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# Bone skates and young people in Birka and Sigtuna

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679 bone skates from two important sites in the Stockholm area were examined. Cattle bones dominate in Birka (8th to 10th centuries AD), while horse bones are more numerous in Sigtuna (10th to 13th centuries AD). The average length of the skates is c. 20 cm in Birka and c. 22 cm in Sigtuna. It seems that in Birka, bone skating was practiced mostly by children. In Sigtuna it also became popular among adolescents and perhaps young adults. Ethnological analogies strongly support the interpretation of bone skates as toys and sporting equipment.

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Bone skates (Sw. *islägggar*) are popularly known as ancient skates. But scholars have had different opinions of exactly how they were used, and in what contexts.

Bone skates are quite common finds at urban excavations and some have also been found at rural sites and in graves. Although these objects are known from many parts of Central and Eastern Europe and the British Isles, the richest known find sites are in Scandinavia (Bone Skates Database, [knochenarbeit.de](http://knochenarbeit.de), checked 1 June 2015; cf. Grieg 1933, p. 264 f). Some findings have been published in the archaeological literature, but almost always in relatively small numbers, ranging from single items to a few dozen. For Sweden see e.g. Lund (M. Cinthio 1976, pp. 383–386) and Eketorp (H. Cinthio 1998, p. 78).

This paper reports on a total survey of bone skates found at two important Swedish sites. The study includes 290 objects from Birka and 389 from Sigtuna, a total of 679 bone skates. No systematic study of such a large number has, it seems,

been done before. The material invites both quantitative and qualitative comparisons.

The bone skates from Birka and Sigtuna were examined by the authors in collaboration. For a comprehensive report in Swedish, see Edberg & Karlsson 2015.

Only bone skates that could actually be retrieved were included in the study. There were from both sites a small number of lost or lent finds, which could not be examined. This shortfall represents 3–4% and is thus negligible.

The vast majority of the Birka bone skates derive from Hjalmar Stolpe's excavations in the Black Earth in the 1870s, but there are also a number from Björn Ambrosiani's excavations in the 1990s. They are all kept in the Swedish History Museum's stores in Stockholm.

Most of the Sigtuna bone skates are from a variety of excavations from the 1890s onward. Others are stray finds from the urban area. The vast majority are kept in Sigtuna Museum's stores. Some are in the Swedish History Museum in Stockholm.



Fig. 1. Bone skate from Birka. Cattle, metatarsus III-IV, dorsal side, completely worn out. No holes. Length 211 mm. SHM find no. 35000-79617. All photos and diagrams by the authors.



Fig. 2. Bone skate from Birka. Horse, metatarsus III, palmar side, surface roughened. Single hole, proximal end. Length 251 mm. SHM find no. 5208-1640 (105).

### *Material and representativity*

Birka and Sigtuna are both on Lake Mälaren in Uppland province, only about 35 km apart as the crow flies. Birka is on an island, Björkö, and Sigtuna on a bay on the lake's northern shore. Birka has occupational layers from the middle of the 8th century to the late 10th century AD. Sigtuna has occupational layers from the late 10th century to the late 13th century. The two localities thus connect chronologically and give the finds a span of five centuries, from the 700s to the 1200s. In Swedish archaeological terminology, this corresponds with the whole Viking Period and the Early Middle Ages.

The first Birka finds (Stolpe's) cannot be dated closer than to the island town's lifetime c. 750-980. Many of the bone skates from Ambrosiani's excavation may however be dated stratigraphically. In total, 43 of them belong to distinct phases (Ambrosiani 2013; Ambrosiani pers. comm.) Although this is only 15% of all the Birka finds,

there is no reason to believe that they are not representative of the bulk.

In Sigtuna 144 bone skates, 37% of all finds from the site, can be dated by their contexts and subsequent archaeological analyses. They are from five major excavations from the 1980s onward at sites located centrally in the urban area. These are the St. Gertrud 3 site, excavation 1983 (Bäck & Carlsson 1994); the Urmakaren 1 site, excavation 1990-91 (Ros 2009); the Trädgårdsmästaren 9-10 site, excavation 1988-90 (Wikström 2011); the Professorn 1 site, excavation 1999-2000 (Mats Pettersson report forthcoming, pers. comm.) and the Humlegården 3 site, excavation 2006 (Wikström 2008). They may be seen as fully representative of the material from Sigtuna.

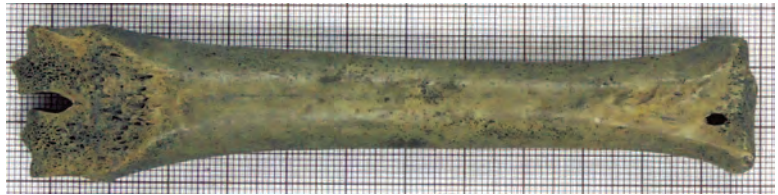
### *Cattle and horse*

All bone skates in the survey could be determined to species and skeletal element. Birka's skates are to 79% made of cattle bone, *Bos taurus*. They

Fig. 3. Bone skates from Sigtuna. Horse, metatarsi III, palmar sides peeled off down to the marrow cavities. Pair, found together but not wholly identical. Only the lower one has an axial hole in the proximal end. Length 260 (lower item). Sigtuna Museum, Professorn-1 site, find no. 34530 (a, b).



Fig. 4. Bone skate from Sigtuna. Sheep, metacarpus III-IV, dorsal side, showing bevelling of the the bone's distal end and wear. Length 121 mm. Sigtuna Museum, Urmakaren-1 site, find no. 5531.



are generally metacarpi III-IV and metatarsi III-IV. But there are also some radii. The rest, 21%, are horse bones, *Equus caballus*, mainly metacarpi III and metatarsi III plus a few radii (fig. 1-2).

In Sigtuna, however, only 39% are made of cattle bone (likewise metacarpi III-IV and metatarsi III-IV). 61% are made of horse bone (metacarpi III and metatarsi III). Here too only a few radii of both species occur (fig. 3).

Skates of sheepbones, *Ovis aries* (metacarpi III-IV and metatarsi III-IV), are rare: a single one from Birka and three from Sigtuna (fig.4). No species other than these three are represented.

Each bone skate was examined and the ways which it has been worked recorded systematically at 23 different points in accord with the scheme of the Arbeitsgruppe Knochenarbeit, published in their Bone Skates Database (knochenarbeit.de). This scheme turned out to be very useful, even though, due to the peculiarities of the Swedish material, some additions became necessary.

Hopefully, the scheme will be implemented also by others in future research and facilitate comparisons between bone skates.

If all points could be checked, the bone skate was classified as complete, otherwise as fragmentary.

#### *Working and wear*

A difference in the method used for this study in relation to Knochenarbeit's is the definition of what constitutes a bone skate. Knochenarbeit requires visible wear, which did not appear reasonable as there are a number of bone skates both from Birka and Sigtuna that are clearly prepared for their purpose, but which have for some reason been used very little or not at all, with no wear visible. Instead, we define a skate such that the area designed to run against the ice (which is almost always the bone's dorsal side) must be at least rudimentarily flattened. Also, the rate of wear was judged on a four-point scale, also as a development of Knochenarbeit's system.

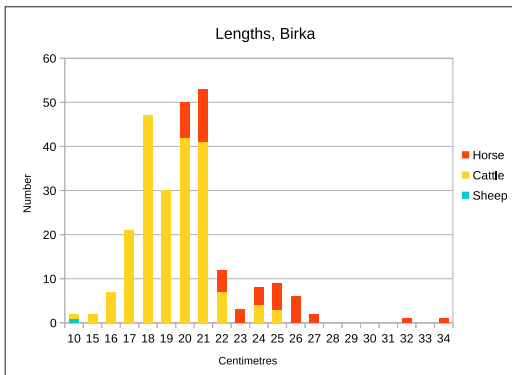


Fig. 5. Bone skates from Birka: length, including all the site's complete skates.

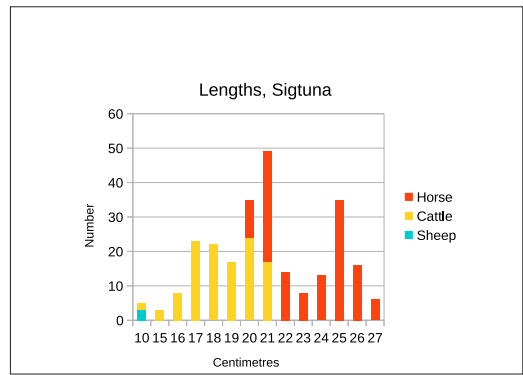


Fig. 6. Bone skates from Sigtuna: length, including all the site's complete skates.

The most frequent point on the 23-point processing protocol is the beveling of the front bottom edge (the bone's distal end). This has been done on practically all bone skates, where this could be checked, in other words where this end is intact. This applies to bones both of cattle and horse and for both sites.

The edges on protrusions on the sides (i.e. lateral and medial) have been levelled off on some bone skates while most have been allowed to retain their natural shape there. The surface where the foot would be (the palmar or plantar side, depending on whether the bone was a metacarpus or metatarsus) is often razed more or less level at the front or back, or in both spots, i.e. distally and proximally to the bone.

#### *Cleft horse bone*

Our overall impression is that Birka's bone skates were processed no more than necessary for their purpose. Here the horse bone skates are slightly more worked than the cattle skates. Sigtuna's bone skates, however, were processed to a much greater extent. Thus, most of the horse bone skates (153 of 236 items, 67%) and also a handful of cattle skates are cleft, the bone's palmar/plantar side having been cut away down to the marrow cavity. This created a smooth surface for the foot. We saw no such processing among the Birka finds.

This stripping of the bone, however, also obviously made the skates more brittle. Wear has

often made them break. This is probably why the Sigtuna bone skates are fragmented to a much greater extent than Birka's.

Traces of processing in the form of holes were also recorded under *Knochenarbeit's* scheme. The differences both within each site and between them proved great. The extreme case is that only 3% of the Birka's cattle skates have some kind of borehole, while 60% of Sigtuna's horse skates do.

Especially in Sigtuna, people seem to have experimented with various ways to tie the skates to your foot, without reaching any generally accepted solution. Holes were apparently also made for other purposes, e.g. in order to tie a pair of skates together so you could comfortably carry them in your hand or hang them on the wall at home. The variation in appearance suggests that the manufacturing process was an individual matter carried out in the household sphere, separate from professional bone and antler craft.

#### *Children's sizes*

Birka's bone skates are on average about 20 cm long, and Sigtuna's 22 cm (fig. 5–6). The reason for the difference is that there are many more horse bones from Sigtuna, and these are on average longer than the corresponding cattle bones. Given that Viking Period and Early Medieval shoes did not have stiff soles and therefore the entire foot must have rested on the skate, 20 cm corresponds to EU shoe size 31–32 and 22 cm to size

34–35. Those are children's and adolescents' sizes. Only four skates from Birka and 20 from Sigtuna are long enough for size 40 feet or larger.

Bone skates could, of course, on the other hand be longer than your foot. The tip is in fact in some cases designed to protrude a little in front of the toe. This applies particularly to the horse bones (particularly the longest, metatarsi III) on which the surface the skater's foot rests on has been lowered by peeling off the plantar side, while the distal trochlea, i.e. the front end of the bone skate, is left untouched. (And has in some cases also been provided with a perhaps only decorative transverse hole in the sagittal verticillus, fig. 7).

#### Early written sources

Historical and ethnological analogies are of great importance for the interpretation of how bone skates were used and in what social contexts. There are many relevant sources, especially as bone skates survived in living tradition past the year 1900. We have reviewed this evidence. Some examples follow.

The use of bone skates is described in three oft-quoted early sources: William Fitz Stephen's description of London (written about 1180; Douglas & Greenaway 1953, pp. 960–961), Snorri Sturluson's *Saga of the sons of king Magnús* (before 1241; transl. Hollander 1964) and Olaus Magnus' *History of the Nordic Peoples* (1555; ed. Foote 1996–98, fig. 8). The common denominator of the three texts is games and competitions on ice. In William's text the skaters are boys and young men of London. With the other two authors, skaters are male youths of the aristocracy. Another early source is the Swedish Duke Charles' (the future King Charles IX) diaries, where he notes that four young labourers

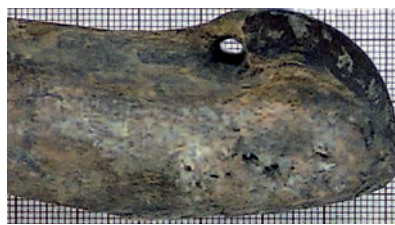


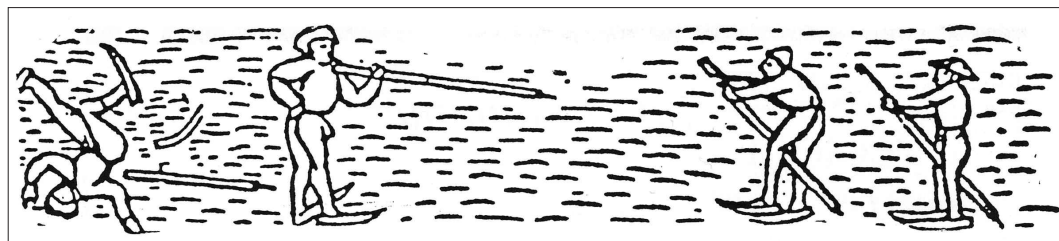
Fig. 7. Bone skate from Sigtuna. Horse, metatarsus III, with a hole through sagittal verticillus. Sigtuna Museum, Trädgårdsmästaren-9-10 site, find no. 28776a.

have drowned in Lake Vättern while running on bone skates (*Calenda Caroli IX*). The accident happened on a Sunday in January 1596 near Jönköping, and suggests that skating on bones was a socially widespread pastime.

#### 1800s

In the 1800s, folk culture became a patriotic passion in certain educated and academic circles. Objects were collected and ended up in museums. Folklore and traditions were recorded and put in archives. Also bone skates received some attention. They were at this time apparently quite common in rural areas both in Central Europe and Scandinavia. From the German-speaking and Hungarian areas there is detailed testimony about how children and adolescents made bone skates for play and amusement, propelling themselves with a pole. The correlation between bone skates in living tradition and archaeological skates also received some attention by scholars (VBGA 1871, pp. 19–21; 1872, p. 42; Herman 1902, pp. 217–238; Choyke 1999, pp. 148–156.)

Fig. 8. Skaters playing games. After Olaus Magnus (XI:36).



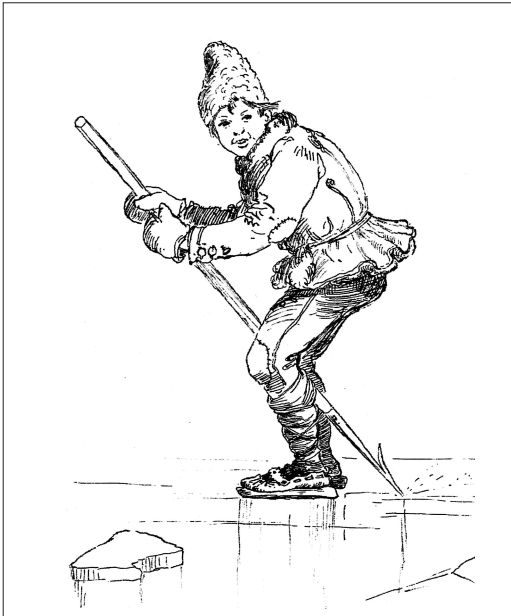


Fig. 9. Hungarian boy on bone skates. Depicted with his whole feet resting on the skates but with no lacing. After Herman 1902.

appear to have considered the lacing quite necessary. So, e.g. there are two good sources from the 1800s that testify to different uses on Gotland. One is from of Pehr Arvid Säve, a collector of folk memories in the 1850s, 60s and 70s:

»This is common in the countryside, and practiced on glassy ice on frozen springs and bogs. One stands on two horse shanks, which are made perfectly smooth underneath on a grindstone, and are carved out a bit on the other side, so that the feet can rest quite firmly there. But these skates are in no way laced or attached to the feet which stand entirely loose on them. Skaters accelerate by means of a pole with a spike at its end...»

(Säve 1948, p. 76 f; our transl.)

A Swedish pioneer work in ethnology, which deals with Varend in Småland, mentions bone skates:

»At Christmas, when there was glassy ice, one would run on bone skates, that is, two split leg-bones, polished underneath, as one propelled oneself forward with a steel-pointed pole... bone skates have been used in Varend from the earliest times until a generation ago...»

(Hyltén-Cavallius 1868 p. 464, our transl.)

A drawing accompanying this note shows a pair of skates made from horse metapodia.

When Hjalmar Stolpe set eyes on similar Viking Period items at Birka in the 1870s, he did not hesitate about what they had been used for, but also noted that his finds were not split in halves lengthwise, as the ones Gunnar Hyltén-Cavallius had described (Stolpe 1873, p. 45).

Were bone skates laced to the feet or not? In the ethnological sources different cultural traditions appear in terms of the boreholes. In some parts you just stood straight up on bone skates, without any lacing at all, while elsewhere people

On the other hand we have an observation by the pioneer archaeologist Fredrik Nordin, himself born on Gotland in 1858. He comments on a bone skate he has found in a Migration Period house foundation on Gotland:

»These are still used on the island too, at least I have seen children use them and have had a pair myself. They are made of the shin bone of a horse in the simple manner that the bone is pierced with two holes. Through these a string is put to lace the skate to the foot. With such a means of conveyance and with the aid of an ice-pole one can run with great speed on glassy ice. The item found was exactly of the same kind.»

(Nordin 1886, p. 163 f; our transl.)

Two parallel traditions evidently existed elsewhere too. According to Otto Herman (1902, p. 221), skates with holes and skates without holes occurred simultaneously in various localities in late-19th century Hungary. He regarded the un-bored skates as the more primitive kind (fig. 9).

In Birka and Sigtuna, the youngest skaters had to make do with bone skates made of cattle.

Fig. 10. Swedish boy from Rågö, Estonia, on bone skates. Depicted with his skates protruding a bit and securely laced to his feet. After Söderbäck 1940.

This is recorded also from more recent times. In the Dialect and Folklore Research Archives in Lund (archive no. 3084-16) is a record made of Petter Andersson, Salberga, Gräsgård parish, Öland province. He was born there in 1843:

»Well, I was only about eight or nine when I started with bone skates. These were of the fore-shanks of cattle. And an ice-pole, which the smith was supposed to make. We used to be in the pastures to the west of the church. We were on the ice Sunday afternoons...»

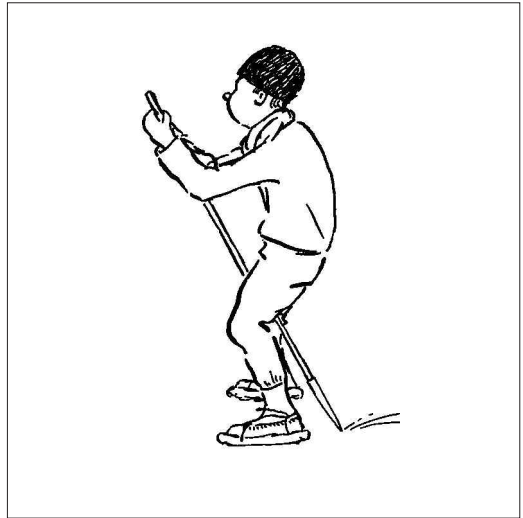
(our transl.)

In Swedish archives there are similar accounts from informants born in the 1800s about bone skates used in rural areas. Everywhere they are described as toys or sporting equipment for children and youth. Children notably often went bone skating on land, that is on frozen bogs or even on fields and meadows, when melt-water froze there. The Öland example above is one of several.

1900s

The most recent description we have found of bone skates in the living tradition is from the 1930s (fig.10). I concerns Estonian Swedes on the Rågö/ Pakri islands, where boys and girls enjoyed themselves in this manner as soon as the shallow strait between the two islands froze over:

»In the winter they go sledging as best they can on on low slopes, and when the ice is glassy on the shallow strait, they take out their bone skates and skating starts. They are made of the horse's ›lower leg‹, the metatarsal bone. One ›side‹ is stripped to obtain as wide a surface as possible for the foot, while the opposite side is ground flat and smooth. In both ends holes are drilled and through them the strings are put with which the skate is secured to the feet. When skating, one can of course not proceed as with steel skates. Instead, an iron-shod pole



is used . . . this one holds with both hands, the pole is thrust into the ice and pressed back between the legs. Quite a good speed can be reached, depending on how nimble you are with the pole. Reversing is difficult, then you must slow down and the pole is helpful. No ice princesses will ever be trained on these bone skates, but the children have fun, and that is in this case the main thing.»

(Söderbäck 1940, p. 256 f; our transl.)

These historical and ethnological examples, covering the period from the 1100s to the 1900s, indicate unanimously that bone skates were made by and for children's and young people's play and sport. This is also what Swedish archaeologists (e.g. M. Cinthio 1976, pp. 383–386; Ambrosiani 1991, p. 46) have long maintained when discussing such finds, and it is confirmed by our study of the finds from Birka and Sigtuna. The vast majority of the bone skates found at these sites are simply too short for adult feet.

#### *In a social context*

But this is not the whole truth. For a closer comparison of the finds from Birka and Sigtuna, and the changes took place over time, let us have a glimpse of bone skates in their social context.

As noted above, there is an important differ-



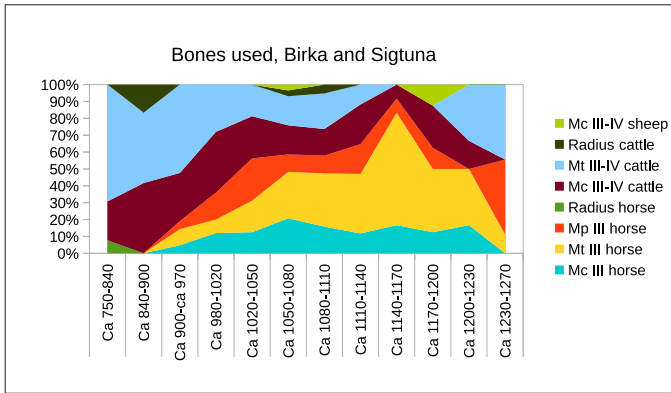


Fig. 11. Bone skates from distinct phases in Birka and Sigtuna combined. Showing relative usage of the various bones as raw material for skates from c. AD 750 to 1300.

ence in the raw materials used at Birka and Sigtuna. Cattle skates dominate at Birka while horse skates are rare there. The stratigraphically dated horse bone skates are admittedly few (five items), but of these only one is from an early phase, while four belong to the 900s (Ambrosiani 2013; Björn Ambrosiani pers. comm.) The only surviving grave find of a bone skate from Birka is a horse skate from grave Bj 86a (Arbman 1943; Vahlne & Arwidsson 1982, pp. 167–169). This grave also belongs to the 900s, like most of Birka’s excavated graves (Anne-Sofie Gräslund, pers. comm.).

In Sigtuna’s oldest phase, before c. AD 1020, cattle skates dominate. After that, horse skates prevail in all phases. Thus, there is a certain tendency in the collected material, and during the whole era, from the 700s to the 1200s, of horse skates becoming increasingly popular, although cattle skates never fall out of use (fig.11).

Cattle bones occur abundantly in waste layers on both sites. Bone suitable for making skates must have been easily accessible. Horse bones are however almost unknown in the waste both from butchering and bone and antler crafts in Birka and Sigtuna (Wigh 2001, p. 54; Hallgren 2011, p. 24; Hårding 2011, p. 5; co-author Karlsson, in prep.) If we leave the horse’s special role in pre-Christian cult aside, horse meat was clearly not on the everyday menu either before or after the Christianisation. Horse bones were hardly ever used as a raw material in skilled bone and antler craft at either site. Horse bones must thus have been obtained from the surrounding country-

side, apparently being brought to town for the specific purpose of making bone skates.

#### *Teenagers’ demand?*

The wealth of horse skates in Sigtuna should mean that the townspeople had much better access to them than had been the case at Birka. This fits well with the notion that Sigtuna’s town plots were owned or allocated to landowners allied with the king (Tesch 2007, pp. 71–121). Inhabitants, or perhaps their masters in the countryside, would not have had any difficulty in getting hold of horse bones.

We wish to suggest that demand for the longer horse bones may have grown in Sigtuna, perhaps among the town’s adolescents. And such a demand could be met. Bone skating was popular among children both in Birka and Sigtuna, but in Sigtuna it seems to have spread gradually upwards in age, as horse bones became more easily accessible.

The longest metapodium of horse (metatarsus III) that we have studied measures 27,5 cm, corresponding to shoe size 42–43. Its longest cattle counterpart is 5 cm shorter, corresponding to shoe size 36. The ability to acquire horse bones may have been a prerequisite for teenagers and young adults to participate in winter amusements. What was child’s play in Birka continued to be so in Sigtuna, but also became a sport for adolescents. A symbolic aspect may also be suggested: the horse is a much more prestigious, fast and nimble animal than the cow.

*Less common uses*

The influential Swedish ethnologist Gösta Berg (1943, pp. 79–90; 1971, pp. 4–13) argued that only very young inexperienced skaters would have needed to lace the bone skates to their feet. This view have been quoted by a number of later scholars, such as Arthur MacGregor (1975, p. 387), who described it as »a well-known Scandinavian tradition».

This idea is not borne out at all by Birka's and Sigtuna's skates. Instead, it seems to have been the other way around: small children used short bone skates, processed in the simplest manner and never tied to their feet. They probably played as best as they could, on their own. Older, probably more skillful skaters needed longer skates and also put more work into preparing their skates in various ways, including drilling holes in them. They also often whittled and cut the surfaces that their feet would rest on, right down to the marrow cavity, a procedure known from Rågå's children in the 1930s.

Berg also suggested that bone skates were mainly used when going fishing. There is some ethnological evidence for this practice. Säve (1892, p. 87) recorded that bone skates were once used when fishing on Lake Martebo träsk on northern Gotland, when the ice was transparent and fish could be caught by hitting the ice above them with clubs, thus stunning them. But similar accounts are rare and Berg's strong emphasis on this practice must be questioned.

Berg mentioned bone skates being used for long journeys and even on icy roads (1943, pp. 79–90; 1971, pp. 4–13). Again, Säve offers an example, where churchgoers from a Gotland farm, using bone skates, used to take a short-cut over a frozen lake when possible (Säve 1948 p. 76 f). We have come across no other historical sources or ethnological analogies beyond this. Long voyages on bone skates would hardly have been very convenient, considering that even a thin snow cover makes bone skating impossible. Berg's assumptions seem uncertain at this point too.

*Traces of young people's pastimes*

To sum up, reliable information and recent analogies for any utilitarian use of bone skates is rare and it is difficult to suggest anything definite in

this regard for the bone skates from Birka and Sigtuna. Of course some people may have used bone skates when ice fishing in early winter, before the snow settled on the ice of Lake Mälaren. If so it would have been during Sigtuna's heyday, when in contrast to the time of Birka people had access to bone skates of sizes that suited adolescents or even some adults.

On the other hand, all historical and ethnological sources agree that bone skates were used by children and youth and for fun and games. Our review of the length and wear of the Birka and Sigtuna bone skates fully supports this. These, and probably also bone skates found in other archaeological contexts, should be seen as toys or sporting equipment. They are traces of the children and youth of long ago. These finds also show that children lived at Birka and Sigtuna in winter-time too. This offers a new angle on the discussion of possible seasonal habitation.

*References*

- Ambrosiani, B., 2013. *Stratigraphy vol. 1. Excavations in the Black Earth 1990–1995*. Birka Studies 9. Stockholm.
- Arbman, H. 1943. *Birka I. Die Gräber*. Stockholm.
- Berg, G. 1943. Isläggar och skridskor. *Fataburen*.
- 1971. Skates and Punt Sleds. Some Scandinavian Notes. Meertens, P.J. & Plettenburg, W.M. (eds). *Vriendenboek voor A.J. Bernet Kempers*. Arnhem.
- Bone Skates Database. www.knochenarbeit.de
- Bäck, M. & Carlsson, M., 1994. *Kvarteret S:ta Gertrud 3: Stadsgårdar och gravar i Sigtuna ca 970–1100*. Uppland, Sigtuna RAA 195. UV Stockholm, rapport 1994: 60. Stockholm.
- Calenda Caroli IX.*, 1903. Utgiven af Föreningen för bokhandtverk genom Adam Lewenhaupt. Stockholm.
- Choyke, A.M., 1999. Bone skates: raw material, manufacturing and use. Pannonia and beyond. Vaday, A. (ed.). *Studies in honour of L. Barkoczi*. Antæus 24. Budapest.
- Cinthio, H., 1998. Isläggar. Borg, K. (ed.). *Eketorp-III. Den medeltida befästningen på Öland. Artefakterna*. Stockholm.
- Cinthio, M., 1976. Isläggar. Mårtensson, A.W. (ed.). *Uppgrävt förflutet för PK-banken i Lund. En investering i arkeologi*. Lund.
- Douglas, D.C. & Greenaway, G.E., 1953. *English Historical Documents II*. London.
- Edberg, R. & Karlsson, J., 2015. *Isläggar från Birka och Sigtuna. En undersökning av ett vikingatida och medeltida fyndmaterial*. Stockholm Archaeological Reports 43. Stockholm.

- Grieg, S., 1933. *Middelalderse byfynd fra Bergen og Oslo*. Oslo.
- Hallgren, E., 2011. *Humlegården. A spatial pattern analysis of the bone material from the site Humlegården in Sigtuna*. Master's thesis in osteoarchaeology. Stockholm.
- Herman, O., 1902. Knochenschlittschuh, Knochenkufe, Knochenkeitel. Ein Beitrag zur näheren Kenntnis der prähistorischen Langknochenfunde. *Mitteilungen der Anthropologischen Gesellschaft in Wien* XXXII. Vienna.
- Hyltén-Cavallius, G., 1868. *Wärend och Wirdarne. Ett försök i svensk ethnologi. Andra delen*. Stockholm.
- Hårding, B., 2011. Osteologisk rapport. Wikström, A. (ed.). *Fem stadsgårdar. Arkeologisk undersökning i kv. Trädgårdsmästaren 9 & 10 i Sigtuna 1988–90*. Sigtuna Museum. (On CD.)
- MacGregor, A., 1975. Problems in the Interpretation of Microscopic Wear Patterns: the Evidence from Bone Skates. *Journal of Archaeological Science* 1975:2. London.
- Nordin, F., 1886. Gotlands s.k. kämpagrafvar. *KHVAA:s Månadsblad*. Stockholm.
- Olaus Magnus, 1555. *Historia de gentibus septentrionalibus. English edition 1996–98: Description of the Northern Peoples I–III*. Transl. P. Fisher & H. Higgens; ed. P. Foote. London.
- Ros, J., 2009. *Stad och gård. Sigtuna under sen vikingatid och tidig medeltid*. OPIA 45. Uppsala.
- Snorri Sturluson. English edition 1964: *Heimskringla. History of the Kings of Norway. The Saga of the sons of Magnús*. Transl. L.M. Hollander. Austin.
- Stolpe, H., 1872. Naturhistoriska och archæologiska undersökningar på Björkö i Mälaren. *Öfversigt af Kongl. Vetenskaps-akademiens förhandlingar* 1. Stockholm.
- 1873. Naturhistoriska och archæologiska undersökningar på Björkö i Mälaren II. *Öfversigt af Kongl. Vetenskaps-akademiens förhandlingar* 5. Stockholm.
- Säve, P.A., 1892. *Hafvets och fiskarens sagor samt spridda drag ur Gotlands odlings saga och strandallmogens lif*. Andra upplagan. Visby.
- 1948. *Gotländska lekar samlade av P.A. Säve utgivna av Herbert Gustavson*. Svenska lekar I. Uppsala.
- Söderbäck, P., 1940. *Rågöborna*. Stockholm.
- Tesch, S., 2007. Sigtuna – det maktpolitiska och sakrala stadsrummet under sen vikingatid och tidig medeltid (ca 980–1200). *Människors rum och människors möten. Kulturhistoriska skisser*. Stockholm.
- Vahlne, G. & Arwidsson, G., 1986. Schlittschuue und Eispickel. *Birka II:2*. Stockholm.
- VBGA 1871. Verhandlungen der Berliner Gesellschaft für Anthropologie, Ethnologie und Vorgeschichte. Sitzung 5. November 1870. *Zeitschrift für Ethnologie* 3. Berlin.
- VBGA 1872. Verhandlungen der Berliner Gesellschaft für Anthropologie, Ethnologie und Vorgeschichte. Sitzung 13. Januar 1872. *Zeitschrift für Ethnologie* 4. Berlin.
- Wigh, B., 2001. *Animal husbandry in the Viking Age town of Birka and its hinterland. Excavations in the Black Earth 1990–95*. Birka Studies 7. Stockholm.
- Wikström, A. (ed.), 2008. *På väg mot Paradiset – arkeologisk undersökning i kvarteret Humlegården 3 i Sigtuna 2006*. Sigtuna.
- (ed.) 2011. *Fem stadsgårdar. Arkeologisk undersökning i kv. Trädgårdsmästaren 9–10 i Sigtuna 1988–1990*. Sigtuna.