

A prehistoric man, possibly a Neanderthal, is shown in profile, walking from left to right. He is carrying a spear with a large, dark, irregular stone head on his right shoulder. He is wearing a simple, dark, fur-like garment around his waist. The background features a vast, open landscape with a dense forest of green trees in the middle ground and a large, rugged mountain range in the distance under a clear blue sky. A bright sun is visible in the upper right corner, casting a long shadow of the man onto the grassy ground.

At the beginning,

there was

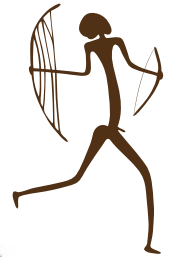
# pitch.

**THE ANCIENT HISTORY OF ADHESION.** Most people today associate adhesives with chemistry and consider them to be a relative recent innovation, as with the industrial manufacture of chemical products. Yet this apparently modern joining technique at 180,000 years is as least as old as mechanical joining. Even 'Ötzi', the Stone Age man who died in the Ötztal Alps around 3340 BC and was first discovered as a glacial mummy in 1991, fixed the shafts of his wooden arrows to the flint tips using plant fibres and birch pitch.





Stone Age people had already invented the adhesive and there is some evidence that this adhesive joining – aside from joining techniques using plant fibres – was used long before mechanical technologies. The all-purpose adhesive from nature's store cupboard?



Researchers even believe that the adhesives from that time were equal to today's all-purpose adhesives. We still don't know for sure how people extracted the birch pitch 'betulin' from the white bark. This specifically requires distillation processes in the absence of air and at temperatures of 340 to 400 degrees Celsius. However, researchers assume that the Stone Age chemists tightly rolled the bark and then covered it with ash in an earth pit and carbonised it. The black, sticky distillate would be left behind.

It seems that birch pitch was the prehistoric all-purpose adhesive per se: in 2001, specialists analysed old findings from excavations in the 1960s in Königsau (Saxony-Anhalt) in more detail and found traces of birch pitch in tools that were more than 80,000 years old. In southern Italy something even more spectacular was discovered in 2006: birch pitch was found on a stone tool that was at least 180,000 years old. Along with beeswax, which can also be used as an adhesive to a limited extent, birch pitch is also incidentally a 'hotmelt'. It just needs to be heated up to redissolve the bond.

The creativity of our ancestors was not just limited to birch pitch. In the Middle East, 6,500 years ago, the Mesopotamians used asphalt from natural oil sources for building. Early people also extracted adhesives based on animal protein. In 3,000 BC, Sumerians created hot glue from animal skins – and in 1,500 BC, the Egyptians used animal glues (e.g. out of fish offal) for veneer work. Evidence of how important adhesives were for life at that time is provided by a bar of hide glue, which was found in the grave of King Tutankhamen.

Other craftsmen in early times used albumins as a binder, a protein of animal origin that they extracted from animal blood or eggs. And the empire of Genghis Khan would hardly have been possible without ancient adhesives: the bows of his quick Asian horsemen were bonded using a glue made from boiled bones and cartilage.

In 500 BC, the Jewish Talmud mentions that casein was already being used as a binder for pigments. The Hellenes claimed, however, that Daedalus – the builder of the labyrinth for King Minos on Crete – was the inventor of the glue. At least legend has it that he used wax as a 'hot-melt' when escaping by air with his son from the island of Crete (see also pages 36 & 37). One thing is certain: that the profession of glue boiler ('kellepsos') already existed in ancient Greece. The Greek word for glue, 'kolla', is still used today – including for OTTO's adhesive products (OTTOCOLL).

In America, the Aztecs used blood albumin from blood to bond construction material as early as 1,400 AD. They mixed animal blood in the cement, which they used to build their typical flat or elliptic curves.

With the advent of book printing at the start of the modern era, adhesive technology experienced another upsurge until finally in 1690 the first glue factory opened in the Netherlands and in 1888 the master painter Ferdinand Sichel, from Hanover, developed the first ready-to-use wallpaper paste.

Without knowing the precise interrelationships and only using what nature had available, people have always known how to use adhesives. And they have done this with results that still amaze scientists today. ■

