

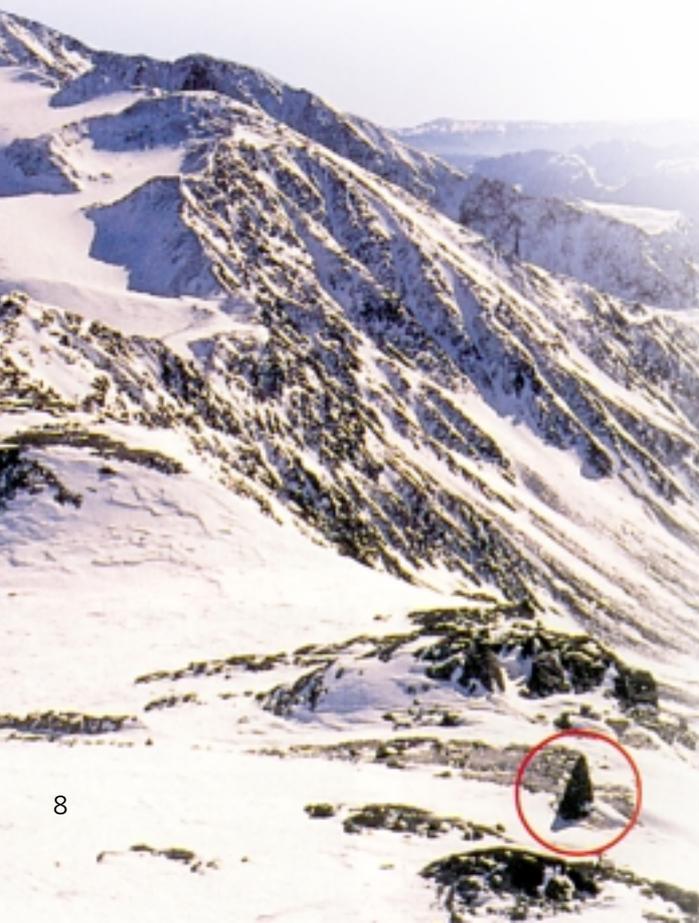
Ötzi the Iceman



Manfred Schindler

The global climate is warming – a process which, though scarcely felt, is nevertheless clearly visible. Glaciers have been receding for years, and not only in the polar zones, in the high mountainous regions of Central Asia or in the northern and southern areas of America! Even in the European Alps, experienced hikers are baffled to see a trail which ran above the edge of a glacier as recently as the previous year now passing through rock and rubble. The increasing melting of snow and ice masses has presented the archaeological community with a sensational find and an outstanding research object. A museum has been set up in Bolzano in South Tyrol to house this discovery.

Fig. 1:
The site of the find at an altitude of 3120 m above MSL, between Schnalstal (Italy) and Ötztal (Austria). In this area, three passages and cattle drive trails known from time immemorial lead across the main Alpine crest via Niederjoch and Hauslabjoch.



In September 1991, a couple from Nuremberg climbing down from the Finailspitze peak in the Ötztal Alps spotted a human corpse half protruding from ice and melt water residues in a rock trough not far from the marked trail. They informed the landlord of the Similaun lodge who reported the discovery to the Italian police in Schnals and their Austrian counterparts in Sölden, as the site of the find on the edge of the Niederjoch glacier was obviously located on the frontier line between Italy and Austria.

The very next day, an Austrian rescue team arrived by helicopter on the site located at an altitude of 3120 meters. Due to the onset of bad weather, however, they had to return empty-handed to the valley. Among the first reaching the site on foot were the two South Tyrolean mountaineers *Reinhold Messner* and *Hans Kammerlander*. They subjected the corpse and its surroundings to closer scrutiny, and found remnants of clothes and various utensils, including a bow, suggesting that the dead man could hardly be a 20th century victim of a mountaineering accident.

This guess was confirmed a few days later. The body and the collected pieces of equipment had been brought to the Department of Forensic Medicine of Innsbruck University, where *Prof. Dr. Konrad Spindler* of the Institute of Pre- and Early History was consulted. He dated the find to be early Bronze Age – a sensation which hit the headlines worldwide.

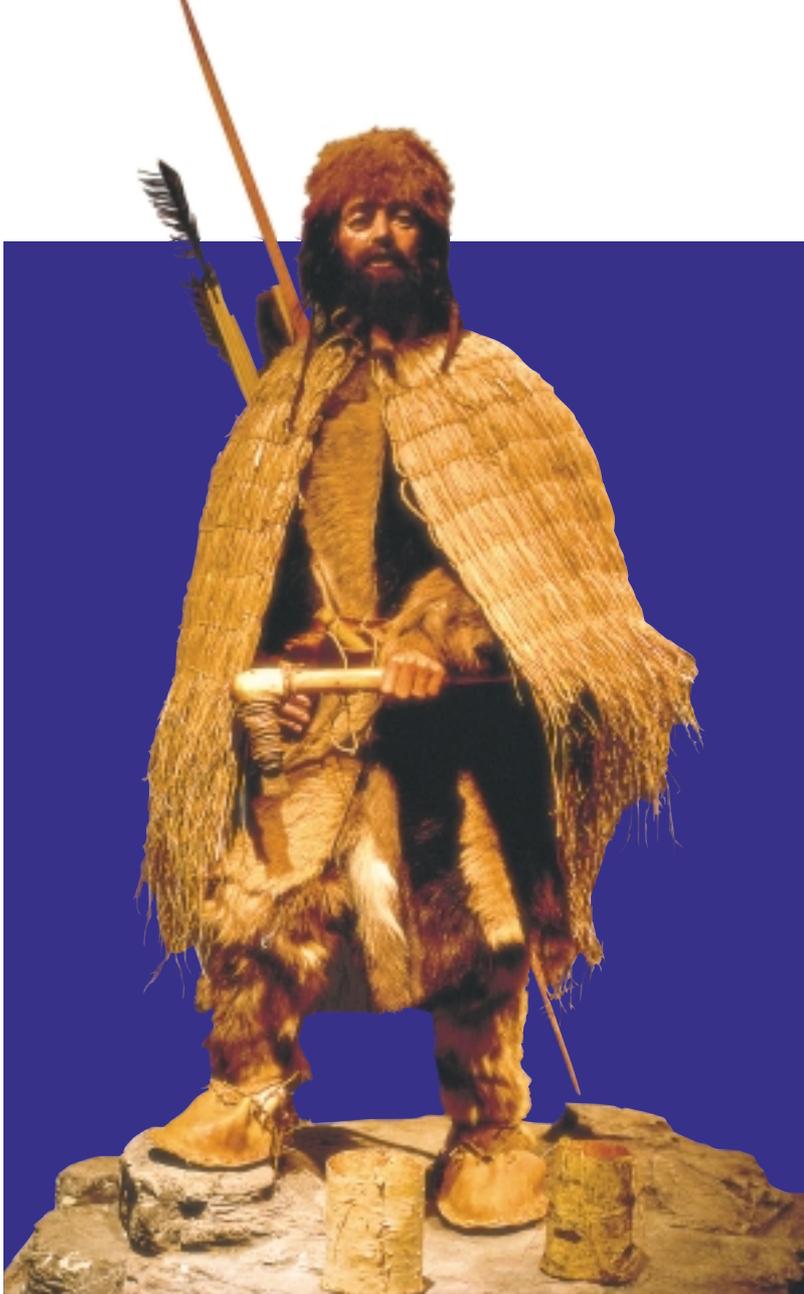
The mummy was then transferred to the Institute of Anatomy where it was preserved in a cold storage room at minus temperatures and with a humidity similar to glacier conditions. All articles found on the site were transferred to the Central Roman-Germanic Museum in Mainz, Germany for preservative treatment.

Just who does the Iceman belong to?

In the very first media reports, it was partly assumed that the site of the find was not located in Austria but on Italian territory. It was therefore up to the Italian authorities to decide what should happen to this discovery that was causing such a worldwide sensation. Although the doubts about the nationality of the location appeared somewhat bizarre at first, different views on the exact course of the frontier line were indeed justified, i.e. on whether it runs north or south of Ötzi's icy grave.

When Tyrol was divided after World War I, the victorious Allied Powers fixed the frontier between Italy and Austria on the watershed between the river valleys of Adige and Inn. But what if nature ignores the decisions of politicians, if melting glaciers change the topographic conditions and water channels?

People in South and North Tyrol have continued to use the bridle paths linking the areas from time immemorial, and have driven their flocks to pastures which have been officially documented for centuries, on both sides of the main Alpine crest. Until the discovery of Ötzi, no one had been particularly interested in where to the exact meter the frontier ran through eternal ice and uncultivable land according to the delimitation of 1919 under international law. However, the increasingly heated discussion about the location's nationality finally necessitated the re-measurement of the national border. As it turned out, the inconspicuous rock trough housing the glacier mummy for thousands of years is in fact located on Italian territory, exactly 92.56 meters from the border line. In other words, the province of South Tyrol was the rightful owner of the find.



The South Tyrol Museum of Archeology

Was the Iceman a South Tyrolean? Where did he come from and where was he bound? These and many other, hitherto unanswered questions will keep the international scientific community busy for many years to come. Since 1998, the specially built South Tyrol Museum of Archeology in Bolzano has provided this spectacular discovery with a home befitting its importance. Here, the Iceman is stored – without any danger of aging – in a specially designed cold storage complex. The complex comprises a decontamination room, an examination room equipped with Zeiss technology, and two cold chambers with independent refrigeration systems. In

Fig. 2: On the upper floor of the museum, a small window allows a glimpse of the preserved glacier mummy inside the cold chamber.



one of the chambers, the Iceman is stored at -6°C and a humidity of nearly 100%, surrounded by mysterious cold light from which all ultraviolet and infrared beams have been filtered. Visitors to the museum can view the mummy through a window. The preservation principle involving an innovative sheathed thermo-system for the exchange of humidity, without any formation of ice on the mummy's body, has been specially developed and is currently unique in the world.

Reconstruction of the Iceman, his clothing and equipment

700 axial sectional images obtained by computer tomography were used to create a stereolithographed 3D representation of the skeleton system and a model of the skull with a level of precision totaling mere fractions of a millimeter. This formed the basis for the reconstruction of the Iceman's body, facial features, hairstyle and beard.

Under a grass cloak, he wore a knee-length upper garment made of strips of goat skin to keep him warm. The "underwear" consisted of a loin cloth made of goat hide which was drawn between the legs. The thighs and lower legs were covered by a kind of

leggings also made of goat hide, to which deerskin shoes with soles of bear skin and with a hay lining were attached.

The Iceman's equipment included a copper axe, a bow made of yew wood, a leather quiver containing some unfinished arrow shafts made of viburnum branches and some arrows with flint heads ready for shooting as well as a dagger with a flint blade.

Two birch bark containers which the Iceman carried with him were not only used for storing food, but also contained embers for a fire embedded in fresh leaves, as can be deduced from charcoal particles found inside.

Figs 3 to 5:
“Ötzi” in the examination room of the cold storage complex at the South Tyrol Museum of Archeology.

The equipment including a Zeiss OPMI® 111 surgical microscope, a MediLive 3 CDD camera, an AxioCam® digital microscope camera and the associated KS 300 software is primarily used for constant monitoring of all major preservation parameters:

- the mummy's moisture content,
- its subjective surface condition,
- its weight,
- the color characteristics of its skin,
- its microbiological integrity

The processes performed for this purpose involve the photographic documentation of details of the mummy, examinations of its surface at different magnifications, and spectrometric measurements of the light reflected by the skin at defined measuring points.



The Iceman, his clothes and equipment form the core of museum's exhibition. A tour through the exhibition area, which has been slightly darkened for reasons of preservation, along special climatized showcases with the original remnants of the items found on site, their excellent reconstructions and very instructive presentations of information in word and picture is a fascinating experience. Interested visitors learn, for example, that scientific studies have estimated the glacier mummy to be approx. 5300 years old, that the Iceman's height at the time of his death was 1.60 meters, that he weighed roughly 50 kg and had probably reached the age of 46 years.

What is so special about this find?

“This find is so unique because organic parts of the clothing and equipment of prehistoric men have never been found before in such an excellent state of preservation and in such completeness. The Iceman was snatched from life for reasons unknown to us, and remained preserved in the ice in this accidental situation, together with his equipment.

In archeological excavations, selected objects are usually found which have been intentionally placed in the location as part of religious or burial ceremonies. The Iceman find, on the other hand, provides a realistic snapshot of man's everyday life in high mountainous regions 5000 years ago.

But not only research into Alpine prehistory is gaining new insights from the Iceman. Other scientific and technical disciplines are also participating in the thorough investigation of the find: medicine (anatomy, radiology, pathology, hematology, dermatology, parasitology, etc.), microbiology, anthropology, paleobotany, cryotechnology” (quote from the museum documentation).



International research

Angelika Fleckinger, coordinator at the South Tyrol Museum of Archeology, writes that the body itself was subjected to no less than 570 scientific examinations between its discovery and the transfer of the mummy from Innsbruck to Bolzano. 100 samples have been taken, the largest of them weighing 60 milligrams and the weight of all samples together totaling just over one gram. Renowned research institutes from all over the world participated in the studies.

The Osteological Research Laboratory of Stockholm University and the Institute of Anatomy of Innsbruck University, for example, examined the

bone structure for age-related degeneration symptoms, and concurrently estimated the Iceman's age to be at least 40 and no more than 53 years at the time of death.

Tissue fibers and bone particles were evaluated for ¹⁴C dating by the Research Laboratory for Archeology and the History of Art in Oxford and at the Institute of Medium Energy Physics at Zurich Technical University (Eidgenössische Technische Hochschule). Likewise, botanical fiber fragments from the clothes were analyzed at the Svedborg Laboratoriet of Uppsala University and at the Center for Weak Radioactive Substances (Centre de Faibles Radioactivités) in Paris. The results concurrently showed that "Ötzi" lived in the period between 3350 and 3100 BC.

The list of spectacular research projects could be continued indefinitely. The universities of Ferrara, Camerino, Rome and Bolzano, the Eidgenössische Technische Hochschule in Zürich and the Department of Anthropology and Biology of London University College are currently performing dedicated DNA analyses which, though based on different approaches, are all aimed at gaining further insights into the Iceman's origin and migration.

"Ötzi" is an international project. Over one hundred experts have been involved until now in deciphering the "Homo Tyrolensis" or "Homo Hauslabienses" as the Iceman has come to be called in scientific terms. We already know a lot about him. For example, he was afflicted by arthritis and suffered from the effects of several fractured ribs, some of his wisdom teeth were missing, the provisions for his journey over the Hauslabjoch consisted of wheat bran, plums and dried capricorn meat, he was protected by surprisingly practical clothing, and he possessed a nearly perfect survival kit.

New discoveries

Initially it was assumed that the Iceman's death had been due to a sudden onset of bad weather leading to hypothermia and exhaustion. In summer 2001, however, *Eduard Egarter*, pathologist and coordinator of the Ötzi research project, and *Paul Gostner*, radiologist at Bolzano hospital, discovered an arrowhead in the mummy's chest and a shot hole under its left shoulder blade. This indicates that Ötzi was shot from behind. A closer analysis of the strangely distorted position of the right hand has

now shown that the Iceman also had a deep gash between his thumb and index finger, but that he was nevertheless holding his dagger with the flint blade firmly clenched.

Forensic specialist *Eduard Egarter* thinks that the severity of the hand injury contradicts any assumption that it might have been caused accidentally, e.g. during the carving of the unfinished arrow shafts found in the mummy's quiver. Instead, it can be assumed that "Ötzi" raised his hand to protect himself in the fight and sustained a further injury.

In all likelihood, the arrowhead under the left shoulder blade paralyzed his arm muscles and led to an internal hemorrhage. Weakened and unable to defend himself and to continue his arduous journey, the injured man very probably succumbed to exhaustion and his injuries, primarily the internal hemorrhage caused by the arrow shot. Whether he died within a short time or after hours cannot be said with definite certainty after 5000 years.

Was the Iceman on the run? And if so, why and from whom? Research will continue, as every new insight not only provides answers but also raises new questions at the same time. Many facts will still be brought to light, but a great deal will remain a mystery. – Let us wait and see what the most exciting find of our time is yet to reveal.

Fig. 6: On a surface area of 1200 square meters, the South Tyrol Museum of Archeology in Bolzano's Via Museo /Museumsstrasse documents the pre- and early history of South Tyrol from the end of the Ice Age (15,000 BC) up to the Charlemagne period (around 800 AD). The central exhibit is the Iceman and the associated finds.



Further information on:
"Ötzi the Iceman"
www.iceman.it

Sources/photos:
see Masthead