within 12 hours of his descent into the valley, he had hiked even farther back up into the mountains, from about 5000 ft to 10,500 ft with a full load of supplies.
- He set up his camp and ate a large meal. He must have felt safe enough to take the time to do this. It appears he may have even made a fungus-based tea to help with his stomach issues.
- Suddenly he was attacked! He was shot in the back with an arrow from about 100 ft away. His skull was cracked by a fall or by an attacker. It is not clear which injury occurred first, but either would have been fatal.
- Blood clots developed in his brain and at the site of the arrow, indicating he didn't die immediately.
- His valuable high-tech copper axe was left with him, so robbery probably wasn't a motive. It looks to be a revenge killing.
- Forensic experts believe that his killer broke the shaft of the arrow off and covered the body with snow from a nearby snowfield, possibly to hide the deed.
 - This act protected the body from scavengers and started the preservation that lasted 5,300 years.
 - Entombed in a low saddle beneath the glacier, Ötzi avoided the typical crushing pressures of the ice to become the oldest and best-preserved mummy in the world.
- With the advent of 3D printing, Ötzi has been digitally reproduced three times.
 - Two copies are in New York, along with 3D printed copies of his bones.
 - The third copy is on a traveling tour, perhaps coming soon to a museum near you!
 - The original Ötzi is still in his freezer in Bolzano, Italy, along with a beautiful reconstruction of how he would have looked when he was alive, created by paleo artists Adrie and Alfons Kennis from the Netherlands.

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