Proc. Estonian Acad. Sci. Humanities and Social Sciences, 1996, 45, 3, 319–333
https://doi.org/10.3176/hum.soc.sci.1996.3.06

AN I-TYPE SPEARHEAD REVEALED BY THE X-RAY METHOD

Kristina CREUTZ

Arkeologiska Institutionen Stockholms Universitet (Department of Archaeology, Stockholm Universtity), S-106 91 Stockholm, Sverige (Sweden)

Presented by Ü. Tamla

Received 26 February 1996, accepted 22 May 1996

In April 1995 a considerable number of Estonian and Swedish spearheads of the Late Iron Age were X-rayed in Stockholm. Through the X-ray method it was possible to establish a spearhead of type I in the Estonian collection. The spearhead is in poor condition and its outside shows only vague traces of copper on the socket. This is the first known I-type spearhead in Estonia. As the I-type spearheads are rare on the eastern shores of the Baltic Sea, this particular spearhead is of great interest. The spearhead is a stray find from Kärneri in Pöide parish on the island of Saaremaa.

In this article the use of the X-ray method in connection with spearheads is discussed. The Kärneri I-type spearhead is also presented and discussed from a Baltic Sea angle. The article is part of an ongoing investigation of Late Iron Age spearheads around the Baltic Sea including the eastern part of Sweden and Gotland, the southwestern and the southern parts of Finland and the Åland islands, Carelia (today Russia), the area around St. Petersburg and Ingria, Estonia, and Latvia. These X-ray examinations were realized with financial support from the Berit Wallenberg Foundation.

THE X-RAY METHOD

Harmless and pre-conserving

Like all methods, the X-ray method also has its negative sides, but undoubtedly the positive ones dominate. First of all and not least important, the method is absolutely harmless to the artefact. Without exaggeration one could even claim the method to be pre-conserving, since invisible cracks and fragile points are revealed by the X-rays. This is an invaluable help for the further preservation of the object in question.

A spearhead can be examined independently of its condition. Spearheads in extremely bad condition may even be examined in their museum boxes as long as the boxes themselves do not contain any metal. The emission of X-rays used for metal does not absorb for instance wood or paper. This means that the spearheads need not be touched or moved during the examination.

Difficulties

The main problems connected with the X-ray examination are mostly related to the spearhead itself, such as its thickness and density. These factors are very important for the quality of the pictures. Unless enough care is taken in connection

with the determination of the thickness of the object, the X-ray examination is due to fail. The pictures will appear either too dark or too light. If the picture is too light, more radiation or longer exposure time is needed and vice versa.

Additionally, less clear pictures need very strong light while being studied, which can be difficult to achieve in normal working conditions. The illumination equipment in highly specialized X-ray laboaratories is in most cases extremely powerful and to a certain degree misleading. This illumination equipment is normally used for discovering minor damages in metal objects for industrial purposes, where accuracy is of great importance. Therefore one ought to be careful and only accept pictures of very good quality, since a picture which appears to be quite good can be difficult to study with less strong illumination later on.

One could say that the only negative side of the X-ray method is the difficulties in getting enough good pictures. Pictures of less good quality are almost impossible to work with and to obtain any valuable information from.

The adjustment of the emission of X-rays

The thickness and density of a spearhead vary. Even the blade varies. The section close to the transition part between the socket and the blade is often much thicker than the middle section of the blade. This can cause problems. The emission of X-rays must be adjusted according to the part of the spearhead which is under investigation. Therefore, two different pictures may be necessary in cases where both the socket and the blade are to be studied. This makes it possible to make exact adjustments and good pictures will thus be obtained.

The use of X-ray film

The cost of X-ray film is high and requires careful consideration, but it has to be seen in relation to interpretation work, which is both time-consuming and a demanding task for the archaeologist. It appears ideal to use one X-ray plate per spearhead. Later on the investigated spearheads may be compared and analysed without any limitations. But this means, on the other hand, high costs for the use of the X-ray equipment and the X-ray expertise.

Less time will be used in the laboratory if several spearheads are X-rayed together on the same plate. It seems to work out quite well when spearheads of the same type or otherwise similar spearheads are X-rayed together, at least when the thickness of the blades does not vary too much. It is also preferable to divide the spearheads according to length in order to avoid waste of X-ray plates.

In cases where, for instance, only the sockets are to be X-rayed it is possible to put a larger number of sockets on the same X-ray plate opposite each other. In this way, at least ten sockets can be examined at the same time. This system also makes it easier to compare the spearheads with one another later on.

However, having several spearheads on the same X-ray picture is a disadvantage when a large number of spearheads are studied simultaneously. Large X-ray pictures can be more difficult to handle, especially when the surface of the illumination equipment is limited.

I used larger X-ray plates partly to save time but also partly because I thought these would be easier to handle. As long as there are spearheads of the same type it works quite well, but when different types are on the same plate it is unpractical, especially when the number of studied X-rays amounts to several hundreds. In retrospect I would have preferred to have each spearhead on a separate plate to be able to put the ones I want to study for a certain reason together on the illumination equipment. This is of special value when spearheads are from different countries as in my case.

Different metals

Different metals clearly show on the X-ray picture due to differences in density. Accordingly, even small amounts of e.g. silver and copper can be visible which otherwise could have remained unknown. It is thus recommened that metal rings used for fastening museum labels are removed or indicated in some way and registered to avoid problems in the interpretation.

Technical information

The X-ray examination carried out in Sweden in 1995 was successful. The pictures turned out well. The examination took place at STK Inter-test in Huddinge, near Stockholm. Björn Adolfsson was responsible on the part of the company. Altogether 200 spearheads were X-rayed.

For thicker spearheads the following adjustments were used:

160 kW
5 mA
700 mm FFA (film focus distance)
1 minute exposure

For thinner spearheads 130 kW was used instead; other adjustments remained the same. In a few cases 145 kW was used.

The film was chosen according to graininess. D4 was used for larger plates and D5 for smaller ones.

THE INSIDE OF THE SPEARHEADS

The X-ray method brings us closer to an understanding of the smith's work and his skills. It helps us understand the procedure behind the making of a spearhead. Several aspects can be studied in this connection, but undoubtedly the blade and the transition part between the blade and the socket constitute the main points.

The blade

The blade is mainly interesting from the pattern-welding point of view. Through the X-ray method it is possible to see the presence (or absence) of pattern-welding, the kind of pattern-welding, the size of pattern-welding, and finally the way in which the pattern-welding has been carried out, including e.g. the joints of the welding.

Pattern-welding can also be studied through mechanical and chemical cleansing. This method has been used in large-scale studies in Latvia and Estonia. These investigations took place in the 1960s and 1970s and were carried out by Aleksis Anteins (Антейнс, 1973) in Latvia and by Jüri Selirand (1975) in Estonia. A negative point about this method is a certain destruction on the spearheads, even though in most cases only a small part of the blade was cleansed. This means that the inside structure of the blade is seen only on a limited part of the blade. The advantage of this method is its exactness as far as the pattern is concerned.

One of the aims of the X-ray project in Sweden was to test these methods against each other. Some of the Estonian spearheads had been cleansed on an earlier occasion in the 1970s. Both methods are good, but the X-ray method certainly brings us much closer to the smith who carried out the work. Through the X-ray method optimal knowledge of the inside structure is available, which is not the case when the object is cleansed. I do not think I am wrong in saying that the X-ray method also brings us much deeper into the problems especially in questions of comparing artefacts and understanding their place of origin.

The ideal way would be to use both methods in combination. In a larger project with many countries and museums involved it would, however, be practically impossible to realize.

The socket

The most interesting part on the socket is its upper part, where the socket meets the blade, i.e. the transition part between the blade and the socket. But also joints along the side of the socket and remains of other metals as gold, silver, and copper may be revealed.

Through the X-ray method it is possible to study how the socket was once connected to the blade or if the whole spearhead was made in only one piece. The way of connecting the blade and the socket may give important chronological information or indicate local traditions.

THE KÄRNERI SPEARHEAD FROM PÖIDE PARISH

Stray find from Kärneri in Pöide parish on Saaremaa (AIK 46:1; Plate I, *1*). Spearhead with a long (230 mm) slender (25 mm) blade with a rhombic section. Total length 285 mm. The point of the blade is slightly broken. The mid-rib is well marked. The edge angle is less sharp and the run (the part between the edge angle and the socket) is comparatively short (8 mm). The transition part is six-sided with an oval-round section (the diameter is 13 mm). The socket is broken. On the socket there are traces of copper (Plate I, *2*) and vague traces of silver. The spearhead is in a less good condition. Pattern-welding of group 1 (Selirand, 1975, list No. 78). X-ray No. 80.

Socket in proportion to blade – not possible to determine. Width of the blade in proportion to its length 1:9.

This spearhead was found in Kärneri. The spearhead was registered together with another spearhead (AIK 46:2), a small M-type spearhead with a narrow blade (X-ray No. 42), but there is no information whether the two spearheads were found together or not. No further information is available (Archive of the Institute of History, Tallinn). For the geographical location, see Fig. 1.

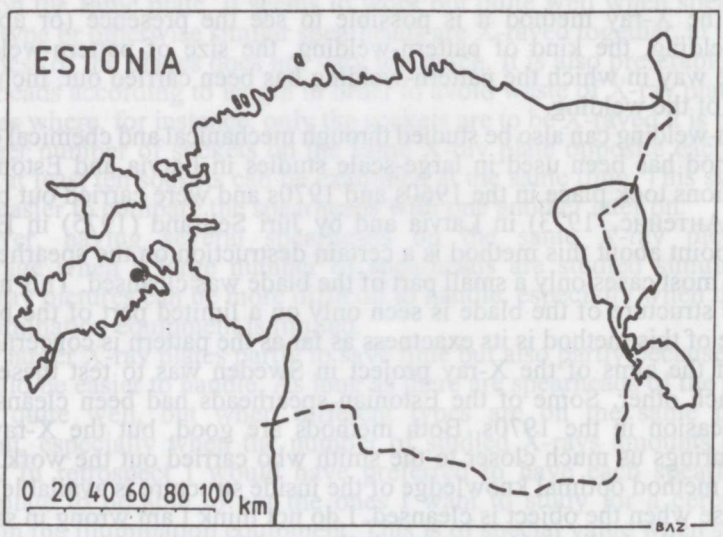
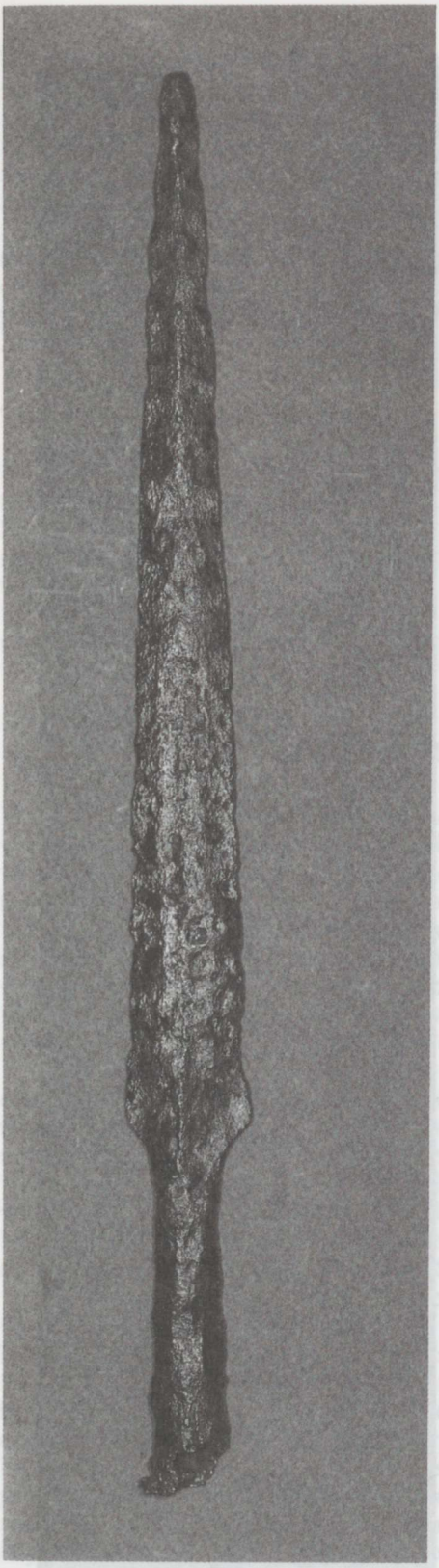


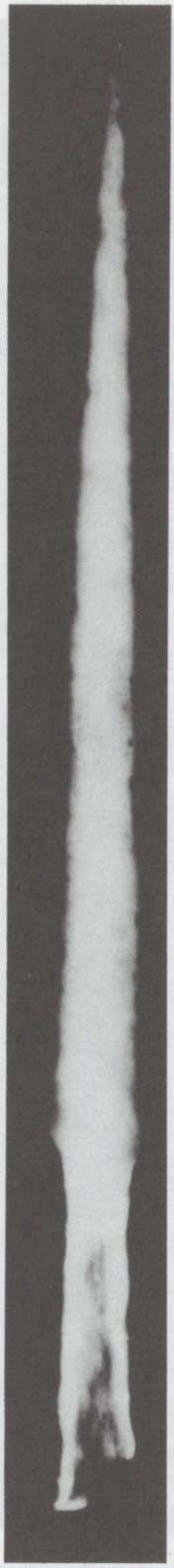
Fig. 1. Site of the find of the Kärneri spearhead.



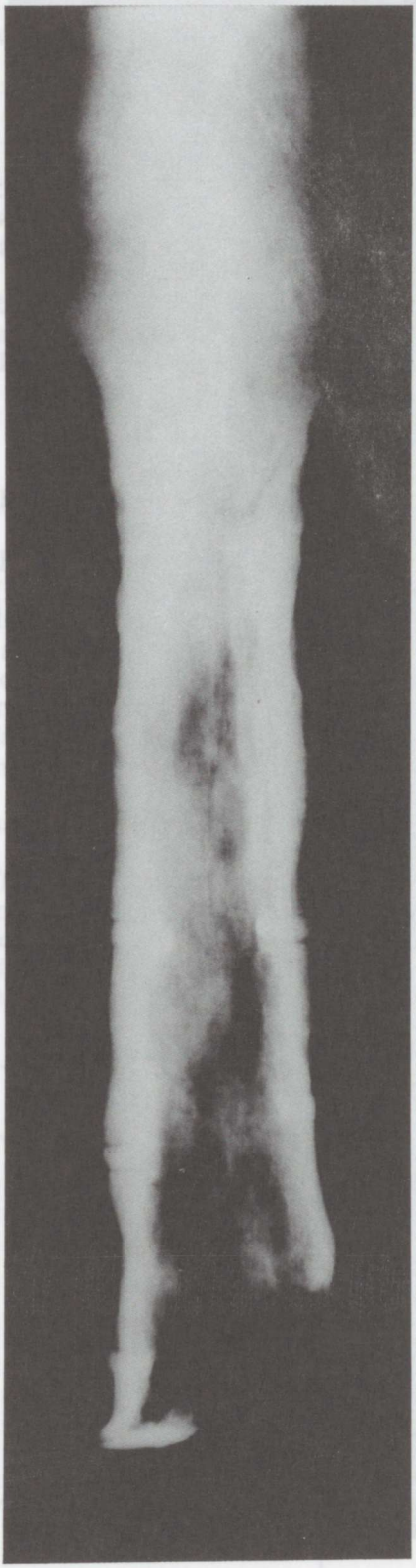
1 The Kärneri spearhead (AIK 46:1).

2 Remains of copper rivets on the socket of the Kärneri spearhead.

PLATE II



1 X-ray of the Kärneri spearhead.



2 X-ray of the socket of the Kärneri spearhead.

The X-ray examination in Sweden in April 1995

Because of the traces of possible copper on the socket the spearhead was taken for further examination to Stockholm. As this was the only spearhead in the Estonian collection showing such divergences the spearhead was of special interest.

On the X-ray plate clear traces of another metal were visible on the socket (Plate II, *1*). The traces also formed regular transverse stripes with three visible dots on one side and two on the other side (Plate II, *2*). The blade showed a pattern-welding with thin stripes. The Kärneri spearhead appeared very similar to X-rays of Swedish I-type spearheads.

The microscopical examination

After the X-rays the Kärneri spearhead was taken for further investigation to the Conservation Institution of the Central Board of National Antiquities in Stockholm. It was studied under a microscope and on both sides of the socket remains of several copper rivets could be seen. Additionally vague traces of silver were established.

In this way the combination of X-rays and microscopical examination revealed the first I-type spearhead from Saaremaa.

THE I-TYPE SPEARHEAD

The I-type spearhead is, according to Petersen's typology of 1919, a spearhead with rivets of "bronze" on the socket. Normally there are 11 rivets, but sometimes 15. Significant is also a long socket and a narrow blade with a well marked mid-rib and a smoothly rounded transition between the socket and the blade (Petersen, 1919, p. 31). Sometimes the sockets are decorated with inlaid stripes of bronze or silver. There is also a transitional type falling between the F- and I-type spearheads (Petersen, 1919, p. 31). According to Petersen the I type dates back to the first half of the 10th century and was considered by him to be a short-lived type (Petersen, 1919, p. 31).

In the 1980s another Norwegian scholar, Bergljot Solberg, made a new classification of the Iron Age spearheads in Norway. This time the spearheads of type I were divided into two subgroups. The F-I variety of spearheads was referred to group VII.1B and the spearheads of type I with narrow blade, to group VII.2A (Solberg, 1984, pp. 79 ff.). The latter group included spearheads both with and without shoulders (Solberg, 1984, p. 85). Solberg also stressed that the I-type spearheads existed throughout the 10th century and consequently were not as short-lived as Petersen once stated (Solberg 1984, p. 159).

After having studied a considerable number of spearheads in the area around the Baltic Sea I can conclude that there are several variants of type I, and this may have an impact on the chronological statements made so far, at least as far as Sweden and the Baltic area are concerned. The spearheads of type I may have been in use longer in these areas. It seems inadequate to me to use too narrow classification in this case. Two different groups are not enough. In my opinion at least three groups ought to be distinguished among the I-type spearheads: the first group consisting of the F-I type, the second of the spearheads with narrow blades and without shoulders, and the third an I-K variant with shoulders. Some of the I-type spearheads resemble the spearheads of K type. The same was also stressed by Lena Thålin-Bergman in her study of the Birka material (1986, p. 18). Petersen also pointed out the similarity between these types, but emphasized

some divergences such as the absence of the rivets on the spearheads of K type (Petersen, 1919, p. 31). This can also be the reason why Selirand referred the spearhead from Kärneri in Pöide parish (AIK 46:1) to the K type or, more precisely, to group II B according to his own typology (Selirand, 1975, list, spearhead No. 78).

The Kärneri spearhead is a stray find (Saaremaa..., 1924, p. 102) and thus cannot be dated by its context. Selirand dates it to the 11–12th centuries (Selirand, 1975, list). Petersen dates the K-type spearheads to the later part of the Viking Age (Petersen, 1919, p. 33), by which he means the 10th or 11th centuries. Irrespective of the type of determination of the Kärneri spearhead, Selirand's dating therefore seems to be too late.

The distribution of I-type spearheads in the northern Baltic region in general

The I-type spearheads are rare in the eastern part of the Baltic Sea region but more common in the west. The distribution of the I-type spearheads is as follows: 1 in Belarus (Ленцъ, 1908, table XXI, E693; Кирпичников, 1966, p. 84, No. 332), 1 in Finland (Kivikoski, 1973, plate 98, figs. 857 and 857a; Lehtosalo-Hilander, 1983, p. 238, Fig. 1), 1 in Estonia, 3 in Latvia (Антейнс, 1973, p. 82 Fig. 28; Atgāzis, 1990, 8.att, No. 9; Atgāzis, 1992, 5.att., No.14) and between 25 and 30 in Sweden (Arbman, 1940, plates 7 and 9; Thålin-Bergman, 1983, p. 275, Fig. 14; 1986, p. 17). Outside the investigated area the I type is common also in Norway (Solberg, 1984, p. 85).

The Swedish spearheads of type I vary, both in shape and in the decoration of the socket. The specimens from the eastern side of the Baltic are all of the same kind with a geometrical ornamentation in silver and copper on the socket. They are also similar to some of the Swedish I-type spearheads, for instance the spearheads from Valsgärde, Gamla Uppsala (Lindquist, 1956, Fig. 7 Valsgärde 12) and from Gothem parish on Gotland (Thålin-Bergman, 1983, p. 275, Fig. 14).

The interpretation of the distribution pattern is a complicated matter. Why so few in the east and so many in the west? It is interesting that the distribution pattern to a certain extent is similar to that of the E-type spearheads with geometrical silver decoration on the sockets: none in Russia, 1 in Finland (KM 29097, Pukkisaari, Jaala parish, southern Savolax, oral information from Timo Miettinen), 1 in Estonia (AIK 499, Kaarma, Saaremaa; Selirand, 1975, list No. 26), 2 in Latvia (A 8942:3, Salaspils, Riga region; Антейнс, 1973, p. 116; LVI 250:64, Dreņģeri-Čunkāni, Bauska; Atgāzis, 1992, p. 28) and again several in Sweden. The find places inside each country also correspond more or less to those of the I type, except for Finland where they are in different regions.

The distributional pattern cannot be explained as reflecting differences in burial customs, which would be the normal way out of the problem. Another traditional view would be to understand this matter in terms of the incompetence of the eastern people to make high-quality spearheads, i.e. of I type. This statement is a crucial issue which has to be touched upon sooner or later. Without question these spearheads represent an advanced kind of handicraft, especially the silver decorated ones, but we cannot exclude that skillful smiths worked on the eastern side of the Baltic Sea.

The uneven distribution seems rather to be a question of supply and demand. The geometrical style and the rivets along the socket, which are characteristic of this particular spearhead, were perhaps more in demand in certain regions than in others. These regions may also have been the production area for this kind of spearheads.

In this respect, the similarity shown by the eastern specimens and, in turn, their similarity to some of the Swedish spearheads is particulary interesting. Perhaps a closer look at the find places and find circumstances may contribute to a further understanding of this problem.

Find places and find circumstances

The Belarus spearhead (State Department of Foreign Eastern Antiquities of the Hermitage 4183) is a stray find from Myskova gora in Volkovysk. It was found in 1885 and no further information is available (Archive of the Hermitage of St. Petersburg). Volkovysk is situated southwest of Minsk in Belarus. Strictly speaking, this spearhead is not within the area of investigation.

The Finnish spearhead (KM 15434:1) is a stray find from Käärmekallio in Raisio parish. Raisio is situated close to the western coastline, in the area of Turku, with a direct connection to the Baltic Sea.

The Estonian spearhead of I type (AIK 46:1) is, as earlier mentioned, a stray find. The find place Kärneri is not far from the village of Tornimäe, which is considered to have been a harbour place during the Viking Age (Archive of the Institute of History, Tallinn). Tornimäe is situated on the eastern coast of Saaremaa not far from the hill-fort of Pöide.

One of the Latvian spearheads (A 8943:1) is from Laukskola in Salaspils in the Riga region. This spearhead is a grave find (inhumations). The other Latvian I-type spearheads were found in Dreņģeri-Čunkāni in the region of Bauska in southern Latvia. One of these (LVI 250:336) is a stray find within a cemetery, while the other one (LVI 250:64) is a grave find (inhumations). Both places in Latvia are situated close to rivers, accessible to seafarers of that time. Large hill-forts are also represented in these areas.

Distribution and find places

The eastern find places appear to be "easily accessible" places. Only the Belarus specimen makes an exception. This phenomenon, together with the obvious scarcity of the I type in the eastern region and the great number in the western part of the Baltic Sea area, seems to indicate that they are imported products. But who carried out the trade? There are two possibilities, either it was done by a Scandinavian travelling eastwards or a person from, for instance, Saaremaa travelling westwards. The former is the general view among the scholars so far, but the latter one must also be considered as possible.

The interpretation of the I-type spearheads east of the Baltic Sea as imports leads to a further speculation on the production place or places. For the moment it is not possible to penetrate this question further since the investigation is in process. But due to the differences among the Swedish spearheads of I type one may presume that several production places once existed or maybe the spearheads were produced over a long period of time. In this respect both Gotland and the Mälar region may come into question.

Another interpretation of the scarcity in the east could be that the geometrical style itself was not popular or accepted among the people. This is strengthened by the scarcity also of E-type spearheads with geometrical silver decorations.

The similarity among the "exported" spearheads could point to a certain chronological conformity or a common origin. This will be further examined in the near future.

WHY THE RIVETS?

The rivets are an interesting issue. Well preserved spearheads of I type show the real shape of the rivets. On these spearheads the rivets stick straight out from the side of the socket (Fig. 2).

Was the function of the rivets practical, symbolic, or were they just decorative details?

Fig. 2. A Swedish spearhead of I type (Dalhem sn, Gotland SHM 5352). From the side of the socket. Drawing by Olof Sörling, ATA.

Firstly the rivets could have had a function as holders of the wooden shaft. But why so many then? Shafts on other types of spearheads have been fastened with only two rivets close to the mouth of the socket. The rivets could also have had a practical function to prevent the spearhead from penetrating too deep into the hunted animal or the enemy. The shape of the spearhead itself indicates such an interpretation. The I-type spearheads have narrow blades and not very thick sockets. This could easily disappear into the victim and the rivets stopped this from happening.

The symbolic function is suggested by the frequent appearance of rivets on the socket in an uneven number. This might have had a special meaning for its user. An uneven number may have brought good luck when its user faced difficulties. The symbolic meaning may also have been connected with status. The I-type spearhead may have belonged to a selected group within the society and few people had access to this kind of spearhead. In other words it may have been very exclusive to own a spearhead with rivets on the socket.

The decorative aspect is likely to have existed independently of other kinds of function. On well preserved spearheads of I type it is possible to understand this side also, especially as the copper rivet is often placed in the middle of a silver or copper plate in a rectangular rhombic shape (Fig. 2).

SUMMARY

The X-ray method is of great value in analyses of spearheads. It can be used independently of the condition of the specimen, which means that also spearheads in poor condition may be investigated. The method brings us inside the object, which may reveal information of importance. The X-ray method is also important from the typological and chronological points of view. Details may come out which otherwise never would have been possible to discover.

Moreover, through the X-ray method an I-type spearhead in Estonia was discovered. The I-type spearheads seem to have played a special role in the society. It was a spearhead which was accessible only to a limited group and apparently not common in the eastern regions. The few specimens found in the eastern part of the Baltic Sea area may have represented a curiosity within the leading group in the society, perhaps once a valuable gift from somebody important to someone of importance.

ACKNOWLEDGEMENTS

The author wishes to thank Mrs. Ülle Tamla and Mrs. Nelli Dvorjadkina, who kindly translated the summaries into Estonian and Russian.

REFERENCES

Arbman, H. 1940. Birka I. Die Gräber. Stockholm.

Atgāzis, M. 1990. Pētijumi Čunkānu-Dreņģeru kapulaukā un aizsardzības izrakumi Plūdoņu II apmetnē. – In: Zinātniskās atskaites sesijas materiāli par arheologu un etnogrāfu 1988. un 1989. gada pētījumu rezultātiem. Rīga.

Atgāzis, M. 1992. Pētijumi Dreņģeru-Čunkānu kapulaukā un pārbaudes izrakumi Stelpes Berķu Kaupusalā. – In: Zinātniskās atskaites sesijas materiāli par arheologu 1990. un 1991. gada pētījumu rezultātiem. Rīga.

Kivikoski, E. 1973. Die Eisenzeit Finnlands. Helsinki.

Lehtosalo-Hilander, P.-L. 1983. Viking Age spearheads in Finland. – In: Society and Trade in the Baltic During the Viking Age. Visby.

Lindquist, S. 1956. Från Upplands forntid. En kort vägledning genom Uppsala Universitets Museum för nordiska fornsaker. Uppsala.

Petersen, J. 1919. De norske vikingesverd. En typologisk-kronologisk studie over vikingetidens vaaben. Kristiana.

Saaremaa ja Muhu muinasjäänused. 1924. – Tartu Ülikooli Arheoloogia kabineti toimetused II. Tartu.

Selirand, J. 1975. Estnische Gruppe der nordeuropäischen Lanzenspitzen mit damaziertem Blatt. – Eesti NSV TA Toim. Ühiskonnateadused, **24**, 2, 171–187.
Solberg, B. 1984. Norwegian spearheads from the Merovingian and Viking period. Bergen.
Thålin-Bergman, L. 1983. Järn och järnsmide för hemmabruk och avsalu. – In: Gutar och Vikingar. Stockholm.
Thålin-Bergman, L. 1986. Übersicht der Speerspitzen von Birka. – In: Birka II:2. Systematische Analysen der Gräberfunde. Stockholm.
Антейнс А. 1973. Дамастская сталь в странах бассейна Балтийского моря. Рига.
Кирпичников А. Н. 1966. Древнерусское оружие, II. Москва–Ленинград.
Ленцъ Э. 1908. Альбом изображений выдающихся предметовъ изъ собранія оружія. С.-Петербургъ.

Abbreviations

A = Archaeological Department, History Museum of Latvia, Riga
AIK = The collection of Kuressaare at the Institute of History, Tallinn
KM = Kansallismuseo, Helsinki
LVI = Latvian History Institute, Riga
SHM = Statens Historiska Museum, Stockholm
UMF = Uppsala Universitets Museum för nordiska fornsaker, Uppsala

RÖNTGENUURINGUGA MÄÄRATUD I-TÜÜPI ODAOTS

Kristina CREUTZ

1995. aasta kevadel valiti röntgenuuringuks Eestist ja Rootsist välja ligi paarsada noorema rauaaja odaotsa. Eesti odaotsad pärinesid Ajaloo Instituudi, Eesti Ajaloomuuseumi ja Viljandi muuseumi arheoloogilistest kollektsioonidest, Rootsi relvad olid Stockholmi Ajaloomuuseumi, Visby ja Uppsala muuseumi kogudest. Analüüse finantseeris Berit Wallenbergi fond ja need tehti Rootsis Huddingenis, kus asub Põhjamaade tuntuim tööstuslikke röntgenuuringuid teostav firma STK Inter-test.

Tänu hästi õnnestunud röntgenülesvõtetele määrati Eesti leidude hulgast üks odaots I-tüüpi (tahv. I, II). Selle viletsas seisukorras odaotsa välisel vaatlusel on putkeosal näha ebamääraseid vasejooni (tahv. I, *2*). Juhuleiuna Saaremaalt Kärneri külast (joon. 1) saadud relv on **esimene teadaolev I-tüüpi odaots Eestis**. Et seda tüüpi odaotsad on Läänemere idakalda maades haruldased, siis pakub Kärneri leid arheoloogidele erilist huvi.

Nagu kõigil uurimismeetoditel, on ka röntgenuuringul oma head ja halvad küljed. Kõige positiivsem on asjaolu, et röntgenuuring on leidudele täiesti kahjutu. See peaks eelnema konserveerimisele, sest üksnes nii saab avastada eseme silmaga nähtamatuid kahjustusi ja hapraid kohti. Ühtlasi on sellest hindamatu abi leiu säilitamisel.

Röntgenuuringut saab teha sõltumata leiu seisukorrast. Näiteks võib eriti halvas seisundis odaotsi uurida isegi ilma neid puudutamata ja leiukarbist välja võtmata. Ainus tingimus on, et magasineerimiskarp, millega koos leidu röntgenis läbi valgustatakse, ei sisaldaks metalli.

Odaotste röntgenuuringu komplitseeritus on seotud kõige enam leidude enestega, täpsemalt nende paksuse ja tihedusega. Need tegurid on eriti olulised kvaliteetse röntgenipildi saamiseks. Viletsa pildi kasutamine on peaaegu mõttetu, sest sellelt saadaval informatsioonil puudub usaldusväärsus. Ehkki röntgenifilmi

hind on üsna kõrge ja uuringud ise kallis ettevõtmine, tuleb ideaalseks pidada ülesvõtete tegemist ühe leiu kaupa.

Röntgeniülesvõte aitab arheoloogil paremini mõista sepatöö üksikasju ning teha kindlaks relva valmistanud meistri töövõtted ja oskused. Selles seoses on odaotste valmistamise juures eriti oluline informatsioon, mille saab lehest ning lehe ja putke üleminekuosast.

Norra arheoloogi Jan Peterseni 1919. aastal avaldatud tüpoloogia järgi on I-tüüpi sellised odaotsad, mille putkel esinevad pronksneedid. Niisugused odaotsad dateeris ta 10. sajandi esimesse poolde, pidades seejuures nende käibelolekut lühiajaliseks.

1980. aastatel koostas teine norralane Bergljot Solberg Norrast leitud rauaaja odaotste uue klassifikatsiooni. Selles on I-tüüpi odaotsad jagatud kahte alagruppi. Solberg rõhutas, et seesugused odaotsad olid kasutusel läbi kogu 10. sajandi ja seetõttu polnud nad nii "lühikese elueaga", nagu väitis Petersen.

Pärast seda, kui olen uurinud arvukalt odaotsi Läänemerd ümbritsevates maades, võin tõdeda, et siin esineb mitmesuguseid I-tüüpi odaotste variante, mis on võinud põhjustada erinevusi dateeringutes. Seetõttu näib mulle siiani kasutatud klassifikatsioon liiga kitsas ja ebapiisav. Lähtuvalt oma tähelepanekutest eristaksin I-tüüpi odaotste hulgas vähemalt kolme rühma. Mõnede I-tüüpi odaotste sarnasus K-tüübi omadega võib olla põhjus, miks Jüri Selirand pidas Kärneri odaotsa just K-tüüpi, täpsemalt tema enda tüpoloogia järgi II B rühma kuuluvaks.

Et Kärneri odaots on juhuleid, on selle dateerimine komplitseeritud. Selirand on leiu dateerinud 11.–12. sajandisse. Petersen dateeris K-tüüpi odotsad hilisviikingiaega, mis tähendaks 10. või 11. sajandit. Hoolimata Kärneri odaotsa tüübimäärangust, on minu arvates Seliranna dateering liiga hiline.

I-tüüpi odaotsad on Läänemere idakaldal haruldased, päris tavalised aga läänekalda maades. Kui Rootsis esineb erisuguse lehekuju ja putkeornamendiga I-tüüpi odaotsi, siis kõigil idakaldalt teadaolevatel leidudel on putkel hõbeda ja vasega geomeetriline ornament.

I-tüüpi odaotste levikupilt on komplitseeritud küsimus. Miks on neid teada nii palju läänes ja nii vähe idas? Huvitav on märkida, et nende levik on mõneti sarnane putkel geomeetrilise ornamendiga kaunistatud E-tüüpi odaotste omaga. Odaotste levilat ei saa seletada matusekommete erinevusega ega sepatöö kõrge tasemega üksnes läänes. Pole välistatud, et meisterlikud sepad töötasid ka ida pool Läänemerd.

Odaotste ebavõrdset levikupilti kahel pool merd võiks seostada pakkumise ja nõudmisega. Võimalik, et geomeetriline ornament odaotsa putkel oli mõnes piirkonnas rohkem nõutud kui teises. Idapoolsed odaotste leiukohad on kergesti ligipääsetavates kohtades. See asjaolu koos I-tüübi haruldusega ida pool ja arvukusega lääne pool merd, näib osutavat, et seesugused odaotsad olid importkaubaartikliks. Milline võis olla aga neetide roll odaotstel – kas praktiline, sümboolne või üksnes dekoratiivne? Autor ei eita ühtegi neist võimalustest.

ОПРЕДЕЛЕНИЕ ПРИНАДЛЕЖНОСТИ НАКОНЕЧНИКА КОПЬЯ К ТИПУ *I* РЕНТГЕНОВСКИМ МЕТОДОМ

Кристина КРОЙЦ

Весной 1995 г. был сделан рентгеновский анализ около двух сотен наконечников копий раннего железного века из Эстонии и Швеции. Эстонские экземпляры были отобраны из археологических коллекций Института истории, Исторического музея Эстонии и Вильяндиского музея,

шведские – из собраний Исторического музея Стокгольма, из музеев Висбю и Уппсала. Исследования финансировал Фонд Берита Валленберга, проведены они были в Худдингене (Швеция), где находится известнейшая в Северных странах фирма STK Inter-test, специализирующаяся на рентгеновских исследованиях промышленных объектов.

На хорошо удавшихся рентгеновских снимках определили среди эстонских экземпляров один наконечник копья типа *I* (табл. II), который был найден в дер. Кярнери на о-ве Сааремаа (рис. 1). Этот наконечник копья был в плохом состоянии (табл. I, *1*), но при внешнем осмотре на его втулке просматривались плохо различимые глазом следы меди (табл. I, *2*). Поскольку это **первый наконечник копья типа *I*** из известных в Эстонии, вполне понятен особый интерес к нему археологов.

Рентгеновский анализ, как и другие методы исследования, имеет свои плюсы и минусы. Его положительные стороны – абсолютная безопасность просвечивания для находки, уникальная возможность выявить в ней невидимые глазу повреждения и хрупкие места. Устранив обнаруженные недостатки, можно передать вещь на консервацию в целости и сохранности. Можно даже утверждать, что рентгеновское исследование должно предшествовать консервации.

Рентгеновский анализ можно проводить вне зависимости от состояния находки. К примеру, наконечники копий очень плохой сохранности можно исследовать даже не прикасаясь к ним, т. е. не вынимая из коробки. Единственное условие – коробка, которая вместе с находкой просвечивается рентгеновскими лучами, не должна содержать какие-либо металлические детали.

Осложнения при рентгеновском изучении наконечников копий связаны прежде всего с самими находками, точнее с их толщиной и плотностью. От этих характеристик зависит качество рентгеновских снимков. Работа со снимками плохого качества просто теряет смысл, поскольку получаемая информация неблагонадежна. И хотя цены на рентгеновские фотопленки высокие да и само проведение исследований дело дорогое, идеальным было бы иметь снимки каждой находки.

Рентгеновские снимки помогают археологам разобраться в деталях кузнечной работы, установить приемы и навыки оружейных мастеров. Так, информация о пере и месте перехода втулки в перо позволяет воссоздать картину изготовления всего наконечника копья.

Согласно типологии норвежского археолога Я. Петерсена, опубликованной в 1919 г., к типу *I* принадлежат такие наконечники копий, на втулке которых выступают бронзовые заклепки. Такие наконечники копий он датировал первой половиной 10 в. и считал, что они имели хождение недолгое время.

В 1980-е годы другой норвежский ученый – Б. Сольберг – составил новую классификацию найденных в Норвегии наконечников копий железного века. В ней наконечники копий типа *I* разделялись на два подтипа. Б. Сольберг подчеркивал, что такие наконечники копий были в употреблении на протяжении всего 10 столетия, т. е. их "жизнь" была долговечнее, чем предполагал Я. Петерсен.

После того, как через мои руки прошло множество наконечников копий из стран региона Балтийского моря, я пришла к выводу, что мы имеем дело с различными вариантами наконечников копий типа *I*, и в этом причина расхождений в датировках. По моему мнению, рамки используемой сейчас классификации слишком узки и размыты. Исходя из своих наблюдений, я бы подразделила весь материал типа *I* по меньшей мере на три группы. Схожесть некоторых наконечников копий типа *I* с типом *K* и стала причиной того, что Ю. Селиранд отнес кярнериский

вариант наконечника копья к типу *K*, точнее, согласно его собственной типологии, к группе II*B*.

Поскольку наконечник копья из Кярнери – находка случайная, определение его возраста вызывает сомнение. Ю. Селиранд датировал находку 11–12 вв. Я. Петерсен датирует наконечники копий типа *K* поздневикинговским временем, т. е. 10 или 11 столетием. Несмотря на типовое определение наконечника копья из Кярнери, по моему мнению, датировка Ю. Селиранда завышена.

Наконечники копий типа *I* на восточном побережье Балтийского моря попадаются довольно редко, тогда как на его западном побережье встречаются в большом количестве. Если в Швеции вид пера и орнамент на втулке у наконечников копий типа *I* весьма разнообразны, то у всех известных находок из стран восточного побережья втулка покрыта серебром или медью с геометрическим орнаментом.

В связи с картиной распространения наконечников копий типа *I* возникает немало вопросов. Почему их так много в западной части и так мало в восточной? Почему в местах их распространения часто попадаются наконечники копий типа *E*, втулка которых украшена геометрическим орнаментом? Объяснить эти странности тем, что существовали разные обычаи захоронения, или тем, что высококлассные мастера работали именно на западе, нельзя. Разве правдоподобно, что в странах восточного побережья Балтийского моря не было искусных кузнецов?

Неравномерное распространение наконечников копий по обе стороны Балтийского моря можно увязать с разным спросом, а следовательно, и разным предложением. Вполне возможно, что наконечники копий со втулкой, орнаментированной геометрическим узором, пользовались в одной округе большим спросом, чем в другой. "Восточные" наконечники копий находились в легкодоступных местах. Это обстоятельство, а также малочисленность находок типа *I* на восточном побережье и большое их количество на западном подводят к выводу, что наконечники копий могли быть статьей импорта. Остается без ответа и назначение заклепок на втулке – практическое, символическое, декоративное? Я не исключаю ни одно из них.