Feature

Ötzi's Shoes

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One of the world's leading experts on prehistoric and ancient shoes from around the world faced his greatest challenge over a decade ago: uncovering the secret of shoes worn by a 5300 year old "Iceman."

Petr Hlaváček knew all about shoes. In fact, he was one of the world's leading experts on all kinds of shoes, especially the study and recreation of shoes from pre-historic and ancient civilizations. He had plenty of experience and training for the job.

Hlaváček was born in Boršice in South Moravia, located near Buchlov Castle. After he graduated from the Secondary Technical School for Leather Processing Industries in Zlin, he worked as a production foreman at a shoe factory. Then, in 1979, he became a lecturer at the Faculty of Technology. From 2007 to 2011, he was the Dean.

He worked with many students at the Faculty of Technology, and gave lectures about the science of shoe-making and its history. Hlaváček was also active in his industry. He was the Vice President of the Czech Footwear and Leather Association, and represented his country in many international organizations. Hlaváček was also chairman of the Chamber of Expert Witnesses leather and shoe section.

Among the ancient and prehistoric footwear that Hlaváček studied were the sandals from Fort Rock Cave in Oregon, the footwear of the Terracotta Army, the boots of Albrecht von Wallenstein, and Byzantine sandals from Turkey. However, Hlaváček's best known work, and what captured people's imaginations, was his study and recreation of the shoes worn by Ötzi the Iceman.

Peter Hlaváček with his recreation of Otzi's shoes.

Who Was Ötzi?

Ötzi is a nickname given to the well-preserved natural mummy of a man who lived between 3359 and 3105 BCE, and most likely died between 3239 and 3105 BCE. The mummy was found in September 1991 in the Ötztal Alps (hence the nickname "Ötzi") near Similaun mountain and Hauslabjoch on the border between Austria and Italy. Ötzi is Europe's oldest known natural human mummy, and it has offered an unprecedented view of Chalcolithic Europeans. His body and belongings are displayed in the South Tyrol Museum of Archaeology in Bolzano, South Tyrol, Italy.

Current estimates, are that Ötzi was approximately 5 ft 5 in (1.65 meters) tall and died at about 45 years of age. The body and all his possessions were extraordinarily well-preserved because they were covered in ice shortly after his death. This has allowed detailed analysis on almost every aspect of the man, including his clothing.

What Did Ötzi Wear?

Although the clothing worn by Ötzi had deteriorated, enough remained that it could be reassembled and studied. In addition to the role of each piece of clothing worn by Ötzi, an obvious question was, what were

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Display of some remains of Otzi's clothing, identifying materials. Image: Institute for Mummies and the Iceman.

each of the pieces made of and how were they constructed?

Researchers used genetic analysis to determine which animals were used to make the clothes. Ötzi wore an outfit fashioned from a range of animals likely selected for the different properties of their skin or fur. His shoes were made from hardy cattle leather, his leggings from more supple goatskin. His coat was made from sheep, for warmth, his hat from brown bear, and his quiver from deerskin. The researchers believe the evidence indicates that Ötzi obtained at least some of his garments or the material to make them via trade. "It is probable that the Iceman was not a hermit," according Niall O'Sullivan of the University College Dublin in Ireland and the Institute for Mummies and the Iceman. "He likely traded furs or domestic animals."

Where does Hlaváček Come In?

With the question of materials addressed, at least in part, the next question was how were the individual pieces of clothing constructed, and how well did they function? For example, were they comfortable and how well did they hold up in actual use? In the case of the shoes, one of the most complex pieces of clothing, Petr Hlaváček wanted the job of finding out.

However, Hlaváček credentials were not those of an anthropologist or an archeologist, and Ötzi's custodians were reluctant to grant him rights of inspection.

He had to fight bureaucratic battles to get at Ötzi's shoes, which were located in Mainz Germany, and his feet, located with the rest of his body in Bolzano, Italy. Hlaváček's unique diagnostic techniques required both.

By studying the stumbling wear patterns on the boots of a seventeenth-century general, Hlaváček had shown that the fellow had died of syphilis. He'd reconstructed sandals of an American native who'd died under volcanic ash in Oregon, five thousand years before Ötzi. Hlaváček could tell you how Alexander's armies succeeded because of how the Persians had made their shoes -- how Egyptian armies had failed during the Six Day's War, in part because they wore nailed boots. The nails conducted heat and burned their feet.

After two years of bureaucratic wrangling, however, the authorities in both countries finally relented. Hlaváček could finally begin the work that would take him the next six years to complete. However, there was one other hurdle: Hlaváček was allowed only 20 minutes of "very hard work" to take a plaster cast of Oetzi's feet. The feet, he found, were much smaller and more slender than those of an adult man today - only as big as a 12-year-old boy's.

Hlaváček's replica of approx. 10,000 year old shoe from Oregon. Source: Wikipedia.

What Did He Discover?

Hlaváček was a very practical man, and his greatest tool for learning the facts about any prehistoric or ancient shoe was to try recreating it out of the same materials, and using the same construction techniques as the original.

Armed with his knowledge of Ötzi's shoes, as well as the feet that had worn them, Hlaváček was able not only to reconstruct the shoes, but also to learn exactly how they worked when Ötzi wore them. This lead to some very important discoveries.

Actual shoe worn by Ötzi.

Ötzi the "Iceman", recreated by Dutch experts, Alfons and Adrie Kennis. Photo: South Tyrol Museum of Archaeology.

Drawing on his experience and his detailed examination, it was clear to Hlaváček the shoes were much more complex than anyone had thought. Looking at the materials in more detail, he found that the leather on the bottom was from a bear. He also discovered that the leather had been cured in a mixture of bear's brains and fat from its liver. Deer leather formed the top. This was then mounted on a mesh of braided linden bark. The bindings were made of calf leather. Straw was used for insulation, and moss as lining.

Hlaváček with recreation of mesh and hay stuffing.

What About the Recreation?

With his analysis as complete as possible from studying the actual shoes, Hlaváček and a university colleague decided to create exact replicas of the shoes, using as many of the same materials and the techniques as possible.

Hlaváček's recreation of Ötzi's shoe. Photo: Josef Chlachula. Source: Wikipedia.

For example, they had to get the right leather. Tests determined it came from three different animals. They easily sourced the calf and deer skin, which were plentiful, but the bear skin was difficult. According to Hlaváček, they finally got a bear's skin from a hunter who had first tried unsuccessfully to prepare the shot beast.

After unsuccessfully trying to tan the leather with vegetable fats, they decided to use boiled pig liver and raw pig's brain - a method known to have been used in the Stone Age in South America. The noxious mixture, smeared onto the skin and left for three days, did its job.

Other unusual materials were also needed. Ötzi's shoes had been stuffed with hay to form a lining that provided warmth and comfort. Using commercial string for the support net was out of the question. They eventually happened upon an old man who remembered how to make it from thin strips of twisted lime lance bark. The partial covering of the instep was made of chrysanthemum and strips of calf leather.

Another problem was finding suitable straw. Hlaváček found some local Boy and Girl Scouts and asked them to make their own shoes, fill them with grass and try them out. According to Hlaváček, the children protested, that the grass was was itchy and abrasive. After a number of experiments, Hlaváček finally found a grass that was long, soft, and resilient. It also passed a critical test: the Boy and Girl Scouts. He had finally found the perfect grass to use with Ötzi's shoes.

How Did He Test the Shoe?

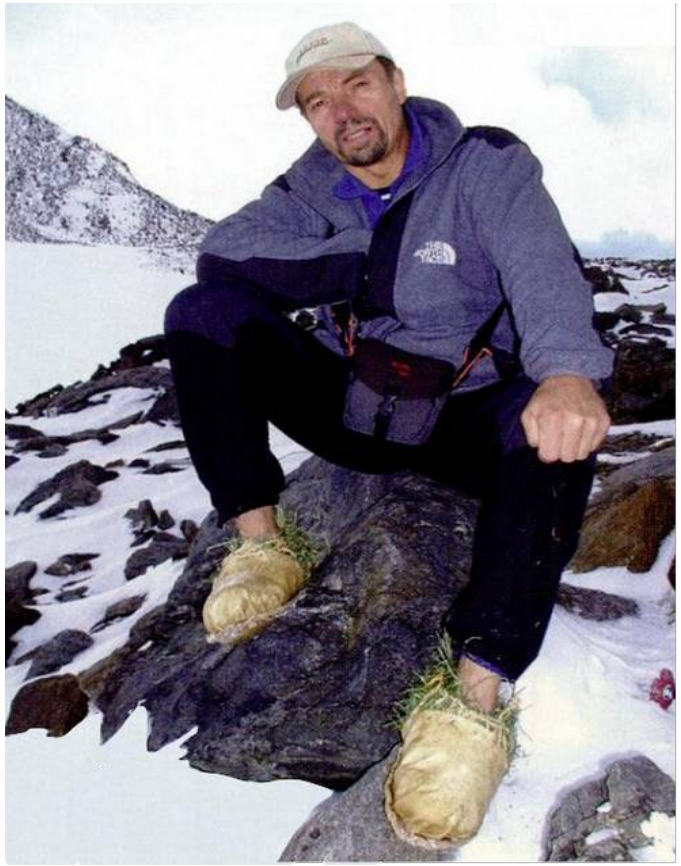
Many scholars had described Ötzi's shoes as uncomfortable without even trying a pair on. However, Hlaváček felt that if they were good enough for this prehistoric man to wear, then they are good enough for the present foot too. He thought that Ötzi's shoes would have a good grip and would be blister-free. In Ötzi shoes, he felt, something like freedom and flexibility could be felt.

Hlaváček knew that the only way to settle the matter would be to wear them and perform the same kinds of activities in the same environment as Ötzi. So Hlaváček and a colleague set out to make three exact replicas of Ötzi's shoes, and five additional pairs, each fitted to a specific living person. They used flint to cut the material and bone needles to sew it.

The group went on a hike in the Alps to test the shoes, and they took along with them the famous Czech climber Vaclav Patek, who is also known for his design of mountain-climbing shoes.

They headed off into the snowy mountain terrain, climbing over 4,900 feet in three days wearing the Stone Age shoes. One of the fascinating parts was when they walked into freezing melted water with the Iceman's shoes, they felt a momentary chill but the inside immediately warmed up again. Traction was excellent, and the shoes offered no opportunity at all for blisters..

After their hiking trip, Patek claimed that these shoes were more comfortable than any shoes that he had worn.



Climber Vaclav Patek testing a pair of Otzi's shoes.

What Were His Conclusions?

Hlaváček concluded that while Ötzi's shoes may not look very attractive, from a technical point of view they were very strong, sound and able to protect the wearer's feet against hard ground, extreme temperatures and damp. They had a very good grip, withstood shock very well, and offered more contact with the uneven ground than modern shoes. He personally found that wearing them was like going barefoot, only better.

Hlaváček was struck by the idea that Ötzi may've been better shod 5300 years ago, than we are today.

Further Reading

"The shoes of the 5,300-year-old Ice Man have been replicated & they are perfect," The Vintage News, June 3, 2017.

"Otzi's Shoes," Engines of Our Ingenuity, No 1978.

"Chechs cobble new line in prehistoric footwear," The Age, July 18, 2005.

"Here's What the Iceman Was Wearing When He Died 5,300 Years Ago," National Geographic Online.

Philip Gust *enjoys sci-fi and fantasy costuming, and has particular interests in props, special effects, and prosthetic makeup. He also costumes in historical periods, including Regency, Victorian, and early 20th century.*

Petr Hlaváček passed away in 2014.