

The Iceman – A *Cold Case*

Death (murder?) in the Tyrolean Alps

**Application of geological and
biological forensic science**

Location of the Body



Location and general view of the discovery site.



Fig. 1. The partly freed body of the Iceman as watched by two famous mountain climbers from South Tyrol, Hans Kammerlander (left) and Reinhold Messner (right). The picture was taken by K. Fritz (Photo Paul Hanny). Kammerlander holds part of a wooden structure later identified as a carrying support of Ötzi. In the right upper corner the bow can be seen, its lower part stuck in the ice and the upper one leaning against the rocks. Just below the tip of the ski pole held by Messner one can see the smashed remains of a container made of bark from a birch-tree, probably used to carry equipment for making fire.



23 September 1991. Recovery of the Tyrolean Iceman (Ötzi).





Not knowing the importance of the find, parts of the corpse have been damaged before and during recovery.



The Iceman was stored in a freezer at the University of Innsbruck, Austria.



The Iceman's survival kit: a flint stone knife and a copper ax.





Arrow heads of flint stone, unfinished arrows, and a deerskin quiver.



Ötzi (the Iceman)

What can we learn about his life and death from his remains?

An exercise in geological and biological forensic science.



How did Ötzi perish?





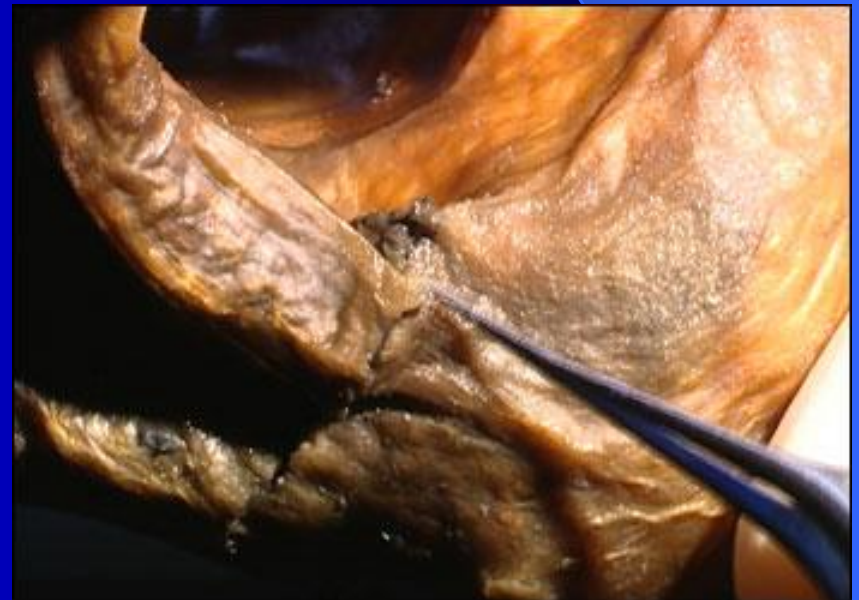
Preparing Ötzi for a CAT scan.

Physical evidence



An arrowhead was found embedded in his left shoulder.

There was a cut in the palm of his right hand and into two of his fingers, damaging the tendons. It was inferred that he was holding a blade.



DNA Tests Suggest Ötzi Died After Violent Fight But Not Alone

DNA tests conducted by molecular biologist Thomas Loy and his team (from the University of Queensland's Institute of Molecular Bioscience in Brisbane).

- During their investigation they saw signs of trauma to Ötzi's body, including bruises (and cuts) on his abdomen (especially on his rib area), which (they concluded) indicates that he may have been beaten.
- Samples were taken from the Iceman's antler-skinning tool, his stone-tipped knife, two of his arrows (one broken), his axe handle, and his goatskin coat. Using techniques devised especially for ancient DNA, the team found four different DNA sequences: one on the knife blade, two different sequences on one arrow, and a fourth on Ötzi's goatskin coat. (They also found a small tear in the coat which may have been the entry point of the arrowhead that was found embedded in his shoulder.)
- They interpreted these findings in this way:
 1. The two different blood samples on the arrow may indicate that Ötzi killed two of his assailants and retrieved the arrow to use again.
 2. The blood on his coat may indicate that Ötzi carried a wounded friend on his shoulder for some distance.
- According to Dr. Loy "On the basis of all my examinations, [Ötzi's] specialty was hunting the high alpine passes for ibex and possibly chamois which would have taken him into boundary conditions where other people would have disputed the territory. His gear was stacked up neatly. He didn't keel over, although he was probably tired, exhausted and hurt like hell."

When did Ötzi die?

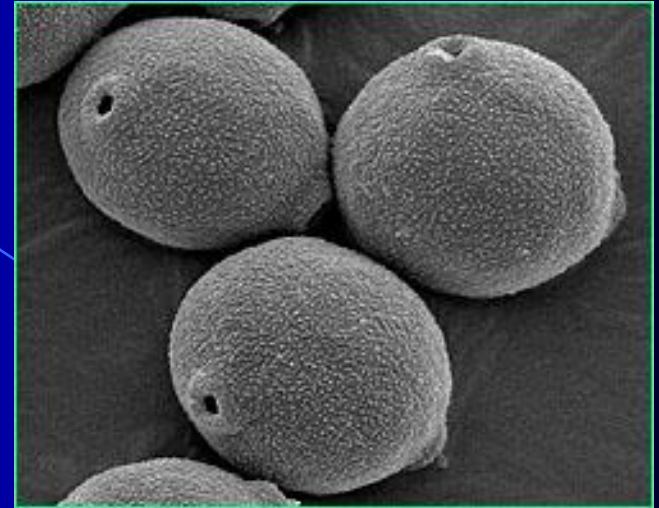
**An Application of C-14
Dating**

Where did Ötzi live?

Biological evidence



Wheat spiklets derived from Einkorn grain, stuck to the Iceman's clothing. The same material was found in the iceman's intestine indicating that he had eaten a hard bread shortly before his death. The plant material came from an agricultural area.



Three grains of *Ostrya carpinifolia* (Hophornbeam) pollen magnified 1600x.

The majority of the pollen came from the hop hornbeam tree, which grows in a warm environment. The hop hornbeam tree blooms between March and June, and because the sperm inside the pollen grain, which normally decays after a short exposure to air or water, was still intact, it had to have been absorbed relatively soon after its release from the tree. The nearest stands of that tree could have grown to the south of the Hauslabjoch, at least five or six hours away by foot. The high valleys to the north are just too cold to sustain it.