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The Neolithic Bow Case from Lenk, Schnidejoch: A Technological and Cultural Analysis

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The find of a yet unknown type of birch bark container in the site of Schnidejoch (Bernese Alps, Switzerland) was a surprise, for in all the wetland or lakeshore sites of Europe no parallels to this unique object are known to date. First, when only a small part was discovered, it was supposed to have been part of an arrow quiver. However, with the final appearance of the ca. 170 cm long container, it needed a new interpretation. The yew bow found at the same site, 160.5 cm long, would fit perfectly inside. Two silex arrowheads found in the bottom confirm an association with archery. The find could be identified as the first Neolithic bow case.

Introduction

The Schnidejoch pass (2756 m.a.s.l.; 46°22'09.10" N, 7°23'19.70") in the western Bernese Alps (Switzerland) represents a connection of the Bernese Uplands with the Alpine Upper Rhône Valley (Hafner *et al.* 2015). This route was, at least during favourable climatic conditions, in use as early as 4.800–4.500 BC, as is demonstrated by the oldest archaeological finds from the site (Hafner and Schwörer 2018). During colder climatic phases with progressing glacier activity, it was probably not traversable. Today, the passage is advised only in summer. The first artefacts were discovered in 2003 by hikers on an ice patch near Schnidejoch. In total, about 900 artefacts dating from the Neolithic to the Early Middle Ages were discovered, most of them from organic materials (Suter *et al.* 2005; Hafner 2009; Hafner *et al.* 2015). Among these was a Neolithic bow, which was found in one piece, together with some arrow fragments.

Keywords: Neolithic, Schnidejoch, archery equipment, bow case

Figure 1 Location of the Schnidejoch site.

The bow, a typical specimen of a late Neolithic bow, a man-tall, one-piece stave of yew wood, with a D-shaped cross-section (rounded back or front side and flat belly) is probably the best preserved specimen found to date. It belongs to the straight sided bow family like the unfinished bow of the Iceman from Tisenjoch (Italy), and not to the propeller shaped type of the Horgen culture (for more information on prehistoric bow types in Europe, see Junkmanns 2013). In the same year hikers also found the upper part of a bow container. Archaeological surveys and excavations started in 2004 and generated a wealth of Neolithic and younger artefacts. Further finds of archery items comprise the complete bow case (Figure 2), a potential bow string, 15 Neolithic and three Bronze Age arrows, as well as two flint arrow heads (Figure 3), which makes it the most complete record of Neolithic archery technology known today. Though no human body was found at Schnidejoch, it seems that an accident might be at the origin of the findings of clothes like leather legging, shoes and a grass cape. The site has been intensively researched between 2004 and 2012 (Suter *et al.* 2005; Hafner 2009; Hafner 2012; Hafner *et al.* 2015). Radiocarbon dating determined an age of 2800 cal BC for most of the Neolithic archery equipment (Hafner *et al.* 2015).

Technology of the bow case

The two-piece container, measuring ca. 170 cm in total, is composed of ca. 40 rectangular pieces of birch bark, which were sewn together with lime bast, reinforced by split twigs and fitted with a leather carrying system (Figure 2). The ca. 137 cm long main part can be closed by sliding a 37 cm long upper cap some centimetres over it. The object today has a maximum width of about 15.5 cm wide and is 3 cm thick; its cross-section is a flat droplet shape. Original width and thickness are not known as the whole container was flattened by being buried in ice for thousands of years. By putting a 3.0 by 2.35 cm thick bow inside a reconstruction, an original thickness of about 4.5–5 cm and a width of 13–14 cm can be postulated. The upper part which

Figure 2 Neolithic bow case from Schnidejoch and its construction.

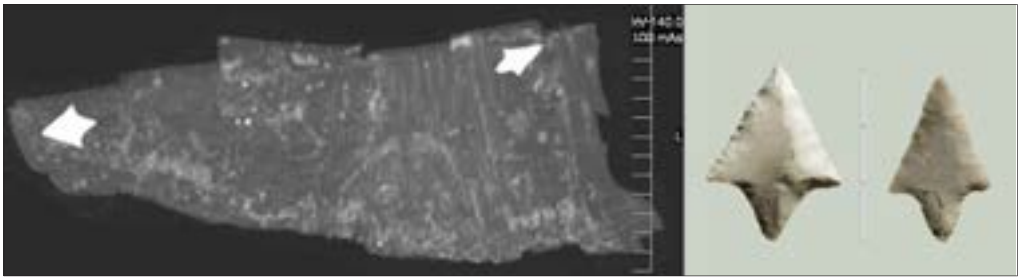


Figure 3 CT image of the Schnidejoch, Neolithic bow case with two silex arrowheads found in the bottom part. © Archaeological Service Canton of Bern.

served as a lid or cap is a little wider, today ca. 1.5 cm, than the upper end of the sleeve so that it could be slipped onto the sleeve. The shape of the bow case with one straight and one convex side suggests that the bow, which very probably had a slightly curved shape from following the string, was put inside with its back facing the seam or convex side. Because of the narrow shape of the container, the bow definitely fits only in its relaxed, not strung state. By containing a bow and some additional arrows, the storage capacity was probably already exhausted to a great extent.

The artefact is at the time of writing of this article still kept under glacial conditions, as a definite conservation strategy could not yet definitely be determined. It is kept in a freezer depot and can only occasionally thawed and be taken out for short examinations. After the object has been fully conserved, it will be available for more in-depth studies. To study the inner structure of the bow case, CT-Scans of most parts of the object were realized. The CT-Scans, which were carried out between 2005 and 2017, are different in the equipment used and in the orientation of the slices. The earliest ones, of the lower and middle part of the container, were done by the hospital of Konstanz (Germany), the upper part was scanned by the Institute of Forensic Medicine at the University of Bern (Switzerland). Both are in relatively low resolution (1 mm sclice thickness). The surface of the bow case was documented by a series of high definition 3D- Surface Scans. This way the actual physical appearance can be documented precisely. But as some of the individual parts have moved, while others are damaged or could not be found during the field work, the original appearance may have differed.

Both parts of the bow case are manufactured from two layers (Figure 2). An inner tube is composed of long bark strips in parallel orientation (shifted by 90 degrees to direction of growth), while the outer coat consists of smaller birch bark pieces arranged transversely and overlapping like shingles on a roof. To obtain bark strips sufficiently long for building the bow case, birch trees with a minimum diameter of about 11 to 15 cm were needed. In total about 1.54 m^2 of birch bark material was used in the construction of the bow case. The amount of birch bark collected must have been much bigger, as a lot of waste is produced by cutting the pieces to size.

The birch bark is used in a way that the inside of the bark (the part which clings to the tree) constitutes the inside, where the bow was kept, and also the outer surface of the construction, like in traditional birch bark container manufacture in Eastern Europe and Russia. The modern boxes and containers, principally double walled, use the inner side of the bark on the exterior and interior surface to prevent peeling.

The basic framework of the main part is composed of several longer pieces of birch bark, which were joint by sewing them together edgeways, overlapping some centimetres (Figure 4). The resulting long rectangular sheet was then folded lengthwise. In a similar way the upper part or lid was folded. The two resulting tubes were encased with 8–10 cm long overlapping “shingles” of birch bark which were folded around the inner part. The shingles are overlapping downwards like the tiles of a roof, so that falling rain was prevented from entering when the container was kept in an upright or canted position with the lid up.

The whole structure was finally sewn together along the edge opposite of the fold. For sewing, long and narrow strips of raw, not twisted lime bast were used. The sewing technique used seems quite basic. All parts were most probably joined by simple running or saddle stitches. Further investigation on the stitching is necessary, but can only be done when the conservation process is finished. The holes are of different diameter, ranging from ca. 1 mm to max. 2.7 mm in their transverse opening. Most openings are from 1.2 to 2.0 mm wide. The distance between the stitches of the lateral seam is varying considerably between 3 and 14.5 mm (Figure 2). Rarely in

Figure 4 Overlapping of the outer shingles of the Schnidejoch bow case to achieve waterproofing, when held tip up. © Archaeological Service Canton of Bern

some seam holes a remnant of the bast strip can be observed. According to these remains, about 2.5 to 4 mm wide strips of raw, untwisted lime bast were used.

The find of a separate 5 x 6 cm object of rawhide in the Schnidejoch site was quite a sensation (Figure 5; Volken and Volken 2015). Folded along the centre like the bow bag´s shingles, the opposite edge was cut to a quarter circle and was sewn with bast. This way it forms a hollow cap that would very likely fit onto the bottom end of the bow case. The tip of the rawhide object is damaged by wear which shows that it was used as protection for the exposed tip of something. It is very likely that this rawhide piece served as a protective cap for the bag.

To stiffen the Schnidejoch bow bag, two rods of split hardwood twigs were attached in its upper centre (Figure 6). The upper one is made of Guelder Rose (*Viburnum sp.*), ca. 27 cm long, 1 cm wide and about 5 mm thick, and the other one of Honeysuckle (*Lonicera sp.*), 26 cm long, 1 cm wide and 3–5 mm thick. They were simply inserted into the fold of the outer bark pieces by cutting small slits into it. The overlapping twigs provide an approximately 47 cm long stiffened area along the folded rim in the centre of the bag.

Additionally, the wooden stiffeners enable the attachment of an approx. 8 mm wide and 4 mm thick leather thong wound 5–6 times around the twig and fastened on one side by slipping the end under it. This strap was wound one time around the bow case

Figure 5 Left, centre: Schnidejoch. Rawhide object, a possible tip protection for the bottom end of the Schnidejoch bow case. After Volken and Volken 2015. Right: Detail of the bottom tip of bow case with dark stain (face B). Structure from Motion surface scan P. Safko. © Archaeological Service Canton of Bern.

Figure 6 Wooden laths as stiffeners in the central part of the Bow case with leather binding and remains of carrying strap. Top to the left. © Archaeological Service Canton of Bern, photograph by main author.

by pulling it through a slit cut near the opposite edge. The other side might have been fastened in the same way, but has come loose since. The reason for this was obviously to produce a secure fastening of the carrying strap. This shoulder strap, a c. 4 cm wide and 5 mm thick leather strip, is attached to the leather thong by pulling the smaller strap through a hole in it. There is only a small portion of it surviving, which finds its counterpart in another preserved piece still clinging to a similar structure on the upper cap or lid (Figure 7). When it was closed by its cap, the bow case could be carried easily over the shoulder.

Bow and arrow containers in historical and cultural context

From Prehistory, surprisingly, not many comparable objects to the Schnidejoch bow case are known. With simple wooden bows and arrows being in use since at least 10,000 BC (Junkmanns 2013), the existence of containers for these can be expected, but no directly comparable object from the Mesolithic and Neolithic is known to

Figure 7 Carrying strap with leather thong on top lid or cap. © Archaeological Service Canton of Bern, photograph by author.

date. In Scandinavia, the Baltics and Western Russia no parallels to the Schnidejoch bow bag have been found. One object of quite similar manufacture, but contrasting in size and function, was excavated in St. Blaise, Switzerland. In spite of being very different in design and materials, the arrow quiver of the Iceman Oetzi (Tisenjoch, South Tyrol, Italy) can nevertheless be assigned a comparable function. It is the only known example of a stone age arrow container in Europe. However, depictions of quivers are known from Late Neolithic megalithic tombs. From the Bronze and Iron Age, there are a few arrow quivers all made from wood

In Asia and parts of Eastern Europe, bow bags, holsters and quivers were used by most of historic peoples and empires like the Assyrians, Scythians, Huns, Turkic, Mongols and others. Mostly made from hides or leather, there were also birch bark arrow quivers. The shapes of the containers are quite diverse, according to the dif-

ferent shapes and sizes of the bows used (mostly more or less recurved and reflexed composite bows). Initially, single arrow quivers were used; sometimes the bow was inserted into these as well when it seemed appropriate. Around 500 BC the combined bow case/ arrow quiver (Greek: *gorytos*) was introduced. About nine centuries later separate bow holsters for the strung, ready to shoot bow and arrow quivers became popular among horse archers. However, combined leather containers for carrying unstrung bows and arrows were common until the nineteenth century in Inuit cultures, as well as for North American Plains and Prairie people.

4000–3000 BC (Late Neolithic)

Neolithic Bow cases and quivers from Europe are very rare. The bow case from Schnidejoch so far is the only find of its kind. Probably there were more bow cases in existence, but made from leather, which cannot survive except in frozen soil or deserts. Smaller containers for arrows and other archery gear were also used. So far the only surviving example in Europe is the quiver of the Iceman from Tisenjoch (Italy). The rectangular container made from hide and leather, stiffened by a wooden stick, is about as long as Late Neolithic arrows and could be closed by a flap. It is not known how it could have been worn. Engravings from graves show comparable arrow quivers, rectangular or tubular in shape with a widening at the quiver mouth.

A Late Neolithic bark object approx. 38 cm long and maximum 11 cm wide that was made in a similar fashion to the Schnidejoch bow case was found in St. Blaise, Switzerland (Figure 8; Reinhardt 1999). The object was found during excavations in 1972 and is dated to the end of the Neolithic period (around 2500 BC), which would be roughly contemporary to the Late Neolithic finds from Schnidejoch.

One end is intact, while on the opposite side some part is missing. Two rectangular sheets of unidentified bark (definitely not birch), about 4 mm thick each, were stitched together with bast strips parallel to the long sides. While the lower seam on the picture is close to the edge, the upper one runs in more than 3 cm distance. Apparently a saddle stitch with two threads was used. One of the narrow sides was also

Figure 8 Neolithic bark object, possibly a sheath or sleeve for an unknown object from St. Blaise/Bains des Dames (Neuchâtel, Switzerland). Laténium, Hauterive/Neuchâtel, photograph by author.

sewn together by a few central stitches, the other end should have been open to insert something, but it has not been preserved. The edges were finally trimmed by cutting along the sides, but today are a bit ruffled looking. The general appearance is that of an unfinished or not well made item. The similarity in manufacturing technique to the Schnidejoch bow case is striking, but the St. Blaise object is strictly rectangular, stitched together on both sides and quite narrow. Particularly the distance between the two parallel running seams measures only 5–6 cm which must have made it quite inflexible and thus not opening enough to insert an object with the dimensions of a bow. It rather appears to be appropriate as some sort of a sheath for a flat item like, for example, a dagger or a knife. However, it cannot be excluded that it was used as a very small arrow quiver. Probably two or three arrows would fit into it but a bigger amount seems impossible. If it was the end part of a widening object, one, we would have to expect converging sides like in the Schnidejoch container.

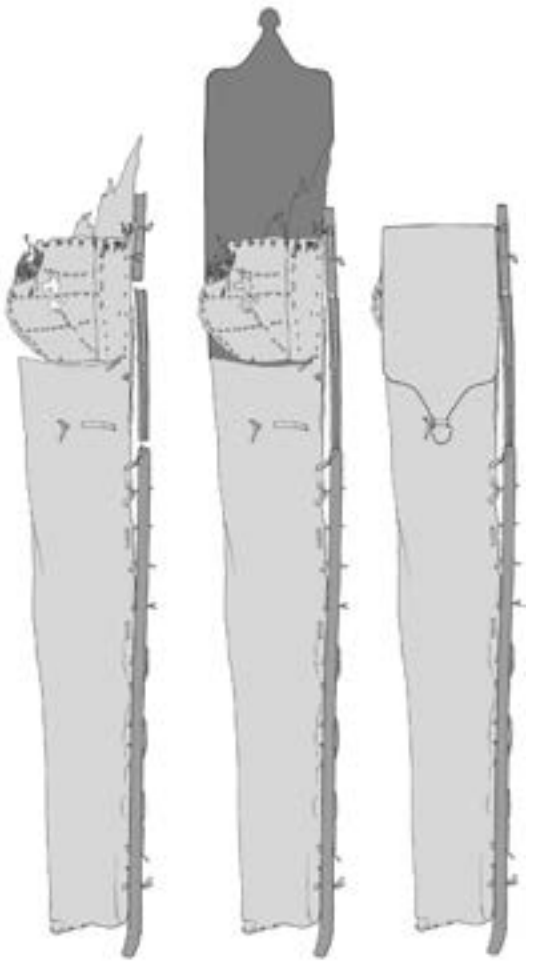


Figure 9 Neolithic quiver from the Iceman find at Similaun (South Tyrol, Italy). Modified after Egg 1992.

The only known European neolithic arrow quiver was found with the Iceman Oetzi. Dated to between 3350–3100 calBC (Bonani *et al.* 1994; Kutschera *et al.* 2000), the complex object, made of various leathers or hides from different animal species, only survived thanks to permafrost conditions. In wetland conditions as in the numerous lakeshore settlements known around the Alps leather objects are not extant because of micro-organism activities. Leather can only be preserved in extremely arid climates or in ice. Oetzi's quiver is a ca. 86 cm long flat trapezoidal container made from hide or fur of roe deer (*Capreolus capreolus,* O'Sullivan *et al.* 2016) and leather, probably cattle (Figure 9). It is stitched together on one side and on the bottom with a 3 mm wide leather strip (Groenman-van Waateringe and Goedecker-Ciolek 1992). While on the side a simple running stitch was used, a whipstitch allowed a flatter bottom (Egg, 1992). The sewn side is inserted into a 92 cm long and 1.4 cm thick Hazel stick (*Corylus avellana*) as a stiffener, which was slotted for that purpose, and attached by sewing with a leather strip through twenty holes cut

Figure 10 Neolithic quiver from the Iceman site at Similaun (South Tyrol, Italy). Quiver top with sideways closing flap, remains of closing lid (to the right), and broken hazel stiffener. © Südtiroler Archäologiemuseum/Harald Wisthaler. www.iceman.it.

into it (Egg 1992). The stick protrudes approx. 4,5 cm from the bottom of the quiver bag, the lower tip ending in an oblique angle. The upper part is made of stiffer bovine leather (Hollemeyer *et al.* 2012). The quiver mouth is approximately twice as wide as the 9 cm wide bottom.

Judging by a crease in the upper lid, the maximum length of the container can be estimated to ca. 85 cm when closed. However, one of the arrows inside was considerably longer (90 cm). The quiver shows damage at the upper part, where the stick is broken into three pieces and the closing lid is torn off. The topmost piece of the hazel rod apparently was attached again, but strangely upside down (Egg 1992), while another piece was found in some distance to it. The reason for this remains unknown. The breaks have a clean appearance which would be unusual with non-degraded hazel wood. The construction of the quiver top is quite sophisticated. Although the upper leather is also damaged, the reconstruction of the closing part is possible. The quiver could be closed by a leather lid extending from the lower leather by folding it around to the front, and probably be fastened to a leather strip attached below (Junkmanns 2013). An additional leather "window" piece of approx. 15 x 15 cm was fastened sideways at the quiver opening. This flap, stiffened by leather

Figure 11 Similaun (South Tyrol, Italy). Neolithic quiver from the Iceman find. Quiver bottom showing a whip stitch for a flatter bottom and curved end of hazel stiffener. © Südtiroler Archäologiemuseum/Harald Wisthaler. www.iceman.it.

strips woven into it, could be opened separately to the side for easier access to the arrows which would disappear completely inside the container.

Besides the fourteen arrowshafts, several probably archery-related objects were found inside the quiver. A bundle of pointed antler strips could be raw material for the manufacturing of arrowheads. A bundle of deer or cattle leg sinews maybe was intended for bowstring production. On the other hand, a clew of a twisted cord of undetermined plant fibre approx. 2 m long could represent a possible finished bowstring or "tillering string," a string temporarily used to examine the bend of the bow during the manufacturing process. Finally, a 22 cm long curved antler awl could have been intended for use during the skinning of animals (Egg 1992).

Unfortunately, there is no surviving trace of a carrying system. Presumably there would have been a possibility to carry it, as it is unlikely that the owner had to hold the quiver permanently in his hands. Eventually leather strips could have been fastened to the stiffening hazel stick. One can speculate that the quiver was intended for carrying on the back by a shoulder strap, attached to the hip or simply held in the hands. As the backpack frame that was part of Oetzi´s equipment very probably was carried on the back, it seems most reasonable that the quiver was attached to the hips.

Göhlitzsch (Saxony-Anhalt, Germany) - On one of the stone slabs of the megalithic tomb from Göhlitzsch are engraved depictions of a c. 130 cm long angular composite bow (the same type used in Egypt) and a ca. 64 cm long quiver holding arrows (Figure 12; Clark 1963), dating from the Late Neolithic (3000–2500 BC). Whether the engravings should be attributed to the Bernburg culture or to the younger Corded Ware culture (Schunke 2013), is still the subject of scholarly disputes. The famous Naram-Sin stele, depicting an Akkadian king with an early composite bow of similar shape, is dated to c. 2250 BC. The Göhlitzsch quiver is depicted as a simple, slightly conical shaped tube

Figure 12 Stone slab from a Neolithic chamber tomb from Göhlitzsch (Saxony-Anhalt, Germany) with engraved depictions of a bow and quiver. © Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt, Photograph Juraj Lipták.

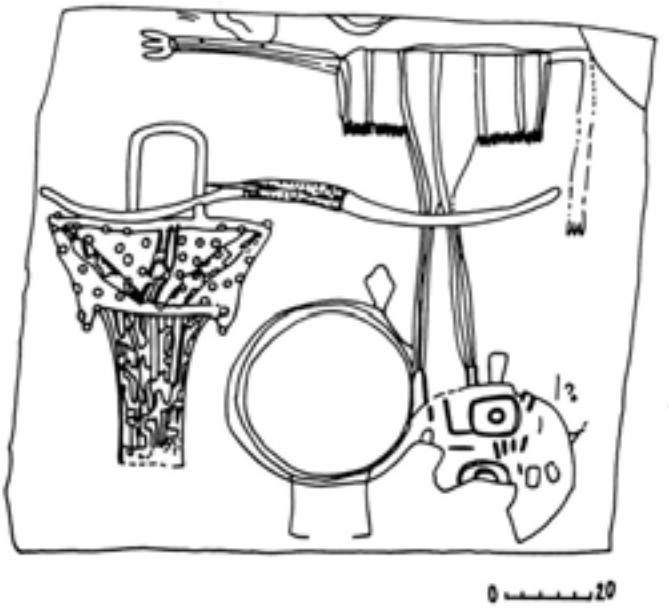


Figure 13 Stone slab from a Neolithic tomb in Klady (Krasnodar, Russia), with painted depictions of a bow and quiver. After Rezepkin 1992.

or trapezoid with a widened opening. There are six arrows drawn by straight lines inside the quiver which is shown in a strangely transparent way so that the contents are visible. A carrying system probably made from an U-shaped cord or strip holds the quiver in vertical position.

A surprisingly similar representation of a late Neolithic quiver and bow can be found on a painted stone slab from a tomb in Klady (Krasnodar, Russia), in the East Black Sea region (Figure 13), dated to approximately 3000 BC (Rezepkin 1992). The whole scene depicted is nearly identical to the image from Göhlitzsch. Again a composite bow represented horizontally is accompanied by a quiver hanging on its left side. On top of it a horseshoe-like element can be identified. The quiver mouth is notably more widening than in the Göhlitzsch image and seems to be opened to receive arrows. The lower part is conically or trapezoidally shaped with concave sides.

3300–2000 BC (Chalcolithic and Early Bronze Age)

In the Ancient Near East there is evidence for a trapezoidal or conical quiver very similar to the Neolithic ones on a seal from 2,800 BC. Younger depictions show quivers a little shorter than the arrow, which are worn on the back. Arrows were oriented with points downwards. The bows used were of the composite reflexed type. See Table 1.

2000–1200 BC (Late Bronze Age)

A wide variety of quivers and bow cases is known from this period thanks to exceptional preservation conditions in arid parts of Egypt. Tubes made from basketry were possibly used by common people for carrying arrows when hunting.

Table 1 Early Bronze Age

Date	Place	Figure	Description/ Type	Material	Museum/ Reference
c. 3300–3000 BC, Late uruk period	Southern Iraq (without precise origin)	14	Carved Stone Seal (modern impression). Depiction of archer with composite bow and a second person with arrows and quiver. - Arrow quiver, conical with wider opening. Comparable to Neolithic depictions (Göhlitsch/ Klady). Worn on back, suspension by neck or shoulder strap	Unknown	British Museum. Mallowan 1964
c. 2244–2236 BC, Akkadian	Girsu, Southern Iraq	15	Stone Stele attributed to King *Rimush*. Depiction of several persons with composite bows and quivers. - Arrow quiver, flat rectangular box just a bit shorter than the arrows inside (point down inside). Worn on back, suspension not shown. Long decorative tassel attached to bottom (lion tail)	Unknown	Museé du Louvre. AO2678. Aruz 2003
c. 2220–2159 BC, Akkadian	Southern Iraq (without precise origin)	16	Carved stone seal of *Kalki* (modern impression). Depicting a person with quiver holding a composite bow. - Arrow quiver like on Stele of King Rimush. Worn on back, carrying strap running diagonally over upper body. Lion tail tassel on bottom	Unknown	British Museum. BM89137 Aruz 2003

Inside the tomb of Pharaoh Tut-Anhk-Amun (1326 BC) much archery gear was discovered. Besides 32 angular composite bows, 14 wooden self bows and 430 arrows, several containers for bows and arrows were found. Additionally, several artistic depictions of archery can be found. The social elite used complex containers for different purposes. There were wooden boxes specially made for storing or transporting bows and arrows, sometimes luxuriously ornamented, as found in royal tombs. Bow and arrow bags made from cloth could be used to transport equipment to the field.

War chariots were equipped with slightly triangular bow cases hanging from the sides, made presumably from wood and leather. The lower part seems to have been stiff, while the upper part, a kind of soft cap which was used for closing, was soft. On some contemporary depictions the cap is hanging down, which would indicate that there was no bow inside the container. Separate, rectangular arrow quivers were worn on the back, arrows stuck inside with their points downwards.

A rare find from Germany, remains of a Bronze Age quiver of presumable rectangular shape, was made from leather covered wood. See Table 2.

1200–500 BC (Iron Age)

During the Early Iron Age rectangular arrow quivers made from leather and/ or metal were used. These were usually carried on the back by foot soldiers. Depictions show

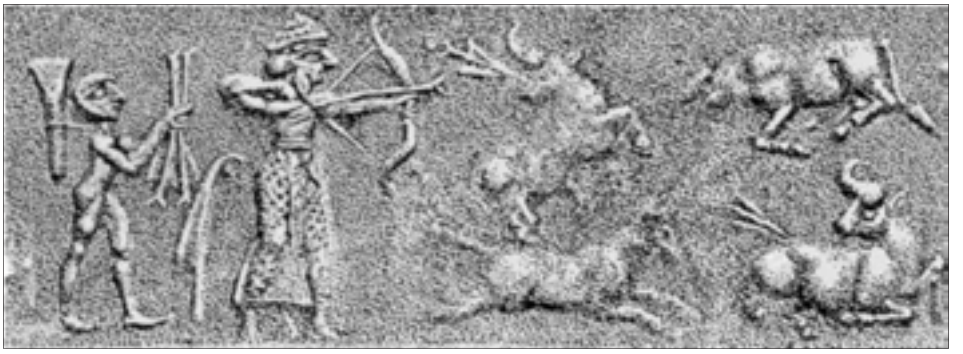


Figure 14 Southern or central Iraq (without precise origin). Stone seal dated to ca. 2.800 BC, depicting a man with bow and arrow, followed by another man with a quiver. After Aruz 2003.

Figure 15 Stele fragment from Girsu (Dhi Qar Province, Iraq) attributed to king Rimush. Akkadian, ca. 2244–2236 BC, depicting a man with a bow and back quiver. Museé du Louvre, AO2678.

Figure 16 Seal of Kalki, from Southern Iraq (exact provenance unknown). Akkadian, c. 2220 –2159 BC, depicting a man with bow and back quiver. British Museum, London. After Aruz 2003.

Table 2 Late Bronze Age.

Date	Place	Figure	Description/ Type	Material	Museum/Reference
c. 1981–1550 BC	Thebes, Egypt	17	Simple tube made of coiled basketry, 65 x 11 cm. 11 cm in diameter. Probable arrow quiver. No suspension preserved	Unknown	Metropolitan Museum Hayes 1953
1326 BC	Luxor, tomb of Tut-Ankh-Amun	18	Triangular box, 166 x 42.5 x 34.5 cm, with lid. Contained seven bows, 254 arrows and other hunting weapons. |Heavy storage box for bows, arrows and other hunting gear, not for carrying (no suspension)	Wood	Egyptian Museum McLeod 1982
1326 BC	Luxor, tomb of Tut-Ankh-Amun	19–21	Triangular wooden box, 153 x 25 x 7 cm. Decorated with hunting and warfare scenes from a chariot equipped with bow cases, the king wearing two back quivers full of arrows. - Light Transport box for archery gear. Fitting the shape of the strung Angular composite (3 found inside). Staples for carrying straps present. 65 cm long lateral opening with lid for access	Light wood, bark, paint, leather, gold, faience	Egyptian Museum Cairo. McLeod 1982
c. 1504–1425 BC	Luxor, tomb of Vizir Rekhmire and	22.a	Artistical drawings after grave painting depicting war chariots with empty bow case hanging on the right side of the chariot. - Triangular bow case of two parts. Longer, lower part is of elongated trapezoidal shape with a narrow bottom that is stiff. The upper, flexible part, probably a lid, is attached at an angle, of similar shape but oriented the other way round and has a narrow ending. The shape fits the strung angular composite bow	Probably wood and leather	Metropolitan Museum
c. 1427–1400 BC	Luxor, tomb of Pharaoh Userhat	22.b			
1326 BC	Luxor, tomb of Tut-Ankh-Amun	23.a	Simple bag of cloth, 250 x 23,5 cm. Inside simple wooden bows and wooden sticks. - Carrying and/ or storing bag for the longer wooden self bows and other gear, probably related to archery games	Unspecified cloth	Egyptian Museum Cairo. McLeod 1982
1326 BC	Luxor, tomb of Tut-Ankh-Amun	23.b	Simple bag made from decorated cloth, 105 x 16 cm. - Possible carrying and/ or storing bag for arrows. Cord for closing on top	Coarse linen cloth	Egyptian Museum Cairo. McLeod 1982
1326 BC	Luxor, tomb of Tut-Ankh-Amun	23.c	Simple bag of cloth and tapestry with leather pouch on bottom. 134 x 15 cm. Found full of reed arrows. - Simple tubular arrow quiver with vertical open slash near top for easy extraction of arrows. This could be closed by a flap.	Linen cloth, leather, gold decoration	Egyptian Museum Cairo. McLeod 1982
c. 1300 BC	Behringersdorf, Bronze age tomb, Southern Germany	24	Fragments of an arrow quiver made of wood, with birch bark strips lining. Ca. 10 cm wide and 1,5 cm thick when found (likely flattened by soil pressure. Inside 6 arrow fragments, points downwards. Arrow quiver. Original shape not determinable	Unspecified Wood, birch bark	Naturhistorisches Museum Nürnberg, Germany Hundt 1977

that the bow sometimes was also being carried, probably strung, inside the same quiver. Arrows were stuck inside with points downwards. The bow, which was longer than the quiver, was sometimes protected by a sleeve of cloth or leather. Horse archers (since ca. 1000 BC) used the same back quiver. War chariots were equipped with multi-purpose containers hung at their sides, into which the bow, arrow quivers and other weapons could be inserted. This changed around the 8th century BC when arrow quivers alone were attached directly to the vehicle.

Figure 17 Thebes, Egypt. Probable arrow quiver made from basketry. Metropolitan Museum of Art, New York, Rogers Fund, 1925, Accession Nr. 25.3.300.

Figure 18 Luxor (Egypt). Simple wooden bow box from the tomb of Tut-Ankh-Amun *in situ*. Egyptian Museum Cairo. After McLeod, 1982.

Figure 19 A. Luxuriously decorated wooden bow case from the tomb of Tut-Ankh-Amun, Luxor (Egypt). Egyptian Museum Cairo. B. Detail of wooden bow case from the tomb of Tut-Ankh-Amun. Staple for attaching a probable carrying strap near the right end at bottom. Photos by Sandro Vannini © Laboratoriorosso, Viterbo/Italy.

Figure 20 Wooden bow case found in Tut-Ankh-Amun's grave depicting the Pharaoh shooting from a chariot. A closed bow case with a braced bow inside is attached to the right side of the chariot, while several arrow quivers are on the king's back. Egyptian Museum Cairo. Photo by Sandro Vannini © Laboratoriorosso, Viterbo/Italy.

Figure 21 Luxor, Egypt. Artistical drawings after grave paintings. A. Tomb of Vizir Rekhmire. War chariot equipped with an empty bow case. B. Tomb of Userhat. Shooting from a chariot. An empty bow case hanging from the side of the chariot. Metropolitan Museum of Art, New York, Rogers Fund, 1930/1931, Accession Nr. 31.6.34, 30.4.42.

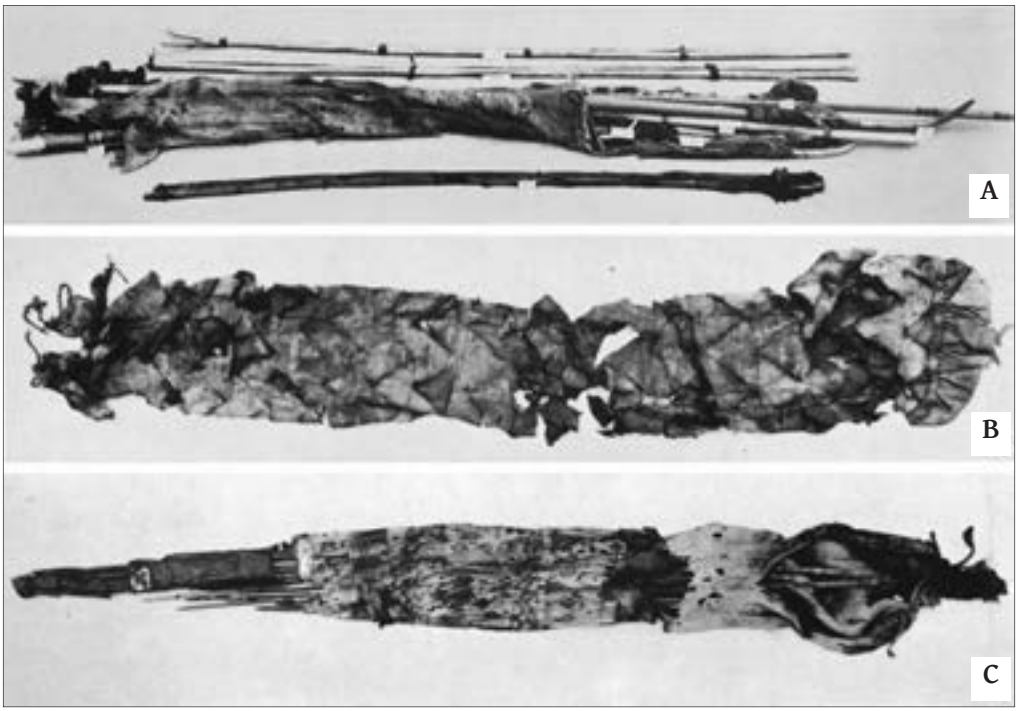


Figure 22 A. Bow bag made from cloth from the tomb of Tut-Ankh-Amun. B. Arrow quiver made from linen cloth from the tomb of Tut-Ankh-Amun. C. Arrow quiver made from linen cloth and leather from the tomb of Tut-Ankh-Amun, Luxor (Egypt). Egyptian Museum Cairo. After McLeod, 1982.

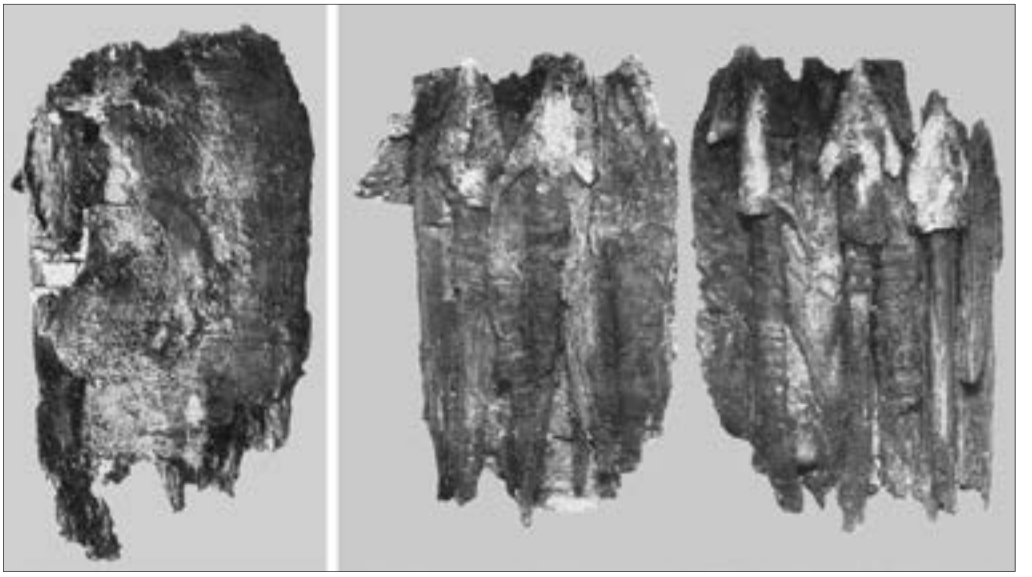


Figure 23 Behringersdorf (Franconia, Germany). Fragments of a Bronze age quiver from wood covered with birch bark, with arrows inside. After Hundt, 1977.

Table 3 Early Iron Age

Date	Place	Figure	Description/ Type	Material	Museum/Reference
c. 879 BC, Assyrian	Nimrud, Palace of Assurnasirpal II, Northern Iraq	24	Relief showing lion hunt, containers hanging on the side of the chariot with bows and other weapons, as well as a separate arrow quiver stuffed inside. Trapezoidal bag-like multi-purpose container for bow, arrow quiver and battle axe. Strap on the top for fastening to the chariot	Probably wood and leather	Vorderasiatisches Museum, Berlin
9th to 7th centuries BC	Urartu, East Anatolia	25	Bronze plaque, 65 x 13 cm. Was sewn through the perforated edges to a piece of leather to form an arrow quiver. Tubular or flat oval rectangular arrow quiver with two eyelets on one side for suspension. Probably to be worn on the back	Bronze (leather back missing)	Museum zu Allerheiligen, Schaffhausen (Switzerland). Collection Ebnöther
700–692 BC, Assyrian	Niniveh, South-West Palace, Northern Iraq	26	Relief depicting an Assyrian foot soldier wearing a quiver. Trapezoidal, probably flat, combined quiver of arrow length. An angle on one side shows that it was intentionally meant to carry the strung angular composite bow inside, too, which is depicted protruding for one third of its length	Unknown (probably leather and maybe bronze)	British Museum
645– 635 BC, Assyrian	Niniveh, North palace of Ashurbanipal, Northern Iraq	27	Relief depicting an Assyrian horse archer holding an angular composite bow and wearing a back quiver for bow and arrows. Trapezoidal combined quiver of arrow length. Beneath the arrows inside the top end of the empty bow a protection sleeve of soft tissue can be seen. It is decorated by two tassels on top	Unknown (probably leather and maybe bronze)	British Museum

Figure 24 Palace reliefs at Nimrud (Northern Iraq). Assurnasirpal II in a chariot hunting lions. Two bow case/quiver combinations hanging on the right side of the vehicle. Vorderasiatisches Museum, Berlin, Inv. Nr. VA 00959. Photograph by Olaf Tessmer.

In Iron Age Europe tubular arrow quivers from wood were popular. Bow cases are not known from the archaeological record and contemporary representations. Horse archery apparently was not practised much in Western Europe in contrast to eastern steppe regions. See Table 3.

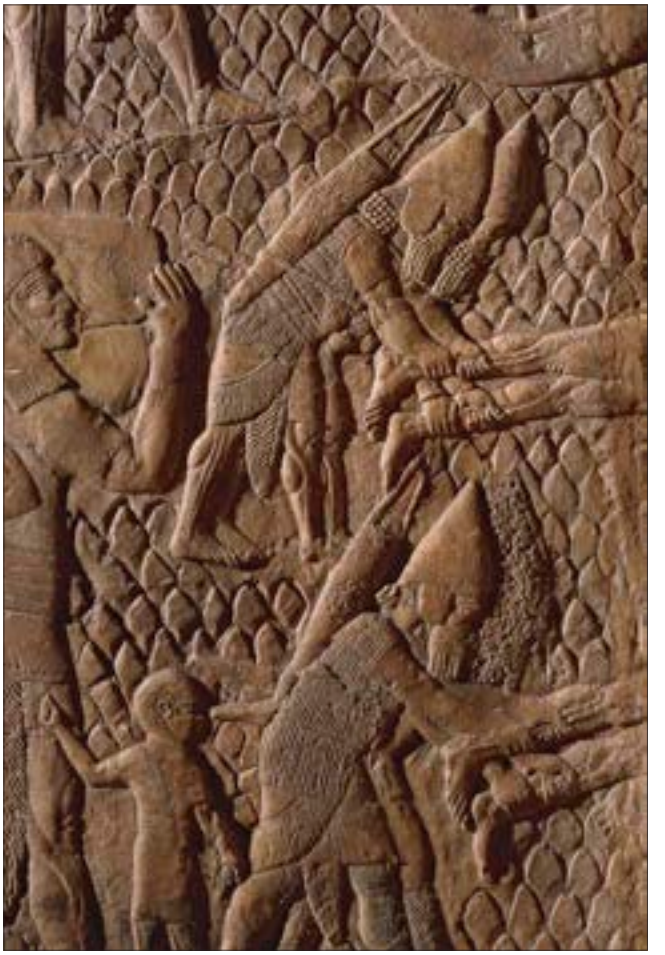


Figure 25 Above left: Bronze quiver plaque of a flat rectangular composite arrow quiver from Urartu (East Anatolia) c. 9th–7th cent. BC. Museum zu Allerheiligen, Collection Ebnöther. Photograph by author.

Figure 26 Above right: Relief from South-West Palace, Niniveh (Northern Iraq). Assyrian foot soldier wearing a back quiver with strung bow and arrows inside. 700–692 BC. British Museum, BM 124909.

Figure 27 Assyrian horse archer with back quiver, from the North Palace of Ashurbanipal, Niniveh (Northern Iraq). From the quiver mouth hangs the tip of an empty bow protection sleeve with tassels, c. 645–635 BC. British Museum, BM124870.

Figure 28 Archers from the bas-relief of the Hundred Columns Hall, at Persepolis (southern Iran), ca. 450 BC. Photograph by Shahpur Shahbazi, 2012, Wikimedia Commons, https://commons.wikimedia.org/wiki/File:Persepolis_stairs_of_the_Apadana_relief02.JPG

500 BC–200 AD (Classical Antiquity)

The combined bow case and quiver worn at the archer´s left hip, named *Gorytos* by the Greek, was developed for convenience on horseback and became the favourite quiver used by steppe people like the Scythians and in Near Eastern states for some centuries. Containing two separate pockets for bow and arrows, respectively, it was made from leather and reinforced by a wooden frame inside. The bow was carried inside already strung, and the position at the hip made a quick withdrawal of bow and arrows and immediate action possible. The protruding bow tip could be protected from inclement weather conditions by a cap of felt or leather.

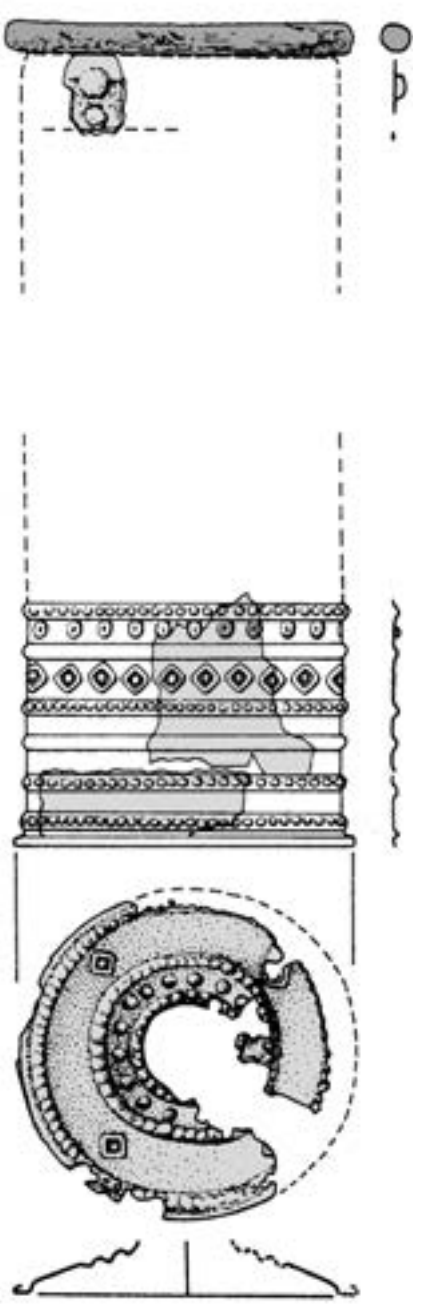
In Western Europe where cavalry with bow and arrows were not used on a large scale, tubular or rectangular single quivers of wood and leather continued to be common. See Table 4.

Table 4 Classical Antiquity.

Date	Place	Fig	Description/ Type	Material	Reference
c. 450 BC, Persian	Persepolis, Hall of columns, southern Iran	28	Relief showing two types of soldiers. Some wearing combined bow/arrow cases (*gorytoi)* on the left hip, others carry a bow and a rectangular quiver on the back. Possibly foot soldiers and horse archers are characterised. *Gorytoi* are shaped to fit the braced Persian composite bow. They are shown here closed by a stiff protective cap of felt or leather. It is not clear if there are different sections for bow and arrows. Foot soldiers are carrying a rectangular type of arrow quiver	Wood and leather	Hall of Columns, Persepolis, Iran
c. 300 BC, Scythian	Pazyryk, Kurgan 5, Altai mountains, Russia	29	Felt carpet depicting a Scythian archer on horseback wearing a Scythian *gorytos* on his left hip. Combined bow and arrow case with separate sections for bow and arrows. Bow part has the characteristic shape of the braced Scythian composite bow, the arrow part looks like a sewn on leather pouch. Arrows were inserted with points down, as shown by actual finds. An attached side piece (made of wood) has two holes for mounting straps	Leather and wood	State Hermitage Museum, St Petersburg, Russia Hajdas *et al.* 2004

6th century BC	Neuwied-Heimbach, Germany	30	Ornamented Bronze fittings and upper iron mouth ring from a wooden quiver. Diameter approx. 7 cm. Tubular arrow quiver, length unknown. Suspension type unknown	Wood, probably leather lining, Bronze, Iron	Joachim 1998
c. 550 BC	Hochdorf, Germany	31	Fragments of a wooden arrow quiver, covered with animal hide. 60–65 x 7.5 cm. Decoration of Bronze nails. The bottom plate and a stepped cap are made of Bronze. Tubular arrow quiver with carrying system (small bronze parts). Arrows inside with points up	Poplar wood, hide, Bronze	Landesmuseum Stuttgart, Altes Schloß, Germany Biel 1985
c. 480–400 BC	Glauberg, Wetterau, Germany	32	Remains of a quiver made from two shells of wood, forming an oval tube encased in linen cloth. Inside lined with leather. At least 50 cm long, 10 cm wide, oval tubular arrow quiver. Suspension unknown. Arrows were carried points up inside	Poplar wood, linen cloth, leather	Keltenwelt am Glauberg, Archäologisches Landesmuseum Hessen Flügen 2002, 2014

Figure 29 Opposite Top: Scythian horseback archer on a carpet from Pazyryk (Altai mountains, Russia). Kurgan 5. State Hermitage Museum, St Petersburg, Russia. Approximately 5th–4th century BC, Inv. no. 1687/93. Photograph © The State Hermitage Museum. Photo by Vladimir Terebenin.



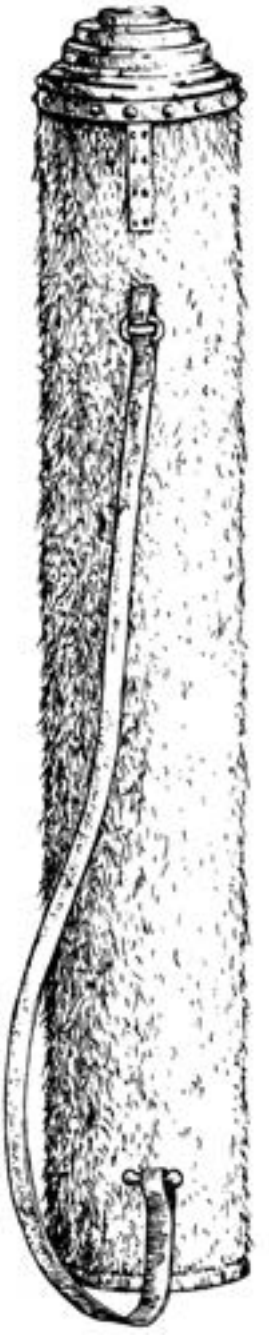


Figure 30 Above Left: Reconstruction of a tubular quiver from Neuwied-Heimbach/Weis (Middle Rhine, Germany), made from wood with bronze fittings and an iron rim at the opening. Diameter c. 7 cm. After Joachim 1998.

Figure 31 Above right: Reconstruction drawing of Iron Age quiver from Hochdorf (Neckar Valley, Germany), c. 550 BC. After Biel 1985.

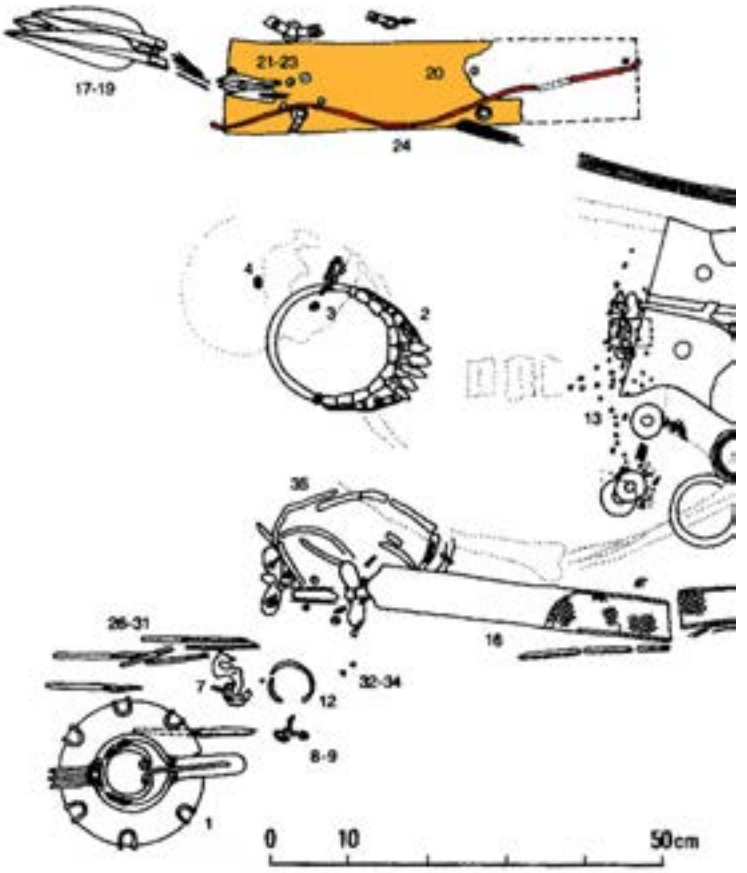


Figure 32 Remains of an Iron Age quiver (tagged yellow) from Glauberg (Wetterau, Germany), c. 480–400 BC. After Flügen 2002.

200–1200 AD (Migration Period, Early Medieval)

In Asia, the combined bow case/quiver combinations made from leather remained in use until around the 5th century, although in a somewhat different shape than before, now adapted to the Hunnic/Mongolian style bows with long rigid ears. The place where they were worn changed from the left to the right side of the body. Arrows could be retrieved and shot by a right-handed archer faster when the drawing hand retrieved them from the right side other than from the opposite left. Around the 5th century the containers for arrows and the bow were separated and worn on different sides of the rider's hip. Arrows to the right and bow to the left seems to have been the rule from then on for right-handed archers. This way the archers were ready to shoot even faster when the left hand drew the bow and the right hand simultaneously the arrow from their containers.

In Western Europe tubular or rectangular arrow quivers from wood and/ or leather remained common. There are no indications for the existence of bow cases. See Table 5.

Table 5 Migration Period, Early Medieval.

Date	Place	Fig	Description/ Type	Material	Reference
c. 200–300 CE, Hunnic	Niya, Xinjiang province, China	33	Three-piece: Leather case, finely decorated, sewn together with two plain leather tubes, broad leather belt strap and finer strips. Bow holster/ Quiver combination. The bow case is a rectangular soft leather bag with reinforced pointed bottom. On the side and on top two stiffer, cylindrical tubes for arrows, one still equipped with a removable leather cap for protection. Several leather belt straps for suspension on the archer´s hip	Bow case soft leather, arrow tubes stiffer deer-skin	Xinjiang Institute of Archaeology Zhiyong 2000
2nd–4th cent. CE, Sogdian	Orlat, Uzbekistan	34	Belt closure plaque of bone, engraved with battle and hunting scene. Depicted are mounted archers and foot soldiers equipped with bow/arrow cases. Bow holster/ quiver combination of the same type as the one from Niya. The engravings show in detail how the asymmetric Hunnic style composite bow fits into the container, shows the two tubes for different arrows. Worn at the right hip of the archer		Institute of Art Studies, Academy of Sciences of Uzbekistan, Tashkent Olbrycht 2015 https://sogdians.si.edu/orlat-plaque/
255–301 CE (C-14), Rouran Kaganate	*Urd Ulaan Uneet, Khovd province, Mongolia*	35	Tube of leather with wooden bottom. Sewn together on the back side from a big leather piece. Dim. 77,5 x 15 cm. Traces of paint near the upper end. Iron hooks and leather straps on back side. Tubular, or hourglass shaped arrow quiver. The mouth on top is cut out on the front side for extraction of the arrows. Bottom is wider than the top, thus arrows were likely kept points down inside. Leather straps for suspension attached by an iron pin running through two leather loops for quick removal. An iron hook probably connected the strap to the archer's belt	Leather, Iron	National Museum of Mongolia, Ulan Bataar Баярсайхан *et al.* 2017; pers. comm. Ж. Баярсайхан
ca. 12th century CE, Mongol Conquest Era	*Mongolia (without precise origin)*	36	Tubular container with widened oval top and cut out opening, 69 x 15,5 x 10,5 cm. Made from several layers of thick birch bark, reinforced with two lateral and a central wooden lath, probably glued on, and also inserted into the raw hide cover of the wooden bottom plate. Typical hourglass shaped Mongol arrow quiver. Bottom wider than top, arrows were put inside with points up. Suspension through two horn eyelets on the left side, sewn on with leather. One is located at the quiver mouth, the second one 28 cm below. Leather straps not present	Birch bark, wood, rawhide, horn, glue	Originally Silk Road Museum, Seoul, South Korea, and private collection K. Zeilinger, now auctioned to Unknown

Figure 33 Bow case/quiver combination found in princely tomb in Niya (Xinjiang Province, China), 3rd to 4th century CE. After Zhiyong 2000.

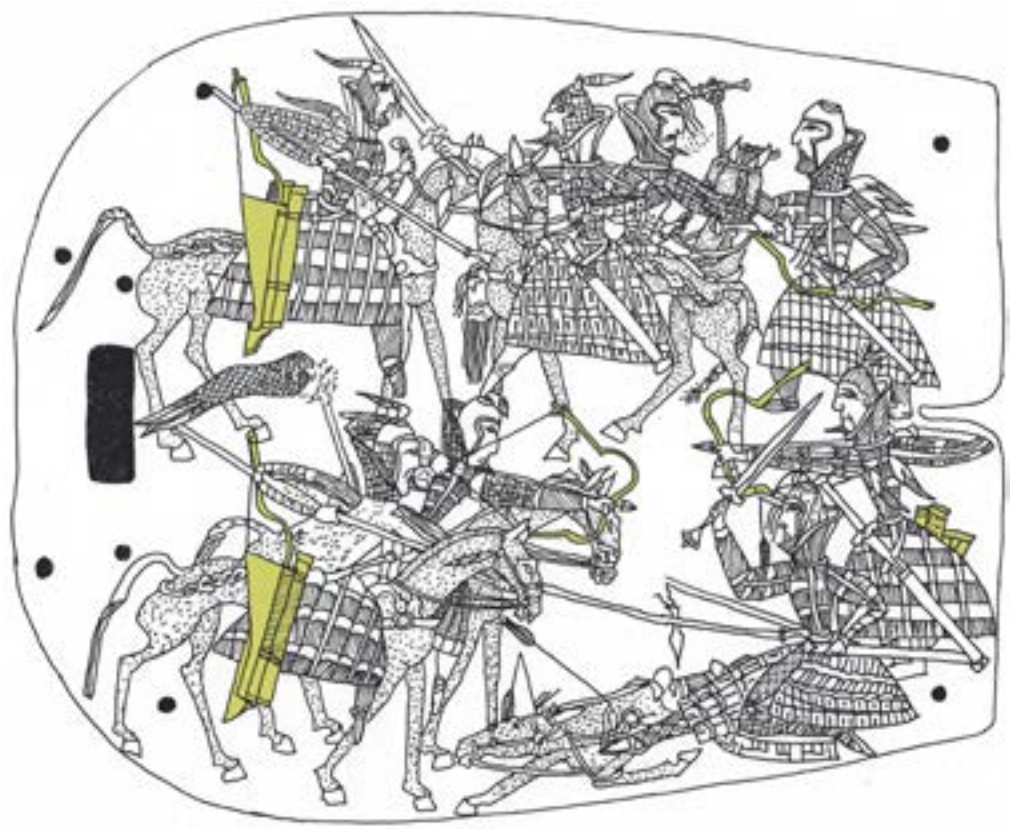


Figure 34 Engraved bone belt plaque found in princely tomb in Orlat (Uzbekistan). Drawing by J. Farrell, Houston, after a photograph.

Figure 35 Above left: Leather quiver from Urd Ulaan Uneet (Western Mongolia), 255–301 AD. After Баярсайхан *et al.* 2017.

Figure 36 Above Right: Birch bark quiver from Mongolia (provenance unknown). Approx. 12th century CE. © Photo M. Jarisch, München.

Figure 37 Detail of mural painting from a tomb of Northern Qi Dynasty in Jiuyuangang (Xinzhou, China), 550–577 AD. Right-handed archers with bow cases and quivers. Wikimedia Commons, https://commons.wikimedia.org/wiki/File:Tomb_of_Northern_Qi_Dynasty_in_Jiuyuangang,_Xinzhou,_Mural_02.jpg

Table 5 continued

c. 550–577 CE, Northern Dynasties	Jiuyuan-gang, Xin-zhou, China	37	Murals from a tomb with hunting scenes on horseback. Depicted are separate bow cases and arrow quivers. The bow case, a slender conical tube is suitable for the peculiar bow type used, which has unusual straight tips. The unbraced bow is kept in the container, protected by a textile sleeve. It is attached to the left, the arrow quiver on the right hip. Arrows inserted with points down	Unknown, probably leather and hide	Shanxi Museum, Shanxi, China Shanxi Provincial Institute of Archaeology 2016
c. 660–680 CE, Alamannic	Altdorf, Switzerland	38	Fragments of a flat, at least 50 cm long, and 10 cm wide container made from two shells of wood joined by wooden pegs. Encased in thin leather, which was pressed into ornaments carved into the wood. Trapezoid arrow quiver quite similar in shape to the one from Urd Ulaan Uneet. Cut out mouth for extraction of the arrows. A special leather cap with a smaller opening protected the arrows, which were stored points up. The bottom part is wider than the top to provide room for the sensible fletching. Suspension unknown	Lime wood, leather	Swiss National Museum, Zürich Marti 1995

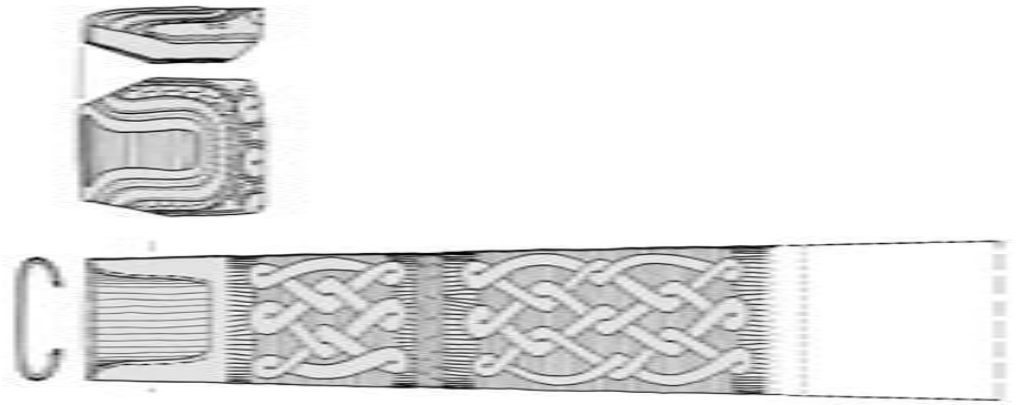


Figure 38 Reconstruction of quiver found in Alamannic grave at Altdorf (Canton Uri, Switzerland), 660–680 CE. After Marti 1995.

1200–1500 (Medieval Period)

The Eastern bow holster, now shorter and wider, was adapted to the strung shape of the shorter bows with acutely forward bent tips, which followed the older Hunnic-Mongolian type with longer ears. They were designed to carry a braced, ready to shoot bow, and to make sure that it could be pulled out quickly. It did not change much during the medieval period. Leather arrow quivers continued to be attached to the right side of the archer, but changed to a wide rectangular shape, open on top and

distinctly shorter than the arrows, which are oriented with points down.

In Europe the use of the bow declined in most countries during the 15th century and quivers went out of use. See Table 6.

Table 6 Medieval.

Date	Place	Fig	Description/ Type	Material	Reference
c. 13th cent., Seljuk	Iran (without precise origin)	39	Painted ceramic bowl with depiction of a Seljuk archer on horseback. Asymmetric, wide bow holster for strongly reflexed, short composite bows		Metropolitan Museum, New York
c. 1280, Yuan Dynasty	China or Mongolia. No place specified	40	Chinese painting depicting Kubilai Khan on a hunting expedition on horseback. Bow holsters and separate arrow quivers worn at the left or right hip, resp. A spare bow is carried in hand, inside a protective sleeve of cloth. Rectangular arrow quiver, open, arrow points down		National Palace Museum Taipeh, Taiwan
1494, Persian	Iran	41	Miniature painting. Wide bow holster on left side, and rectangular short arrow quiver with arrows sticking out on right side		The David Collection, Copenhagen, Denmark

Figure 39 Seljuk horseback archer with bow holster and strung bow. Iranian Bowl, 12th–13th century CE. Metropolitan Museum of Art, New York, Harris Brisbane Dick Fund, 1951, Accession Nr. 51.53.

Figure 40 Detail of a Chinese scroll painting by Liu Guandao from c. 1280, depicting a Kublai Khan hunting expedition. National Palace Museum Taipeh, Taiwan, Image Nr. : K2A000866N000000000PAA

Figure 41 Miniature from a copy of Firdawsi's Shahnama "The Battle Between Kay Khusraw and the King of Makran," Iran, 1494. The David Collection Copenhagen 22/1979. Photograph Pernille Klemp.

1500–1900

The Asiatic bow holster and arrow quiver again did not change much during this period and existed in quite similar shapes well into the 20th century in some countries, in China or Korea for example.

Additionally, bow cases are well known from Native American people from the plains and prairies, as well as from the Inuit. These containers, dating from the early 19th century, are the closest parallels in shape and function to the Neolithic Schnidejoch bow case. They were made from leather or hide, frequently stiffened by thin wooden rods and equipped with straps to carry them over the shoulder. See Table 7.

Table 7 Modern Era.

Date	Place	Fig	Description/ Type	Material	Museum/Reference
c. 1812, Greenland Inuit	Greenland	42	Flat semi-circular bag of sealskin, 143 x 32 cm. One compartment for bow and arrows. Central bone or antler handle for carrying on top, plus long leather shoulder strap. Additional small pouch for other equipment is sewn onto one side	Sealskin, bone or antler, sinew	Norwegian University of Science and Technology, Trondheim, Norway
Early 19th century, Crow tribe	North America	43	Two long tubes of leather, sewn together to form a combined container. Stiffened by a thin wooden rod in between them. 107 cm total length. Soft bow/ arrow quiver for the unbraced bow and arrows. Leather straps attached for carrying	Leather, wood	Linden-Museum Stuttgart, Germany
1824, Omaha tribe	NW Plains, North America	44	Similar to above item, but 115 cm long	Leather, wood	Linden-Museum Stuttgart, Germany, coll. P. von Württemberg
1820–1830, Blackfeet tribe	NW Plains, North America	45	Painting by C. Bodmer, depicting a Blackfoot native on horseback. Showing the way the Plains tribes quiver/bow case combinations were worn. The short size and a wide central carrying belt enabled a horizontal position of the container over the back and both shoulders		*Prinz von Wied* 1843, plate 19

Figure 42 Western Inuit bow case from Greenland, ca. 1812. Norwegian University of Science and Technology, Trondheim, Norway. Inv. Nr. E35.

Figure 43 Crow tribe bow case/arrow quiver combination made from leather with wooden stiffening rod. Early 19th century. L. 107 cm. Linden-Museum Stuttgart, Germany. Inv. Nr. 044319.

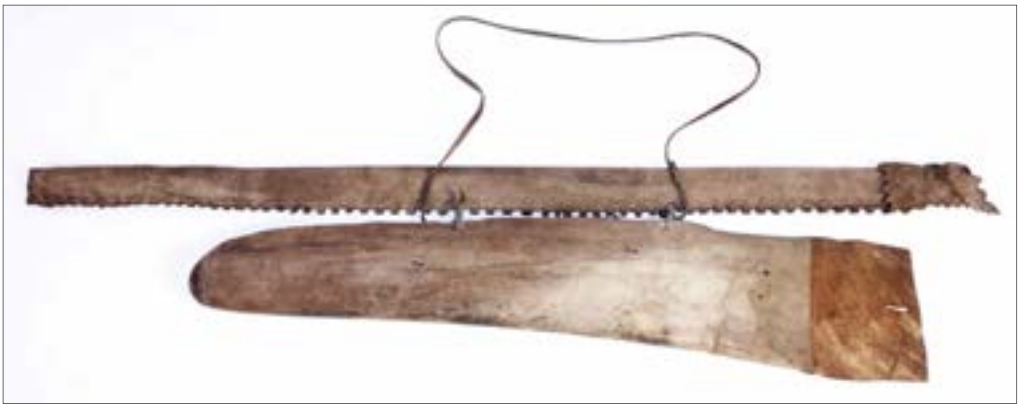


Figure 44 Omaha tribe bow case/ arrow quiver combination made from leather. Ca. 1824. L. 115 cm. Linden-Museum Stuttgart, Germany. Inv. Nr. 012571b.

Experimental reconstruction, features and possible use of the Schnidejoch bow case

The creation of accurate reconstructions is a method which can add significantly to the knowledge about the technology, manufacture, purpose and the handling of rather uncommon prehistoric artefacts. As the Neolithic bow case from Schnidejoch is the first one of its kind found to date, reconstructing it was an important means of this research. It was necessary to gather precise data about the structure and the dimensions of all components used which was not always easy. The nature and the differences between the CT Scans conducted on parts of the object did not allow high precision measurement of the parts hidden inside, but luckily most components were at least partially visible from the outside. On the base of all available data, a map of the materials and parts used in the bow case was compiled. As some of the individual parts are missing, these had to be reconstructed, following the standards observed on available components. A first reconstruction of the bow case had been made for an exhibition several years earlier without very precise knowledge about the inner

Figure 45 Blackfoot warrior on horseback equipped with a plains type quiver/bow case combination on his back. Painting by Carl Bodmer. Ca. 1834. Published in Prinz von Wied 1843, plate 19.

structure of the object. The experience of this attempt proved to be quite beneficially for the accurate reproductions.

To begin, a substantial amount of birch bark pieces had to be collected. More than 1.5 m^2 of birch bark pieces cut to size are needed. The best season for the harvest of birch bark is, based on personal experience, late spring and early summer, when lots of sap is transported to the leaves. As spring and summer 2018 and 2019 were extremely dry in most parts of Europe, harvesting was very difficult. When too dry, the bark cannot be separated from the bast and the removal of bigger pieces is nearly impossible. So the material in stock from the years before and additional birch bark collected by a friend in Finland and also a lot of Chinese Birch bark obtained through a trader were finally used. All of this material was already dry. All birch bark pieces except the Chinese ones were curled up badly and had to be straightened by heat before use. The bark strips used vary from approx. 1 to 2.5 mm in thickness.

Following the detailed map of the components (Figure 2), first the long rectangular pieces for the inner shell were cut to size and stitched together (Figure 46). Cutting the birch bark with flint blades turned to be very time-consuming and was later executed with modern knives; resulting in a similar cut. It proved to be better to do the connective stitching before folding. This way the lengthwise fold was straighter than when folded separately before joining. To ensure the correct curvature in the fold, a bow stave was inserted before.

For sewing of the whole structure three replica bone needles were used. The first needle used was max. 3.5 mm in diameter. It was well-suited for the seam connecting the pieces for the inner sleeve, but not fine enough for the more delicate stitching

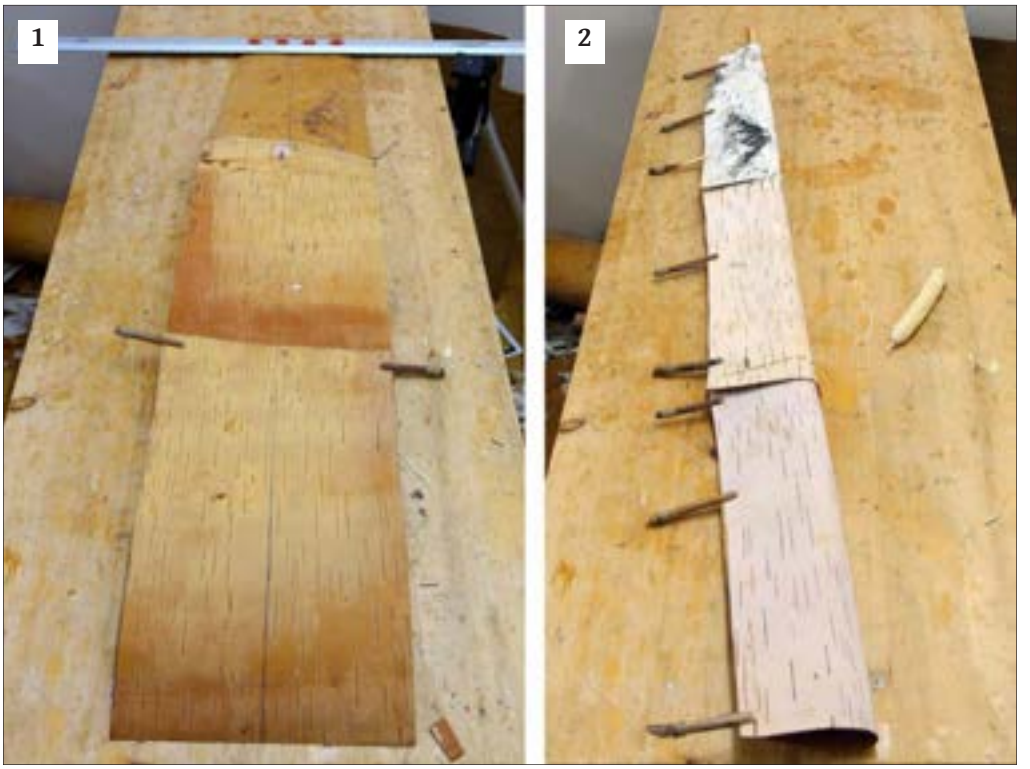


Figure 46 Reconstructing the Schnidejoch bow case. The first steps: 1. Joining the tailored long inner birch bark strips, 2. folding along the centre.

along the edge of the case. With this needle it was possible to prick a hole and do the sewing simultaneously when not many layers of birch bark had to be pierced. The rest of the sewing was done with a finer needle ca. 2.5 x 2.0 mm thick (Figure 47b), which broke in the eye after about two thirds of the work and then was be replaced by a third one.

All parts were joined by simple running stitches (Figure 47). In some places on the original find the thread runs alternating (running stitch) between holes while in other places there is thread connecting every seam hole, looking like a saddle stitch. But a backward stitching can look the same. In the reconstruction, multiple backward stitching was necessary whenever the end of a bast strip was reached, and a new thread had to be inserted (Figure 48d). Bast fibres long enough to sew the whole case were not available. Also, because of the complicated structure in the bottom part, it was not possible to sew the whole edge in one turn. On the bottom part of the bow case, with its additional shingle layers, a parallel double seam can be observed, extending further into the lower third of the centre piece. As this was most likely a repair, only a single seam was sewn on the replica.

In the original find there was an extra bottom part added after the section above was already equipped with outer shingle layers, probably a later repair or extension, which was tested in the reconstruction, too. The additional inner tube extension was

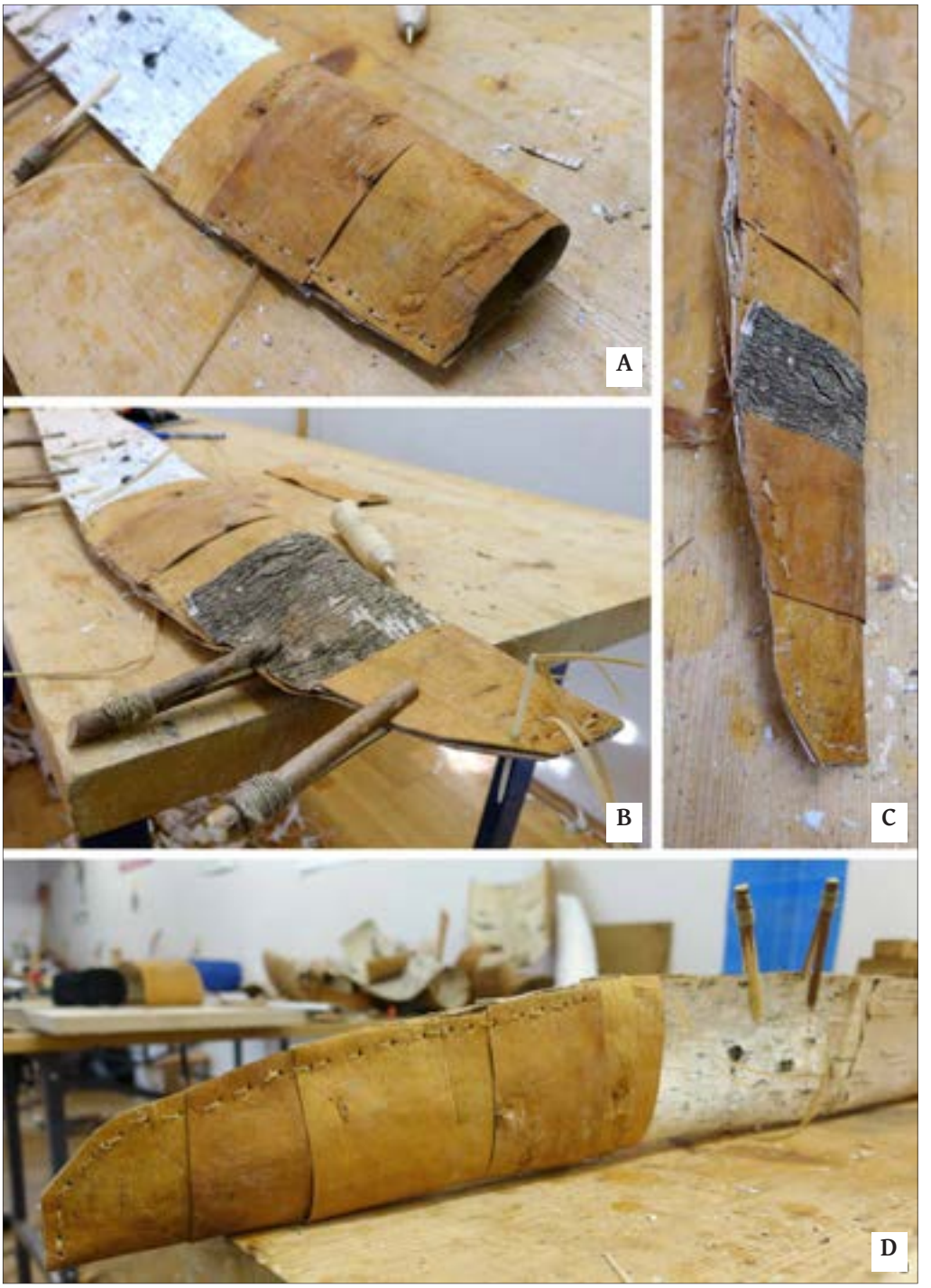


Figure 47 Reconstructing the Schnidejoch bow case following the sequence in the original find. A. Sewing the first outer shingles onto the lower part. The actual bottom part of the inner strip is not attached yet. B. Addition of the actual bottom part of the inner strip (white outside) and C–D. sewing of new layers of outer shingles.

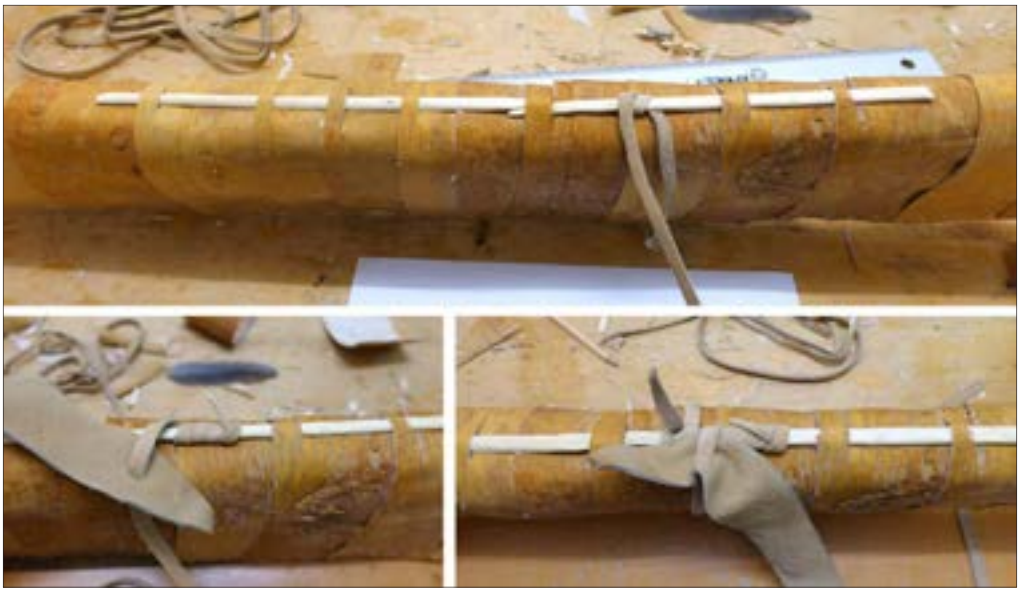


Figure 48 Reconstructing the Schnidejoch bow case. Inserting the stiffening rods and attaching the leather carrying strap on the main section.

slipped over the existing part with shingles already sewn on (Figure 47c–d). Then the procedure of shingle adding was started again from the bottom. To achieve the superposition for waterproofing, it had to be done from bottom to top. In the bottom part of the original, however, with its many added layers, the correct sequence was not always followed and thus the best possible waterproofing was not achieved there. The superposition of up to 12 layers of birch bark in the bottom additional segment made it difficult to pierce. A bone awl with a round section was used to pierce the holes needed for sewing. A turning movement was necessary to get through the tough birch bark sheets. After piercing the hole, the bone needle could be slipped through with the lime fibre thread, sometimes using considerable force. Because of the subsequent distribution of overlaying shingles, sometimes the same places had to be sewn more than once, and up to three times. It proved no difficulty, and in most cases sewing could be done using the same holes as in the layers below.

For the stiffening rods a shoot of dogwood (*cornus sp.*) was split in two halves which were thinned and cut to measure. The outer layers of birch bark were cut slightly, and the stiffeners inserted, overlapping at the centre (Figure 48). At this point it proved a mistake to have sewn the outer shingles as tight as possible to the main frame. It was very difficult to insert the rods without damaging the birch bark, and only possible with addition of grease. Still in some of the slits the bark began to split considerably. In the first reconstruction done several years ago, the author had believed that the fit of the outer shingles to the inner tube was made a bit too loose, which led to the "improvement" in reconstruction no. 2, creating problems inserting the twigs.

The upper lid or cap of the bow case had to be tailored to fit the main part quite well because only the friction of this insertion keeps the two parts together while hang-

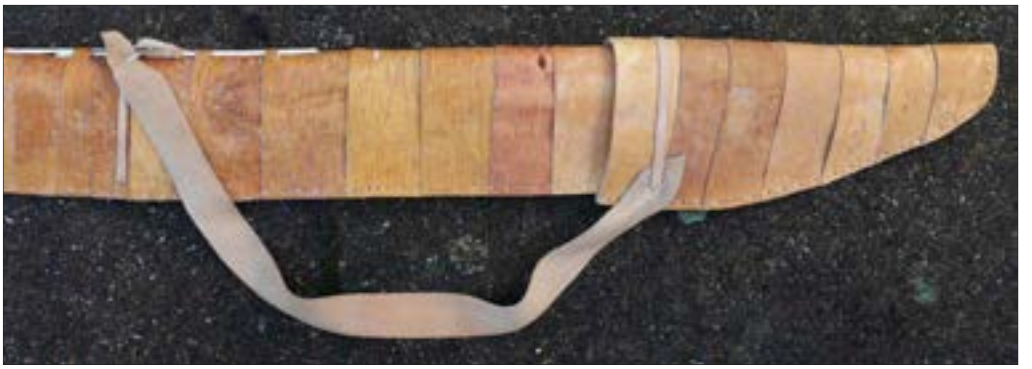


Figure 49 Reconstructing the Schnidejoch bow case. The carrying system.

ing from the users' shoulder. The surface of the birch bark proved to create sufficient friction to create a stable connection even with only 3–4 cm of insertion. The cap and the centre section were covered by one layer of shingles only. The ca. 70 cm long and 4 cm wide carrying strap is connected to the centre of the main body and near the bottom of the cap (Figure 49). Both ends of the strap were secured by 66 cm and 45 cm long and 0.8 cm wide leather thongs inserted into the main body and stiffening rod and the cap respectively, and running around most of the width while being inserted through a hole in it.

The bottom tip of the bow case was fitted with a protective rawhide cap which can be assumed to have been the case in the original find, too. A piece of deer rawhide was soaked in water, cut to size and sewn onto the lowermost shingle before it was sewn on the bottom of the bag (Figure 50). It is not possible to sew it on when the shingle is

Figure 50 Reconstructing the Schnidejoch bow case. Protective cap of rawhide on the bottom tip.

Figure 51 Reconstructing the Schnidejoch bow case. Finished reconstruction.

already attached because doing a running stitch through the birch bark and directly outwards through the next hole would need a semi-circular upholsterer's needle. A needle like this made of bone would break when using it this way, so the top of the rawhide piece must have been attached to the birch bark shingle before.

This protection for the lower tip proved very useful against scratching on the ground. The edges of a birch bark object are very sensitive and prone to abrading. It does not matter that this shingle would let water inside from the top, because it is part of the third layer which is on top of two other layers of shingles.

The weight of the finished reconstructed bow case (Figure 51) was 828 grams. Depending on the thickness of the birch bark used, the weight of the object might differ considerably. The bow would add about 450–550 grams to the package, and

Figure 52 Wearing the reconstructed Schnidejoch bow case in the presence of a TV team.

each arrow about 40–50 grams. In carrying the position of the container should be as vertical as possible on the back to avoid too much of sideways projection, which leads to bumping into rocks for example. The vertical fit could be adjusted a bit by

Figure 53 The rain experiment: After being exposed to light continuous rain for 4 hours, the inside of the bow case remained absolutely dry.

sliding the carrying straps sideways on the leather fastening thongs. The fit on the back while wearing it was quite comfortable but not optimal. For comfortable wearing it was positioned a bit too low which made the bottom part project too much from the body. On a 1,76 m tall person the distance to the ground is ca. 40 cm which seems sufficient for walking even in rocky terrain (Figure 52). With a person around 1.50 m the container would nearly touch the ground.

The replica of the Schnidejoch bow case was tested in regard to its water resistance. To this end, a bow covered by a sleeve of fine garment was put inside and the closed bow case was hung outside during continuous light rain for a period of 4 hours (Figure 53A). After this the bow case was thoroughly wet on the outside. When opened, not the slightest water stain was visible on the fabric covering the bow (Figure 53B). Any drop of water which would have penetrated and could have touched the bow would have shown clearly as a spot or stain on the cloth. An inspection of the inner quiver mouth could also not detect any traces of water inside.

Discussion

The find of a full size bow bag made of birch bark on Schnidejoch (Lenk, Switzerland) was a big surprise because similar objects have been absolutely unknown before. Despite of the numerous finds of artefacts from organic materials in lakeshore or bog settlements, previously only the leather arrow quiver from Tisenjoch (South Tyrol, Italy) was known before from European stone age cultures. It is striking that the artefact from Schnidejoch would have been conserved very well in the sediments of any wetland sites if it would have been deposited there. But, to date not a single remaining piece of a similar object was ever found. It raises the question if the Schnidejoch container was the only one of its kind. But apart from the fantastic coincidence that it would be, there is reason to assume that some kind of protective bow case would have been a useful item to own for any prehistoric archer.

The benefit of such a container and the reason to make one is for one thing protection of the bow and for another to be able to carry it having the hands free for other tasks. Both advantages make a lot of sense. A wooden bow is sensitive to water which can can be absorbed and soften the wood. A bow can even be totally ruined if it is shot while the wood is absorbed with water. A protective coat of wax or animal grease can keep the moisture out, but unlike modern varnishes only for some minutes. An additional protection of the valuable hunting weapon against water therefore seems very adequate. In the case of the Schnidejoch container, it was made from birch bark, a material especially known for its impermeability. Furthermore, it was constructed in a way to ensure that no rain could enter the gaps between the individual parts. The bow case can protect its content from rain showers for the most part, although moisture can creep through the seam holes which may wet the content to a minor degree. However, a wooden bow and arrows, additionally protected by a coat of wax and/ or grease would tolerate this amount of wetness easily.

To keep the hands free while roaming the hunting grounds would be beneficially, too, especially in rocky environment. The replicas of the Schnidejoch bow case which have been manufactured faithfully to the original find proved to be surprisingly sta-

ble and resilient containers. The light weight of only 820 grams is not too great a burden, so that a bow and some arrows can be transported conveniently inside. Future tests will show whether it is resilient enough for long distance travel, but so far nothing seems to contradict that possibility.

Research on parallels in archaeology and ethnography demonstrates the existence of protective bow containers more or less comparable to the Schnidejoch case in all Eurasian steppe cultures using the bow and arrow on horseback, but also among hunters on foot, or in open boats, like the Inuit. In Asia bow cases were in military use until the early twentieth century at least in China and Korea. The closest parallels to the Schnidejoch bow case are the combined bow/arrow containers of indigenous peoples of the Great Plains and from Inuit people in Greenland and Canada, which are remarkably close in shape and function, but mostly made from hide or leather.

Judging from the number of arrowheads found, the bow and arrow must have been very common equipment in stone age civilizations throughout Europe. Around 200 or more Meso- and Neolithic wooden bows were found to date in Europe, most of them in wetland sites. If quivers from wood and tree bark would have been common, many of these objects should have been found in stone age lakeshore and bog sites, more or less fragmented of course.

The only conclusion to be drawn from this, if one would not assume that bow cases were generally uncommon in the European stone age, is that these were normally manufactured from materials not able to survive in wetland conditions, probably leather. This hypothesis can be further confirmed by the only other comparable find from the European stone age, the quiver of the Iceman from Tisenjoch (Italy). This leather quiver was preserved in a perfect state in the ice. If a similar object, manufactured from leather, would have been lying in the sediments of a lakeshore village, only the hazel rod which was used as a stiffener would have been preserved.

In a time of retreating glaciers and ice patches all over the world, it is perfectly possible that more bow cases like the one found on Schnidejoch site will be released from ice and snow, and hopefully they will be discovered. Everybody going into the mountains should be aware of the retreating ice and snow releasing precious archaeological finds.

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