KNIVES FROM EKETORP.

An evidence of the growing influence of the centralized production
from medieval town communities

by Birgit Arrhenius

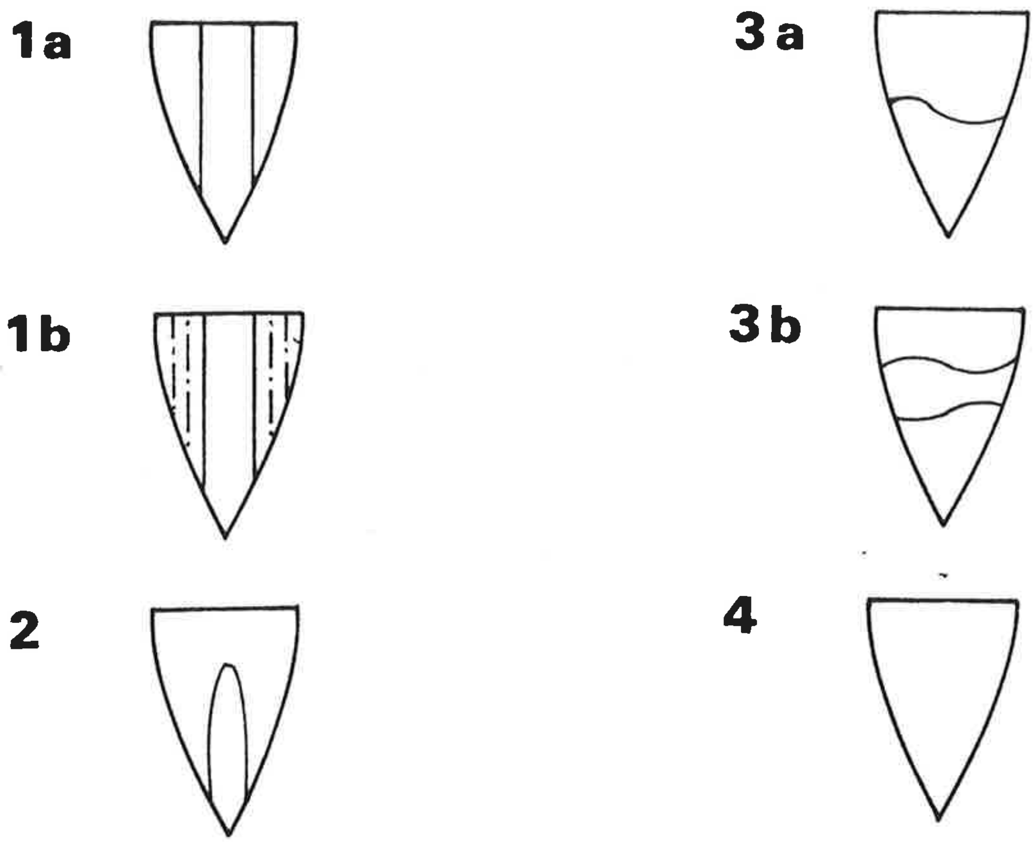


Fig 1. Construction type classification of knives according to different manufacturing processes.

1a. An inserted edge running through the entire knife and with a layer on either side. Each layer and side layers have different carbon content. .

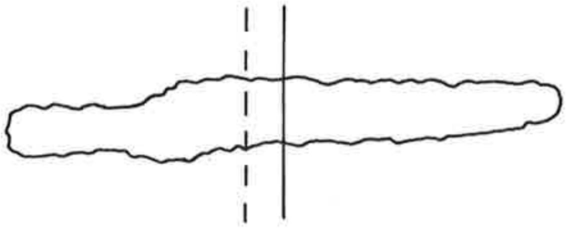
1b. Same as 1a, but the side pieces consist of several layers.

2. An inserted edge which does not run through the entire knife, i. e. the side layers are welded together at the ridge without an edge between them.

3a. The knife is welded together consisting of a ridge and an edge part with a trans-verse weld.

3b. The same as 3a, but with 2 transverse welds.

4. A homogeneous knife without any visible welds.



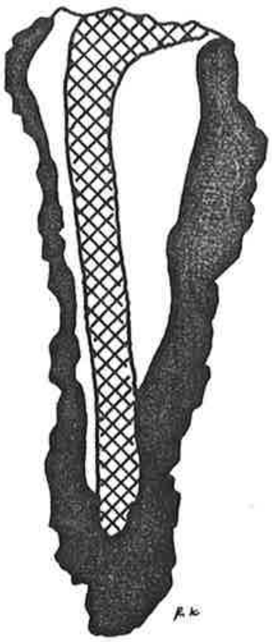


Fig 2. K 2, N 19, Fnr 64.
A through-going insertion with martensitic structure somewhat shifted towards one side of the knife of the knife. There are parallel slag strips along the weld joint on the broad, ferritic side of the insertion. Construction type 1. a. The knife, 1:1. b. A metallographic section, 10:1. c. A detail from the insertion. Microphoto 200:1.

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ABSTRACT

A total of 241 knives has been found at the medieval settlement at the Eketorp ring-fort e.g. Eketorp III.The knives seem to be evenly distributed all over the habitation area within the fort. Only one of the types, a knife with a curved edge, type B, has a more limited distribution. The reason probably being that it was a special tool, perhaps a tool for leatherworking.

The knives were examined and divided into types according to shape and size, e.g. type Aa, figs 2-6, Ab, figs 11-16 and 26, A2b, figs 17-18, Ac, fig 19-21, where A denominate knives with an accentuated tang and a straight or almost straight ridge and a, b, c the sizegroups. Type B is a knife with curved ridge, figs 22-23. Type C a razor with a raised tang, unique in Swedish material, and type D represent clasp-knifes, figs 24-25.

10 percent of the knives were analyzed for their metallographical properties.

The construction techniques found are shown in fig 1. It appeared that in type A, construction 1 was most used, in type Aa with a total dominance. In type Ab was also construction type 2 used and in type Ac were only construction type 2 and 3 found.

The closer examination of the length showed that type Ab and Ac had a certain standardization. This property in combination with the more complicated technical construction 2 and 3 may be evidences for that the production of these knives was centralized, e.g. produced in a medieval town community. For the big knife type Ac with construction technique 3, a Slavonic origin was proposed.

Introduction

A total of 241 knives and fragments of knives has been found at the medieaval settlement at Eketorp ,e.g. Eketorp III (cf Borg 1976). To distinguish different types of knives, the measures (length, width, thickness, and weight) were studied statistically, and all these criteria, together with other external form elements, make up the characteristics that form the basis of the type classification of the knives. A number of knives were then examined metallographically in order to find out whether the technical construction is in any way relevant to the external design.

In prehistoric times, a knife was probably chosen because of certain external characteristics since, for obvious reasons, no metallographic examination or merchandise description could be made. Therefore, the technical structural elements that are in any way relevant to the function of the knife should be reflected in its external design. On the other hand, the external design may, of course, not have shown technical variations reflecting the manufacturing traditions of different workshops.

Thus, the method of investigation was here dissimilar to the one previously recorded by Tomtlund (Tomtlund 1973), who maintains that a type classification should be based only on the technical construction of the knives.

The metallographical structural examinations carried on 10 per cent of the material recorded, i.e. 25 knives in all, show that the knives were made according to four different manufacturing methods, here accounted for in fig 1.

The metallographic examination was carried out in collaboration with ingeneer Roland Mellberg at the Archeological Research Laboratory, university of Stockholm.

When studying the external form elements of the knives, the material could be divided into 5 main types. Within these main types, the technical construction proved to have a comparatively regular variation.

Below are recorded the 5 main types, based on external form elements, and the metallographical structural examinations will be summarized within each type.

TYPE Aa

Type Aa (where A denominate a knife with an accentuated tang and a the general size) is a notably small knife, its total length varying between 6 - 8.5 cm. It has an accentuated tang, a narrow blade with a straight ridge and a width varying between 0.75 - 1.1 cm, and a thickness between 0.20 - 0.40 cm. The weight varies between 2 - 9 g.

22 knives in all have been ascribed to this group. Noteworthy for these knives is that a remarkably small number, altogether 6, i.e. less than 30 per cent, is more fragmented, i.e. their points are broken off. The edge, which is mostly next to straight, has in two cases been so much ground as to have attained a slightly concave shape. Otherwise, the knives do not display traces of intense wear, and in 4 cases the edges are almost completely intact. Five knives in this group have been examined metallographically (cf figs.2, 3,4,5 and 6). One of the knives analysed,(fig 4) was, however, so corroded that a clear interpretation of its structure could not be made. The others, displayed a plainly three-layered structure with, in the centre, an inserted strip of hardened steel, martensite, 0.9 mm thick, on either side surrounded by a layer of malleable iron.

The distribution of the small knives does not differ from that of knives in general, and therefore it does not seem probable that these knives represent a more specialized tool. The narrow edge makes it plausible that the knives were suitable for the carving of antler or bone, a handicraft that would seem to have been quite frequent during this period.

TYPE Ab

Type Ab comprises knives with a length of between 8 - 22 cm, the mean value, however, being 10.6 cm with a standard deviation of 1.5 cm. The small standard deviation shows that the distribution of the size of the knives is comparatively small, i.e. more than 50 per cent have a length of between 9 - 12 cm. The greatest width of the blade (provided the knife is not completely worn down) varies between 1.2 - 1.6 cm, and the greatest thickness of the blade between 0.25 - 0.8 cm. As a rule, the ridge of the blade is straight, but in nine cases (14 per cent) the ridge-line is angularly curved towards the point. In four cases this angular curve is slightly concave.

Type Ab is the most frequent knife at Eketorp. Altogether, 73 complete and 93 fragmentary knives of this type have been found. In this case, the number of fragmentary knives is thus considerably larger than in type 1. Another characteristic is the heavy wear of the edges of this type, the edge often having a concave shape. In all probability, the wear accounts for the great range of variation of the width of the blade.

Altogether 10 knives in this group have been examined metallographically. 4 knives (figs.7,8,9 and 10) proved to belong to construction type 1, i.e. knives with a steel strip inserted in the centre. The steel strip, which in two cases had retained its hardened martensitic structure, had a thickness of 1 mm. Of interest is the wave-shaped curve that the steel strip displays in three cases and which must be a result of the cold-forming done after the strip had been welded. In one case (fig 8), the inserted steel strip has a so-called Widmanstätten structure, i.e. the steel strip has been over-heated so that much of the hardness of the steel has disappeared. It would seem probable that this occured at the welding-together of the knife, and that, therefore, the knife should be regarded as an unsuccesssful specimen. Also, the knife shows very little wear.

In another case, the steel strip is also damaged since the steel consists of granular cementite (fig.10), a structure caused by dead-soft annealing followed by slow cooling. This damage, however, appears to be secondary, i.e. it might have occurred when the knife was being used since the knife shows clear traces of wear. It should also be pointed out that this knife belongs to construction type 1 b, i.e. the steel strip is surrounded by two layers of malleable iron.

As I have reported before (cf Arrhenius 1974, fig 2), construction type 1 can be distinguished as an external criterion of de-corroded knives, on which, by etching, the steel strip is visible in the ridge-line. It would seem probable that, in prehistoric times, this property was recorded in this way, i.e. the knife was used in the same way as other damascened objects, which had been polished and probably etched by means of urine or acetum.

For within group Ab there are also knives which are not characterized by this property, but which have only had a steel strip set into the edge, i.e. construction type 2. I have previously (Arrhenius 1974) had occasion to discuss this construction type in connection with a cross-section of such a knife from Helgö recorded by Tomtlund (Tomtlund 1973). On Tomtlund's cross-section, the strip is set into a u-shaped slit in the blade. I doubted at the time that the cross-section had been correctly reconstructed since I considered that this construction would have been technically difficult to perform. Further, I had noted that the tang was of another construction, where the steel strip was welded directly into a plane joint. The last-mentioned circumstance, as also the traces of slag incusions in the grinding section, made me suspect that the grinding section had been misinterpreted and that the knife had instead belonged to construction type 3, i.e. knives with a welded steel edge. When examining the Eketorp knives, I have once more had occasion to study this construction technique. In all cases where I have observed construction type 2, it has been constructed as a steel strip set between two layers of malleable iron, i.e. it is closely affiliated to construction type 1, but differs from it in that the steel strip is not continuous. A common characteristic has also been that the tang has had the same construction as the edge. It would therefore seem probable that this procedure is the correct reconstruction of construction type 2. In his account of the construction techniques for knives from Novgorod, Kolcin too, has recorded a construction of this kind (Kolcin 1957). In an earlier work (Kolcin 1953) he has, it is true, drawn the construction without marking a weld between the pieces of malleable iron, but this is probably due to a mistake, since, in the later work (1957), he draws this weld in all specimens. It may be difficult to observe welds between pieces of malleable iron of equal quality, and they require a particularly careful etching. It should, however, be pointed out that in a seminar essay, Jacobsson (Jacobsson 1977) shows that it is technically possible to join a steel edge to a piece of malleable iron with the aid of a u-shaped weld, since, however, as is apparent from the cross-sections made at Eketorp, it was difficult to make the welds firm without using too high temperatures and thereby damaging the steel as was the case with fig 8, it seems to me most probable that what was preferred was a technique using the power of the side layers to conserve the welding heat as well as to form two contect surfaces. It may also be noted that Jacobsson obtained a certain decarbonization when manufacturing a steel edge with a u-shaped weld.

In the metallographic examination, six knives of construction type 2 were found (figs.11,12,13,14,15 and 16). Since it has not been possible to de-corrode all the Eketorp knives, it is difficult to determine whether construction type 2 was as predominant at Eketorp as construction type 1 among knives of main type Ab. In the Birka material (cf Arrhenius 1988 in print), which I have had occasion to examine more closely with the aid of de-corroding, construction type 1 was the predominant technique. It may be, however, that we have here a successive chronological development from construction type 1 over 2 and on to 3, where the steel edge is welded on directly. Anyhow, this seems to have been the case at Novgorod, where construction type 2 does not occur until the 11th century to be succeeded by construction type 3. Interesting in this case is the find of a knife of type Ab from Eketorp, which on the ridge, has been provided with a copper plating in the form of crossed strips,cf fig.26. In this case it would seem quite clear that the knife must have been manufactured according to construction type 2 since, otherwise, the copper strips must have concealed the damascene.

In the find material from Lund, Thorvald Nilsson (Nilsson 1976, fig 196) records a copper-plated knife closely resembling the Eketorp knife. The knife from Lund was found in an occupation layer dated to 1020-1050. This dating corresponds well to Kolcin's dating (Kolcin 1959, fig 36) of construction technique 2, which he first records from Novgorod layer 20, dated to the 11th century.

Within knife type Ab, finally, there is a variant, here called A2b, the characteristic of which is that the ridge-line is bent angularly down towards the point; occasionally the angularly bent part has an almost concave recess. Of this variant, 9 knives in all have been found at Eketorp. This knife has not been classified as a type of its own since the angular bend can only be observed on complete specimens or where the point has been preserved and since, for the rest, the knife has no particular external characteristics. Two knives of this variant, figs.17 and 18, have been examined metallographically. They turned out to have been manufactured according to construction type 3, i.e. the edge had been welded on to the blade. The angularly bent ridge-line may have been caused by this welding process since a good grip was obtained with the forging tongs. The same knife form is recorded, for instance, in the Lund finds in an occupation layer dated to 1020 - 1050 (cf Nilsson 1976, fig 195). It is interesting that, according to Kolcin, the welded edge occurs at Novgorod only towards the 12th century (occupation layer 19). A considerably earlier dating of this technique is, however, found in the Slavonic fort Dessau-Mosigkau, where Pleiner (Pleiner 1967, p 175 ff) records knives manufactured in this technique from the 8th century. In this case, too, the knives seem to be provided with an angularly bent ridge manufactured in this technique, in which, however, the ridgepart, too, is made of martensitic steel.

TYPE Ac

Type Ac comprises broad knives, i.e. the greatest width of the blade is more than 1.6 cm. The most common width is 1.7 cm, and the broadest knife found is 2.35 cm. In other respects, these knives do not differ much from the type Ab. Thus, the average length is 11.4 cm, i.e. inconsiderably longer than that of type Ab. A result of the increased width of the blade is that the accentuation of the tang on either side is more distinctly marked. Moreover, there are in this type no instances of edges so heavily worn as those of type Ab, but this may be due to an error in cataloguing since the grinding, of course, has an immediate effect on the width of the blade. It is, however, generally found that at the very transition to the tang of type Ac, the accentuation has retained its width also after grinding. In all, 13 complete and 66 fragmentary knives of this type have been found. Thus, within this type, the number of fragmentary specimens is still larger than in type Ab. On account of their width, the knives have a considerable weight; the average weight of the complete knives is 21.5 g as compared to the 12.93 g of type 2.

Three knives of this type have been examined metallographically (figs.19,20 and 21). One knife, fig.19, was manufactured according to construction type 2, i.e. with a steel edge set between two bits of malleable iron. We get here a quite natural explanation of the emergence of this manufacturing technique. For the steel edge turns out to have the same volume as that of construction type 1. If steel pieces of about equal size were available, it is natural that, in the broader type 3 knives, the steel piece could only be inserted as a wedge whereas, in the narrower type Aa knives, it could go all through. The narrower the knife, the less the steel piece had to be hammered out to make it suffice - the thickest steel insertions are consequently found in type Aa, in which the steel insertion may be up to 2 mm thick, cf fig 3.

All the Eketorp knives belonging to Aa and Ab are considerably smaller than knives with a similar design from Novgorod. It is only in knives of type Ac that the size becomes fairly comparable. In this context, the metallographical cross-sections of figs.20 and 21 are interesting. They were selected so as to represent the largest knives of type Ac. The metallographical cross-sections showed that the construction of these knives was extremely complicated. A striking feature is, however, that the knives were heavily corroded, which partly made the study of the cross-sections difficult. The heavy corrosion indicates that, in this case, the iron material is of a kind different from what we have encountered before. The structure of the knives seems to be welded pieces of perlitic steel hardened to martensite. The welds between the steel pieces can be difficult to distinguish. The structure is very like that of the clasp-knives described below. Of importance is the possibility that the sheath mounts of Polish-East-Prussian type that have been found in the fort and which are to be described by Kaj Borg, (forthcoming,personal communictaion) are affiliated to these knives. In connection with the study of the knives from Dessau-Mosigkau, Pleiner describes knives characterized by a similar, complicated structure, which may be most correctly described as a genuine damascene (Pleiner 1967, p 188). It would seem probable that these knives and sheath mounts are imports from the Slavonic region in East-Prussia - Poland. If so, the type Ac knives which were manufactured in the simpler construction technique 2 would represent domestic imitations of the knives imported from there.

TYPE B

Type B is characterized by the fact that the knife has a curved ridge. A mapping of this type showed that, contrary to the others, these knives were found somewhat concentrated to the South Gate, indicating that they had a special function. In other respects, this knife is not of a very regular design; the length of the blade varies between 3 - 11 cm. The width is somewhat more stable with a variation range of 1.32 - 2.32 cm. The edge is quite straight throughout. The tang is accentuated towards the curved ridge, whereas the accentuation towards the blade seems to occur only on unworn specimens. In all, 15 knives of this type have been found. Out of these 15, 5 show an accentuation of the tang towards the blade while the others have been worn down so that tang and blade run in one line.

2 knives (figs 22 and 23) have been examined metallographically. They showed a fairly uniform construction, where the edge consisted of a piece of obliquely welded edge steel which, in fig 23 , had been hardened to martensite. The other parts of the knife consisted of perlite and ferritic perlite respectively, and on knife fig 22 a martensitic surface hardening could be observed all round. Probably this had been attempted with knife fig 23, too, but had failed since the carbon content was too low.

It is unclear what these knives were used for. That hardness was especially aimed at is apparent from the fact that they are altogether made of steel.

Tomtlund puts forward an interesting hypothesis concerning the use of knives of this type, namely that they could have served as polishing steels (Tomtlund 1973, p 61). However, the grinding of the edge of the knives dealt with here speaks against such usage. Neither have the modern polishing steels that he represents the straight, sharp edge which is characteristic of the Eketorp knives. Kolcin records a series of knives with curved ridge, but with a riveted tang, which, according to him, should have been used as razors (Kolcin 1957, p 68, fig 44). This application should probably be extended in that the knives might also have been used for leather work (removal of hair and scraping of hides). For such work, a stiff and, at the same time, sharp knife will probably have been needed. If so, this would explain the concentrated distribution of the knives within the fort since, owing to its smell, such leather work was often carried out at special places.

Knives of this type occur sporadically in the find material. Such knives were found in several Vendel graves. They have been found at Helgö as well as at Birka, cf Arrhenius 1988 in print. On the other hand, I know of no parallels from medieval finds.

TYPE C

Type C comprises only one small knife with curved edge and raised tang. In this case, it is most certainly a razor of the type recorded by Kolcin (Kolcin 1957, p 58, fig 45), and which he dates to the 14th century. This knife has not been examined metallographically since, as far as I have been able to find, it is unique in the Swedish material.

TYPE D

Type D consists of clasp-knives, 7 of which have been found in the fort. They are evenly distributed. Most of them consist of an almost rectangular blade of uniform thickness provided with a rivet-hole at one end. A couple of specimens have a narrow, small tang. In one case, the point of the blade has been furnished with the concave recess that characterized type 2 b.

Three knives were examined metallographically. As was the case with the big type Ac knives, corrosion was very heavy, and only 2 of the cross-sections could tell us anything definite about the construction technique. These two (cf figs 24 and 25) proved to be manufactured of perlitic pieces welded together, where probably two or three parts have formed a knife. In fig 25, the edge part was made of perlite with a large inclusion of ferrite, whereas the edgepart had been hardened to a martensitic structure. In fig 24, there were martensitic structures both in the edge part and along the side.

Pleiner records a clasp-knife from Dessau-Mosigkau in a layer belonging in the 8th century (Pleiner 1967, p 184). It is the earliest known clasp-knife from the Slavonic region. In Sweden, the first specimens occur at Birka. At Novgorod, clasp-knives are not known until the 14th century. According to Kolcin, these knives were used as razors (Kolcin 1957, p 57).

The clasp-knives found at Birka are from graves 129, 452, 456 and 506 (cf Arrhenius 1988 in print). These graves, all of which are cremations, seem, to judge by their content of buckles, to be male graves. The oldest seems to be grave 456, which belongs to the earliest Birka period judging from a buckle decorated in animal style. The latest is probably grave 452 which, with its plated buckle, should probably be dated to the late Birka period. The clasp-knives from Birka are smaller and somewhat more elegant than those recorded from Eketorp. Contrary to the Eketorp knives, they are also provided with a hole at both ends, i.e. they consisted of three parts. The central part has the same rectangular form as the pieces found at Eketorp, and the Eketorp knives may therefore have been more similar to those from Birka than is apparent now. In any case, the knives from Eketorp are totally different from those from Novgorod which have curved blades. The only thing combining these two types of knives is the clasp mechanism, which is, in both, one-sided, not two-sided as is the case with the Birka knives.

CONCLUSION

Most of the Eketorp knives here recorded consist of two pieces of malleable iron with a steel edge set in between them. These knives have a construction technique and a design found in the Scandinavian find material from the Late Iron Age. In the Eketorp material, however, we can note a certain standardization of the length in types Ab and Ac, where the length could be given with a standard deviation of 1.50 and 1.41 cm respectively. On the other hand, the weight showed considerably greater variations. The standardization of the length is a characteristic that distinguishes these knives from the prehistoric material, where, for instance, the knives from Helgö (Tomtlund 1973) display considerably greater variations. The standardization may be explained as a result of the medieval town community in which the knives were a mass-produced article, which was sold from the towns.

Quite divergent in metallographic structure is a number of large, broad knives of type Ac, and clasp-knives. These knives were probably imported. The large type Ac knives were probably connected with knife mounts of an East-Prussian-Polish type, which were found in the fort. The clasp-knives, too, seem to be an import from the Slavonic region. It is interesting that the imported knives were imitated in domestic manufacture, in which, however, the old manufacturing traditions were followed in the technical construction.

The knifes with a curved ridge were unique both as to construction technique and design. This knife was probably a special tool, possibly used for leather work (removal of hair and scraping of hides). The knife originates in the prehistoric find material.

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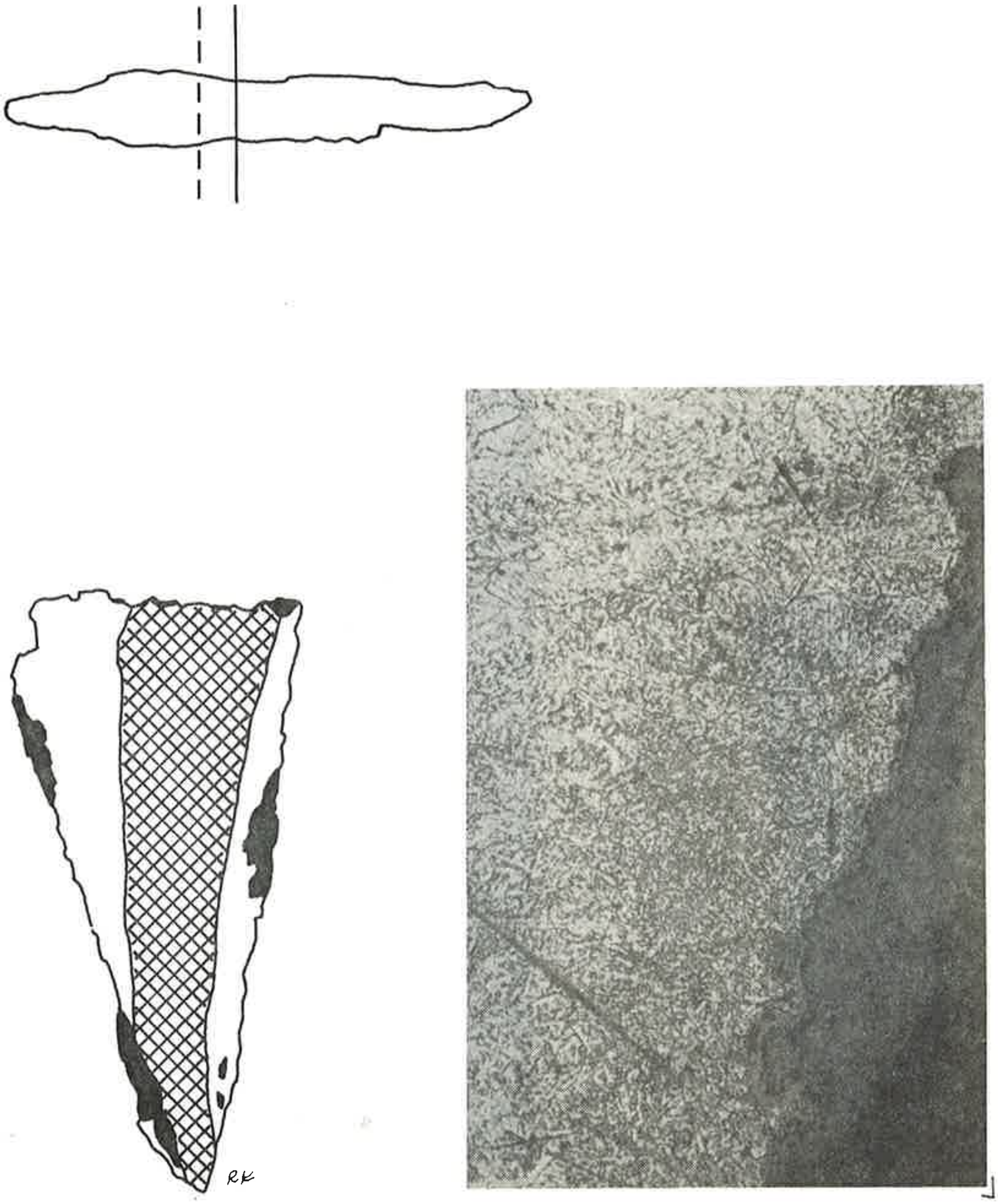
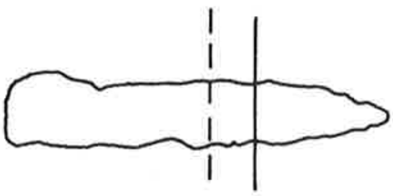


Fig 3,K 9, Aa 21, Fnr 77.
Small knife with a broad, through-going insertion of fine grained martensite. In the weld joint is seen a kind of "dotted line". The surrounding metal: ferrite-perlite. Construction type 1. a. The knife, 1:1. b. A metallographic section, 10:1. c. A detail from the insertion at the edge of the knife. Microphoto 200:1.



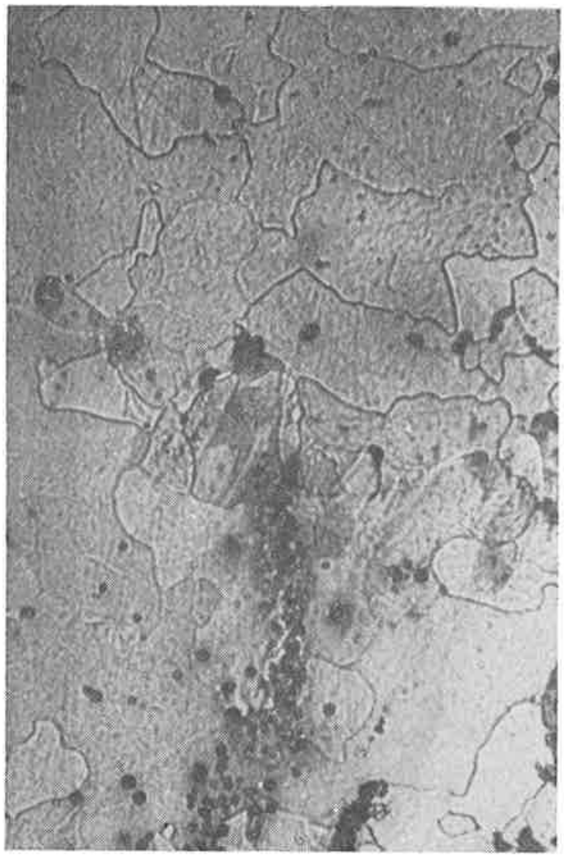


Fig 4.K 14, X 17, Fnr 46
The knife is heavily corroded. The remaining piece of metal in the centre of the knife is of ferritic structure. The manufacturing type is difficult to determine but does probably belong to construction type 1. a. The knife, 1:1. b. A metallographic section, 10:1. Detail from the upper part showing a ferritic structure. Microphoto 100:1.

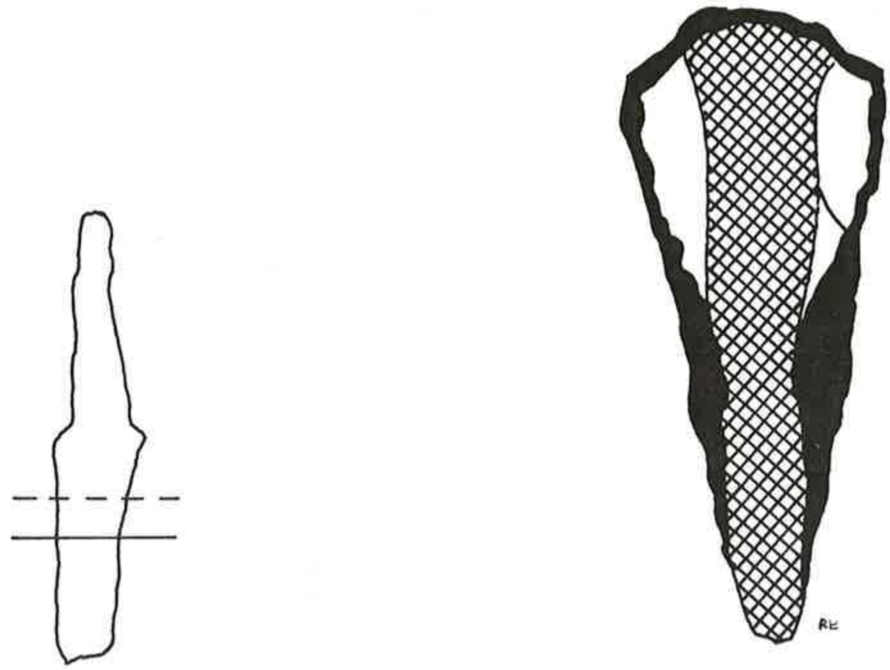


Fig. 5, K 21, R 15, Fnr 23.
Through-going, broad insertion of fine grained martensitic structure. The surrounding structure is ferrite. Construction type 1. a. The knife, 1:1. b. A metallographic section, 10:1.

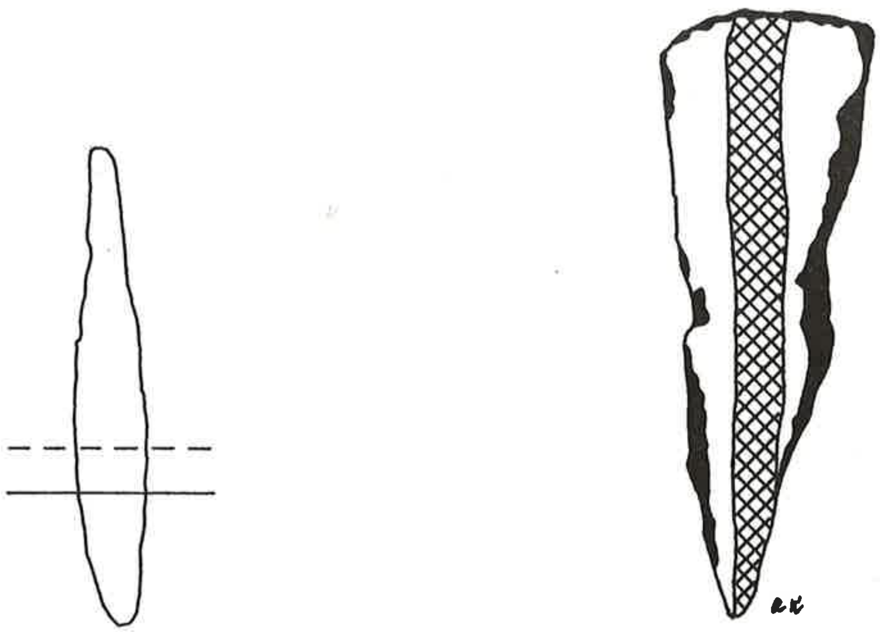
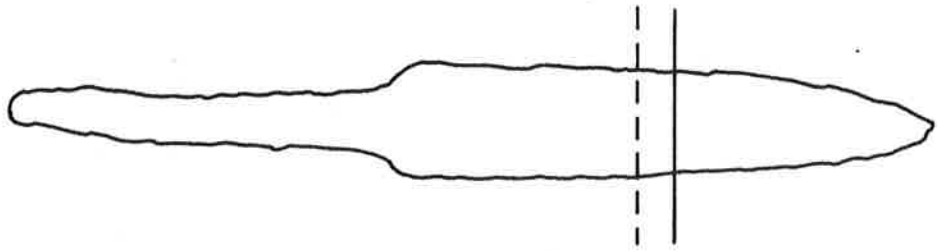
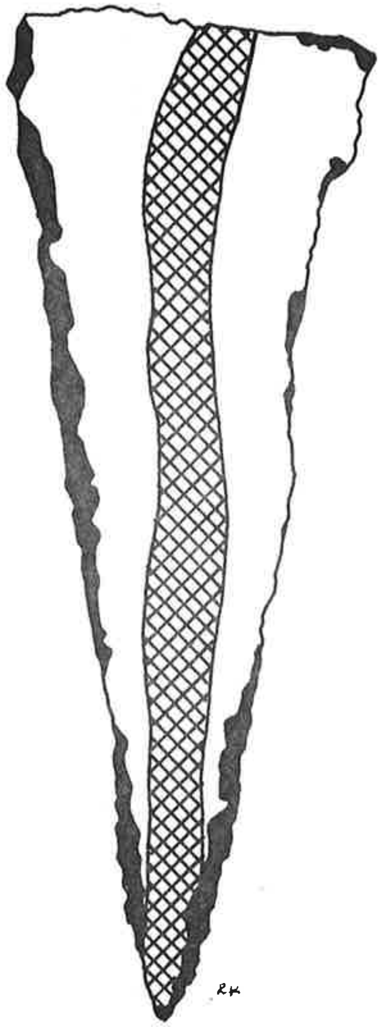


Fig 6. K 23, Q 16, Fnr 32
A small knife with a through going insertion of fine grained martensitic structure. Construction type 1. a. The knife, 1:1. b. A metallographic section, 10:1





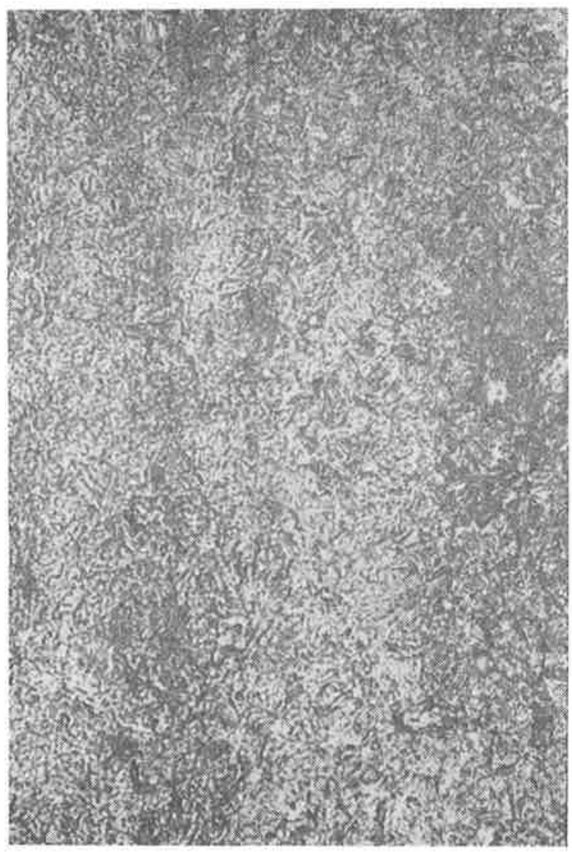


Fig. 7. K 5, G 20, Fnr 12.
Through-going insertion of fine grained martensite which, towards the ridge, becomes somewhat coarser. (Less hardened at the ridge.) Other parts of ferrite with some slag. The welding is well-made, and the joint wave-formed in a part in the centre of the knife. Construction type 1. a. The knife, 1:1. b. A metallographic section, 10:1. c. A detail from the insertion. Microphoto 200:1.

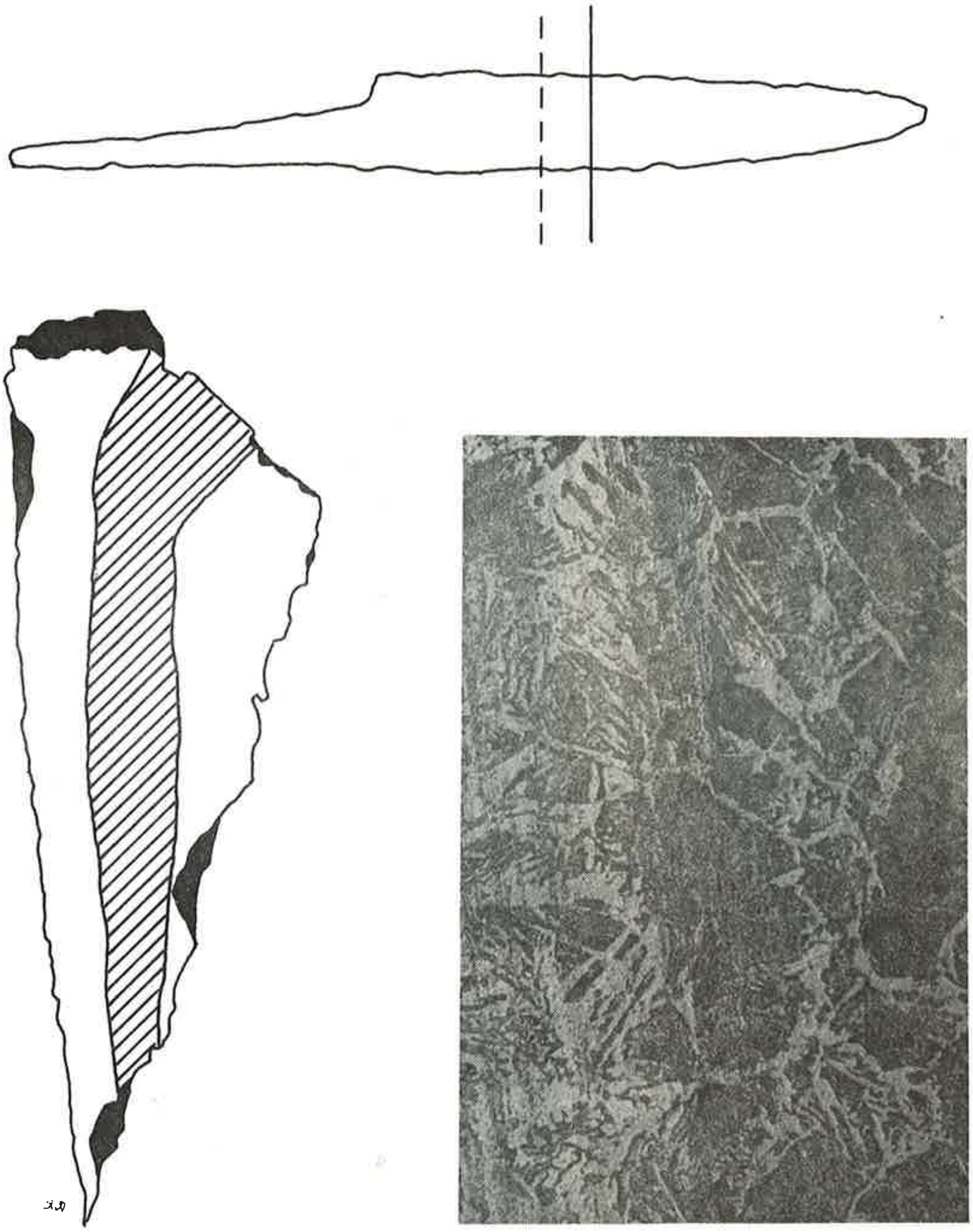
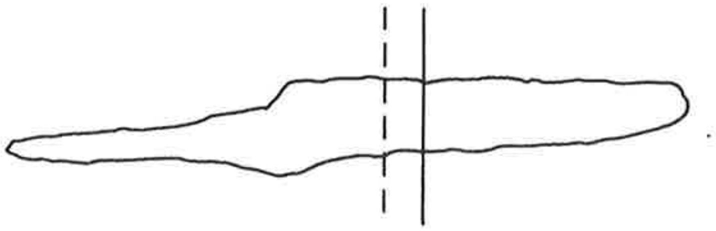
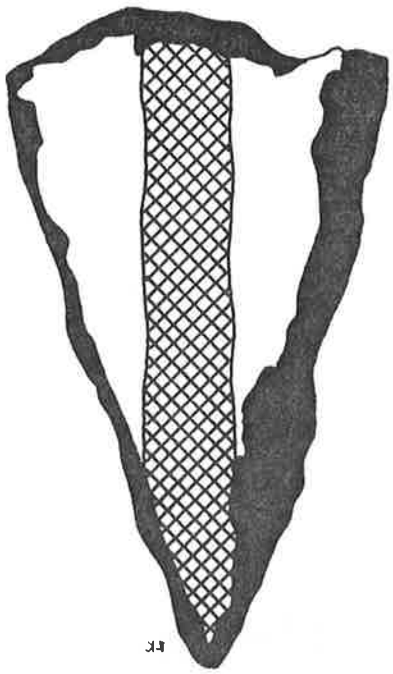


Fig 8. K 10, Y13, Fnr 101
A knife with a through-going insertion of Widmanstätten structure, characteristic of steel that has been heated to high temperatures. The insertion is bent at the ridge and the edge heavily worn . The surrounding structure is ferritic. On either side of the insertion in the middle of the surrounding ferrite there are slag strips, probably remains of further weldings. Construction type 1. a. The knife, 1:1. b. A metallographic section, 10:1. c. A detail showing the Widmanstätten structure. Microphoto 200:1.





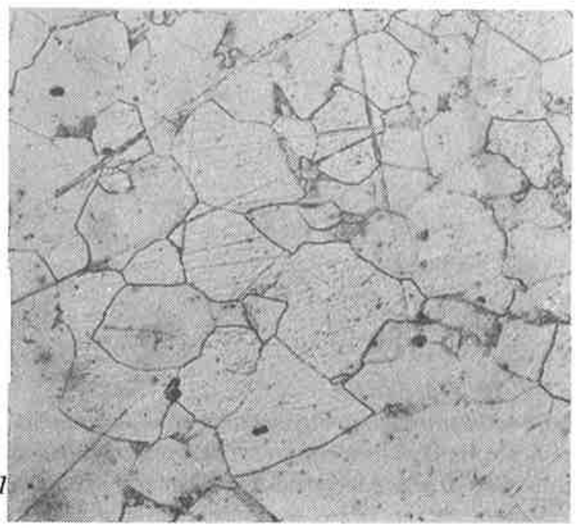


Fig 9. K 11, Y 25, Fnr 105.
Small knife with through-going, martensitic (coarse) insertion, surrounded by ferrite. Construction type 1. a. The knife, 1:1. b. A metallographic section, 10:1. c. The martensitic insertion. Microphoto 800:1. d. The surrounding ferrite. Microphoto 200:1

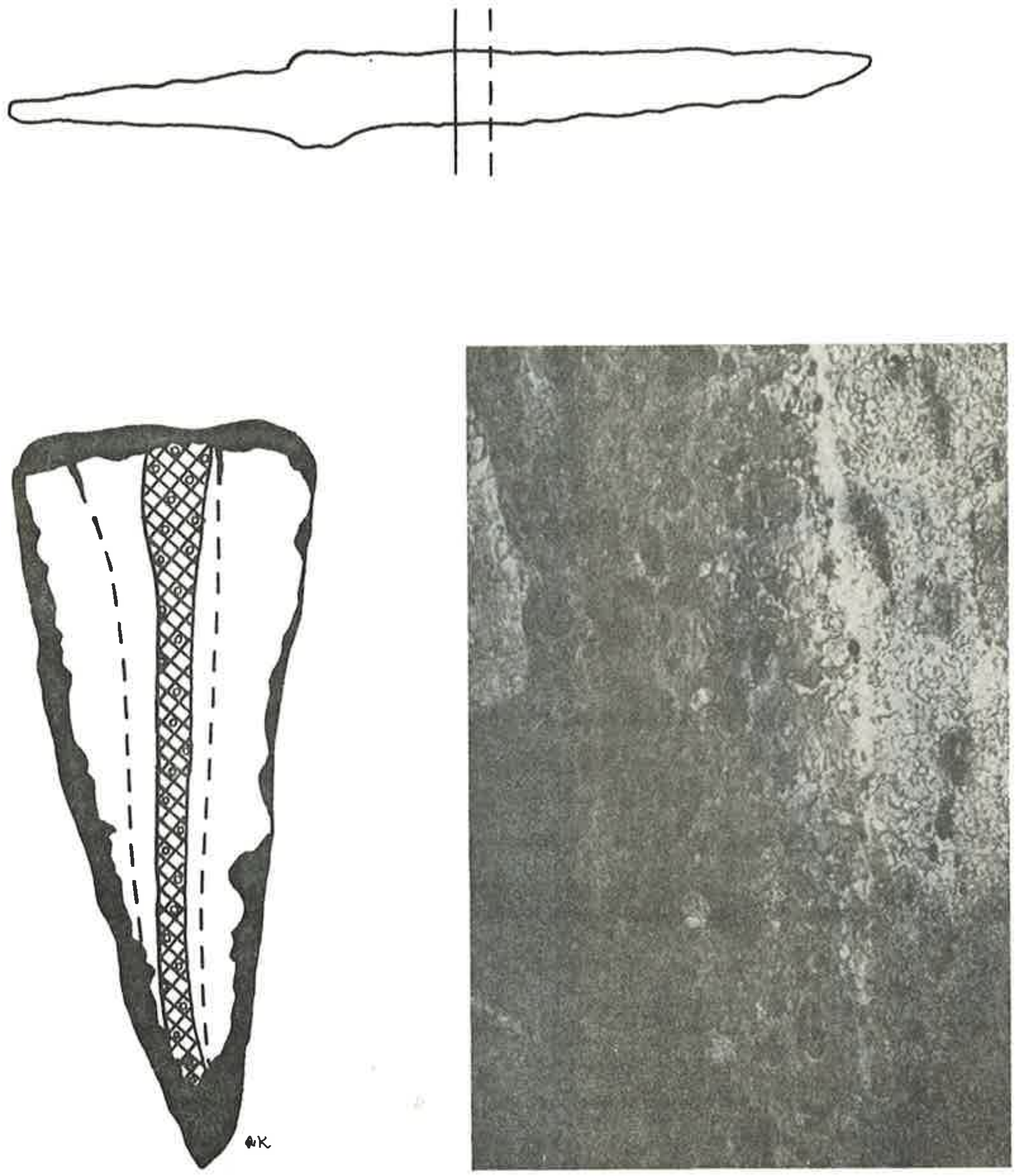


Fig 10,K 18, S 15, Fnr 105
A through-going insertion of perlite with granular cementite with well-made weld joints in the centre of the knife, but of somewhat lower quality towards the ridge, which has resulted in cracks corroded by rust. On either side of the insertion run continuous slag strips, probable remains of weldings of the surrounding ferritic layers. These, too, are cracked at the ridge. Construction type 1. a. The knife, 1:1. b. A metallographic section, 10:1. c. A detail showing the insertion and the surrounding ferritic layers. Microphoto 200:1.

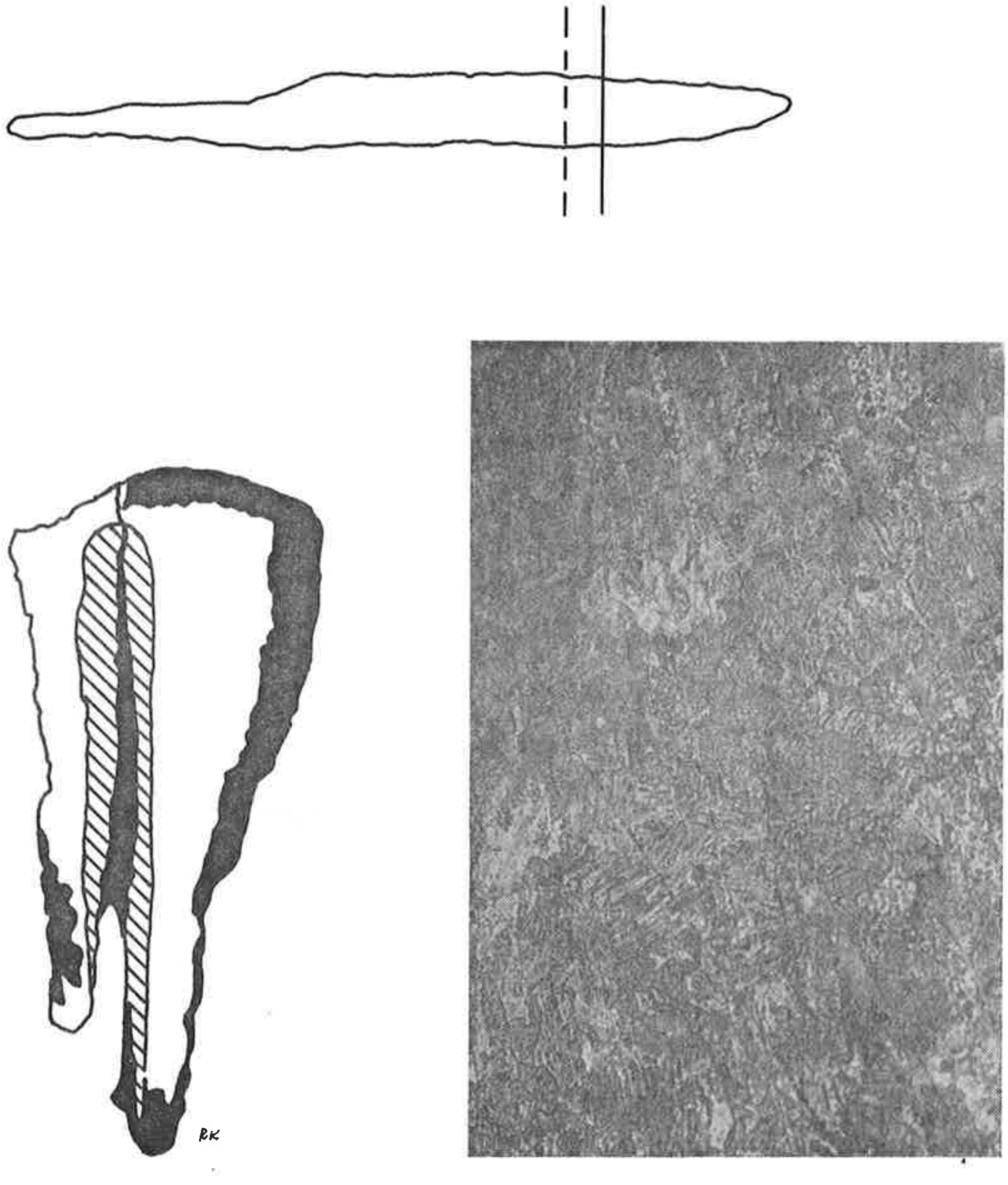


Fig 11.K 6, à 18, Fnr 52.
The knife corroded by rust in a crack up in the steel insertion, probably caused by careless welding or by hardening. On either edge of the crack the structure is similarperlite. Construction type 2. a. The knife, 1:1. b. A metallographic section, 10:1. c. A detail from the insertion. Microphoto 200:1

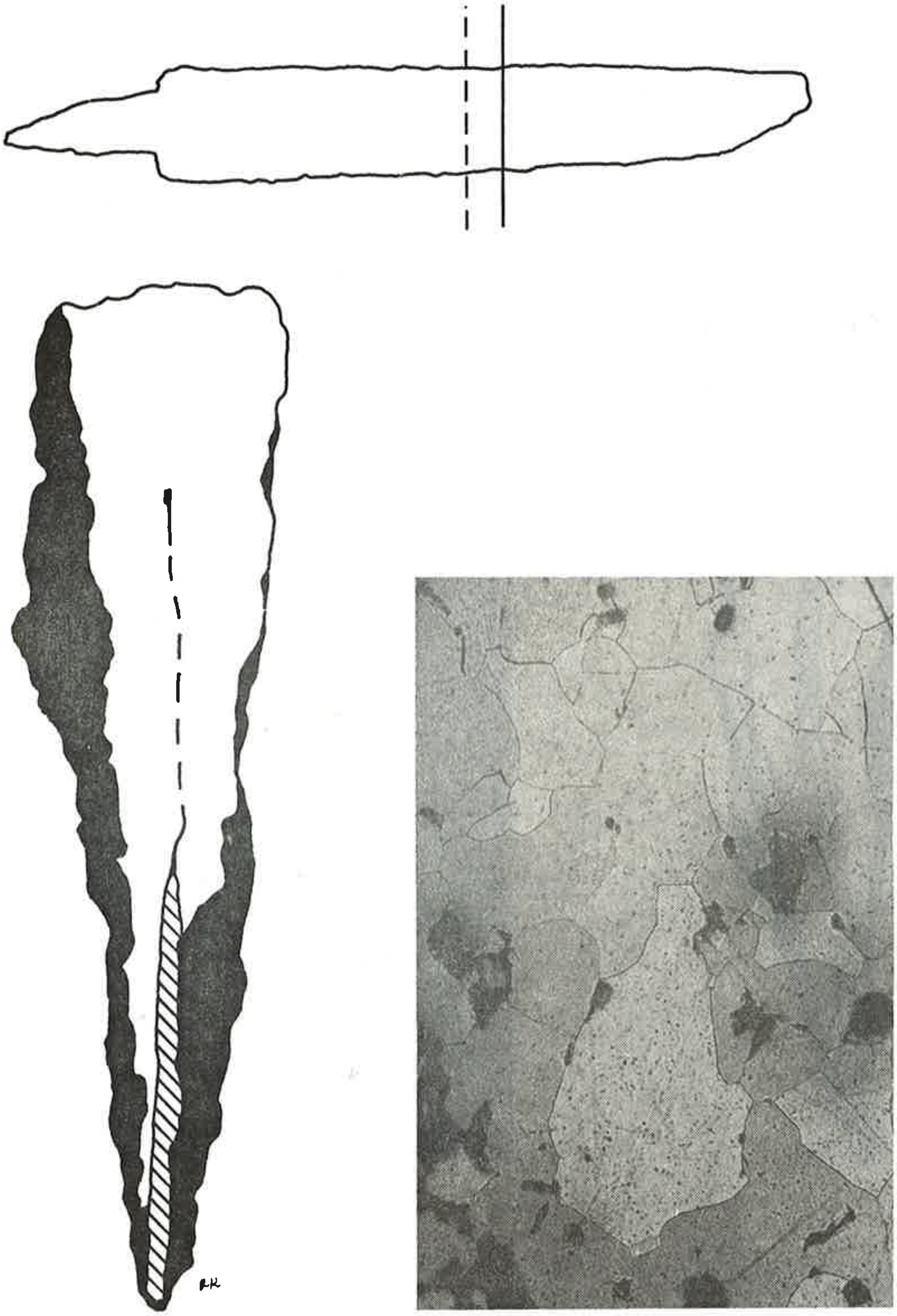
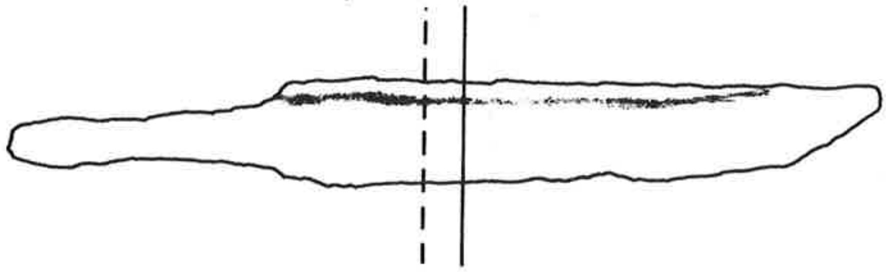


Fig. 12. K 7, Aa 16, Fnr 46.
Perlitic insertion of type 2. The weld joint continuous faintly backwards at the end of the insertion. For the rest: ferrite + some slag. Construction type 2. a. The knife, 1:1. b. A metallographic section, 10:1. c. A detail from the ferritic part. Microphoto 200:1



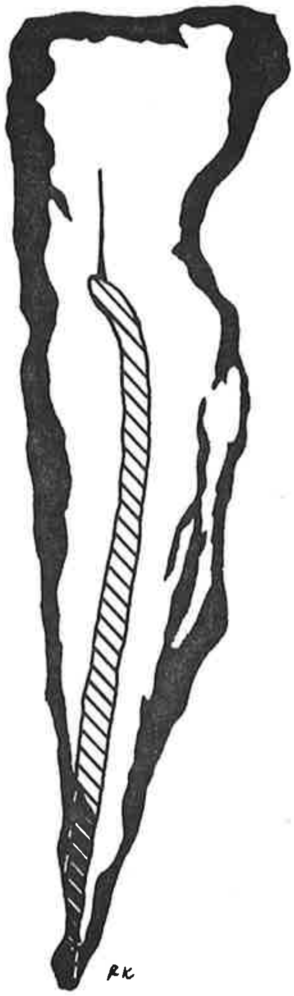


Fig 13. K 8, V 15, Fnr 34.
The knife provided with a "blood notch", which is indented at the end of the forging, which appears from the curve of the insertion at the end and from bow shaped slag inclusions following the blood notch. The insertion perlitic . Construction type 2. a. The knife, 1:1. b. A metallographic section, 10:1. c. A detail showing the insertion and the surrounding layers. Microphoto 100:1.

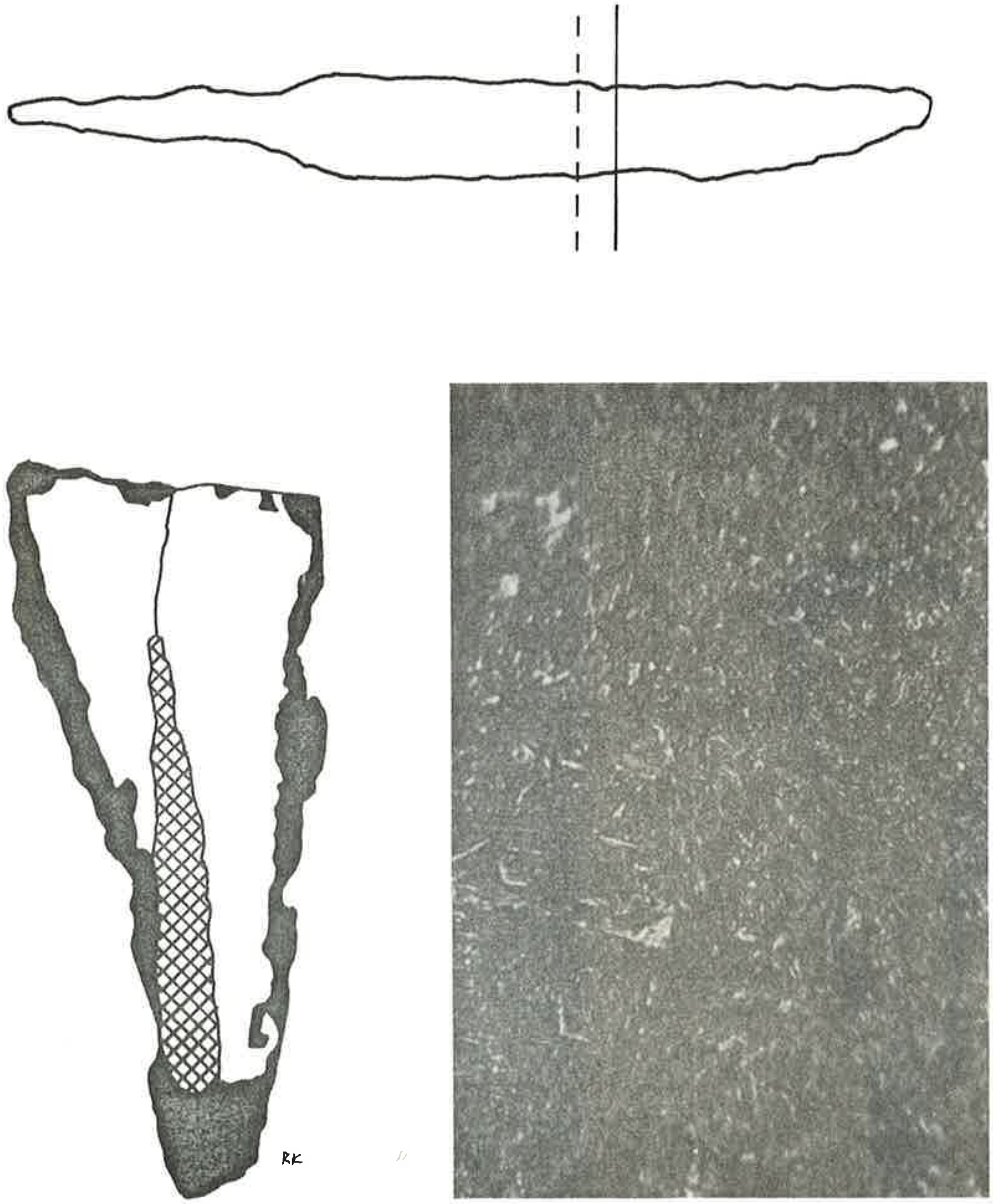


Fig 14. K 20, X 24, Fnr 32.
Insertion of martensitic structure. Surrounded by ferrite, which is rich in slag towards the ridge. The weld joint continues after the insertion towards the edge of the ridge. Construction type 2. a. The knife, 1:1. b. A metallographic section, 10:1. c. A detail from the martencitic insertion. Microphoto. 800:1

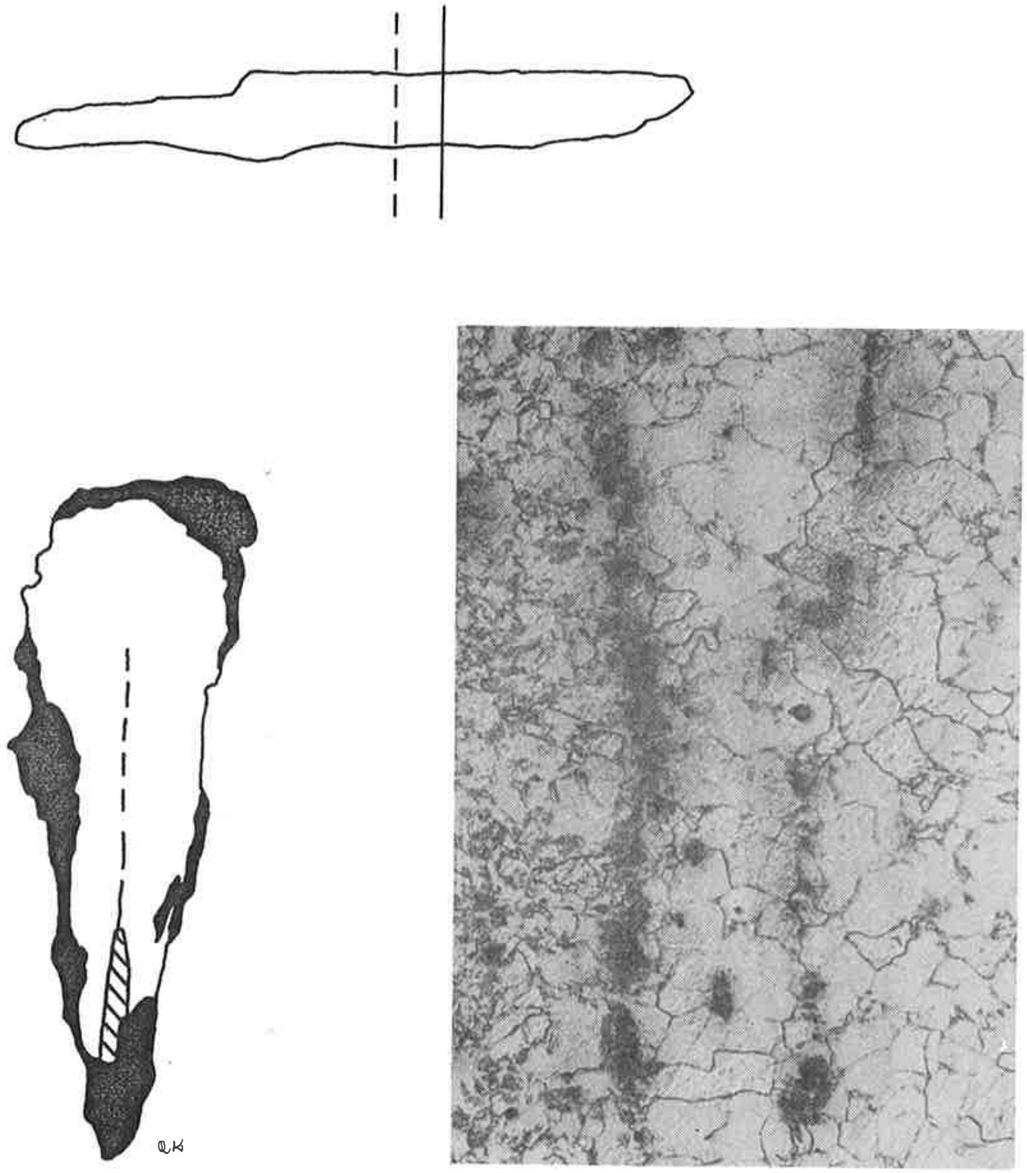


Fig 15. K 24
Merlitic insertion surrounded by ferritic structure. The weld is partly visible only as dots of slag. Construction type 2. a. The knife, 1:1. b. A metallographic section, 10:1. c. A detail showing part of the insertion, to the right, and dots of slag. Microphoto 200:1

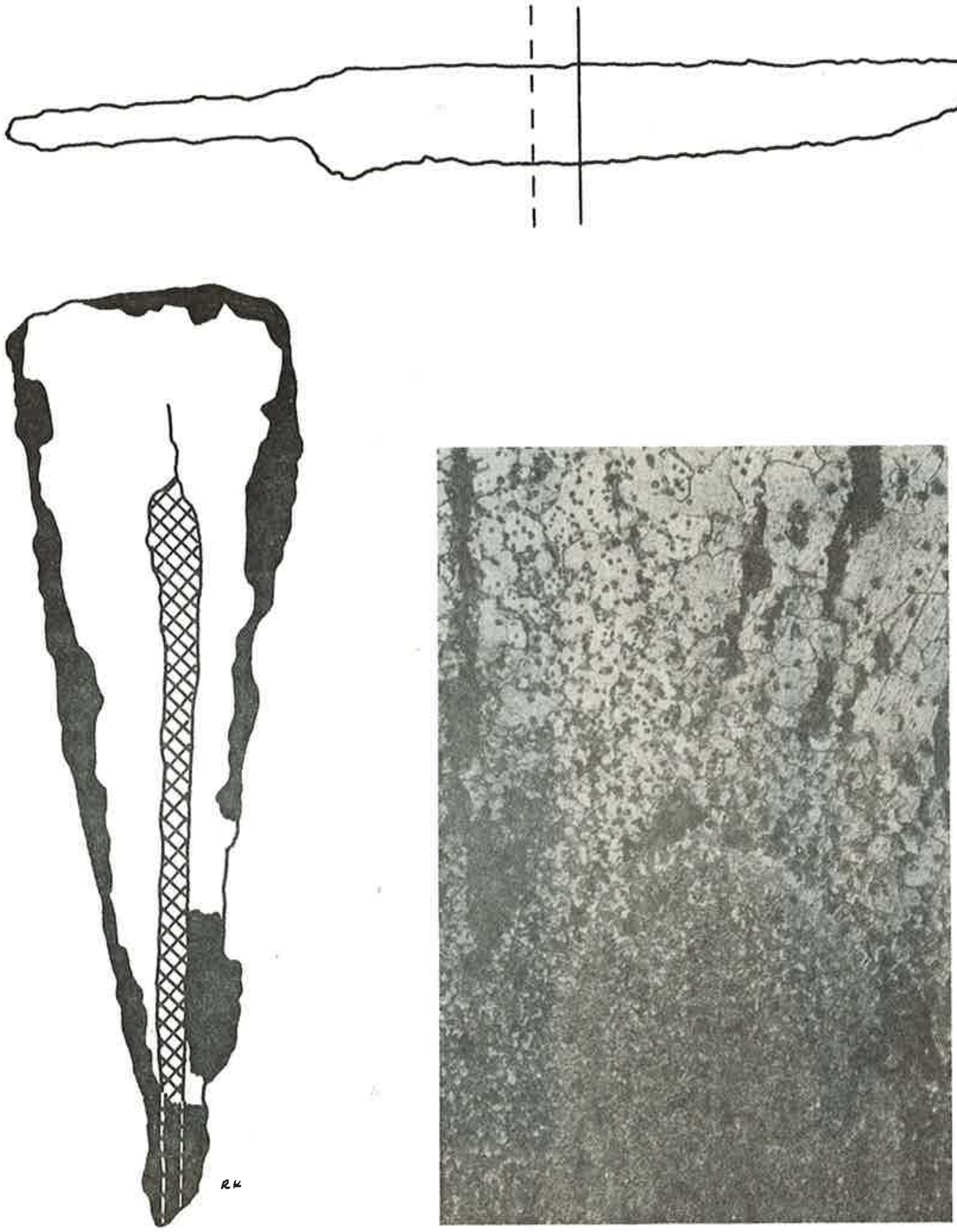


Fig 16. K 1. D 16, Fnr 29.
Insertion of martensite, surrounded by clear traces of welding. Well welded. Parallel to the insertion run granular slag strips in the ferritic area; at the ridge, too, there is plenty of slag. Construction type 2. a. The knife 1:1. b. A metallographic section, 10:1. c. A detail showing the upper part of the insertion. Microphoto 100:1.

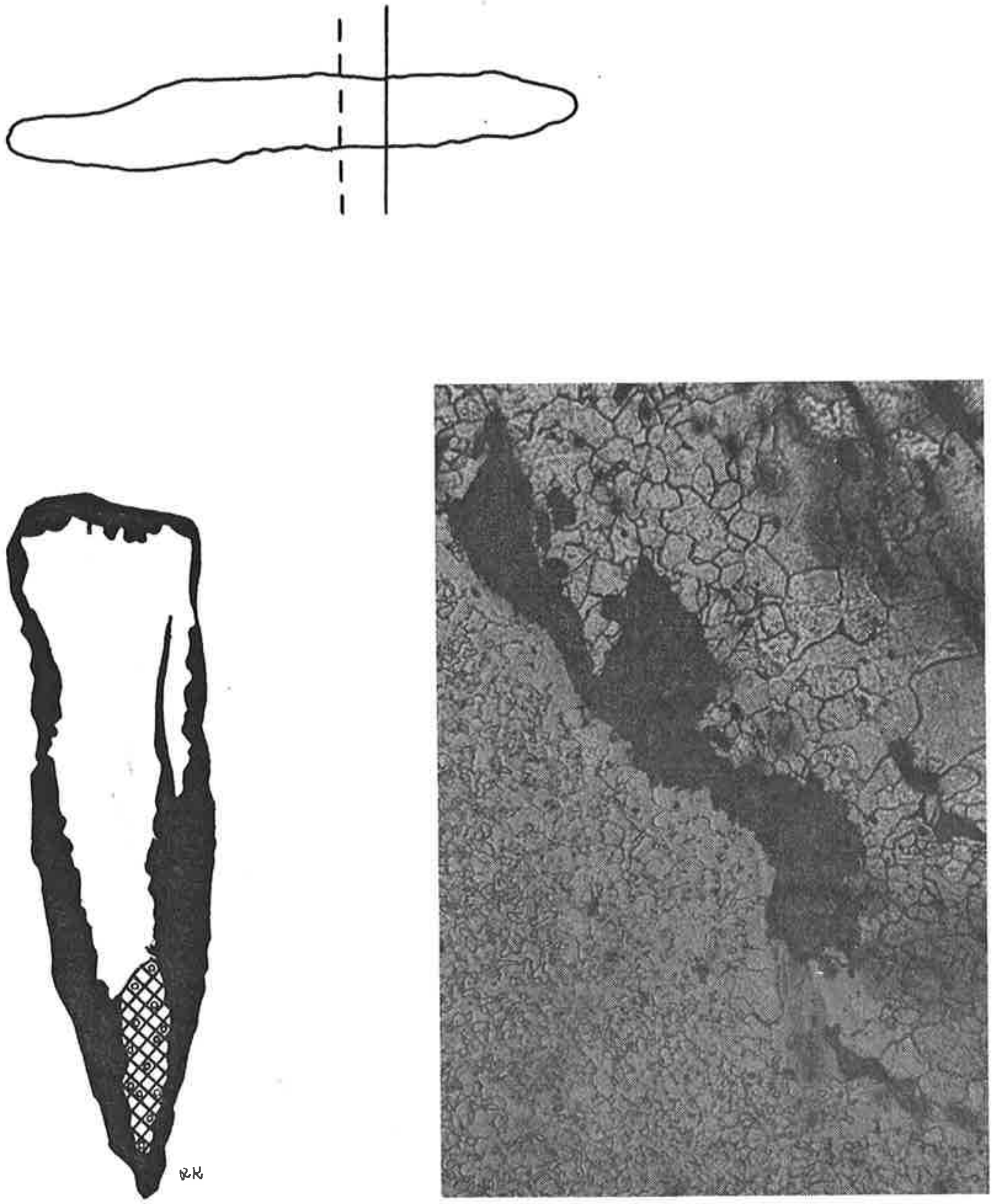


Fig 17. K 12, Y 15, Fnr 42.
The structure of the edge is probably granular cementite in a ferritic basic mass. Heavy slag inclusions at the joint. Construction type 3 a. a. The knife, 1:1. b. A metallographic section, 10:1. c. A detail showing the joint. Microphoto 200:1

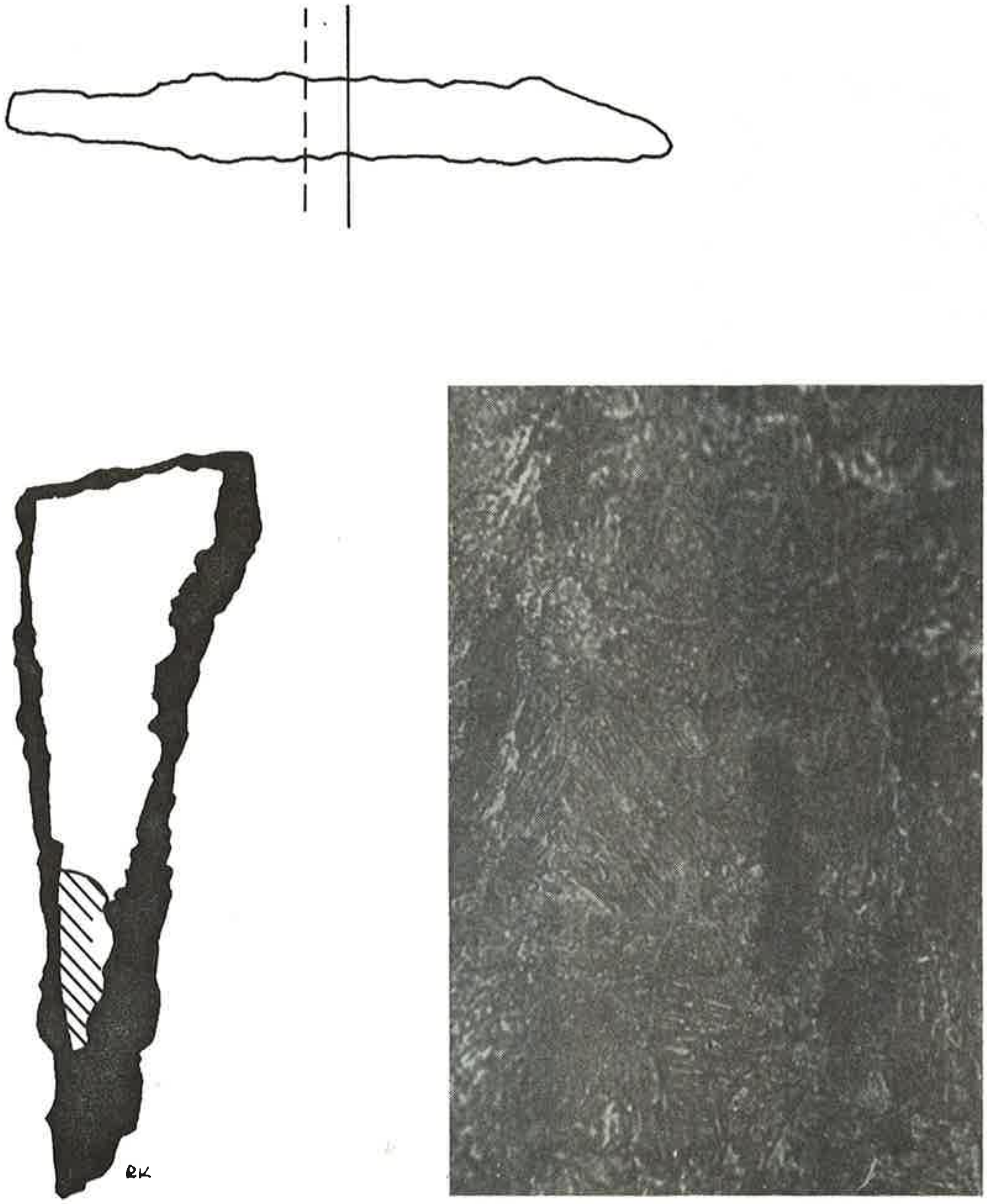


Fig 18. K 22, Y 15, Fnr 53.
The edge of the knife is heavily corroded, which makes it difficult to determine whether the knife belongs to construction type 3 a or b. The area at the edge is perlitic. The ridge part consists of ferrite rich in slag. a. The knife, 1:1. b. A metallographic section, 10:1. c. A detail from the perlitic edge. Microphoto 800:1

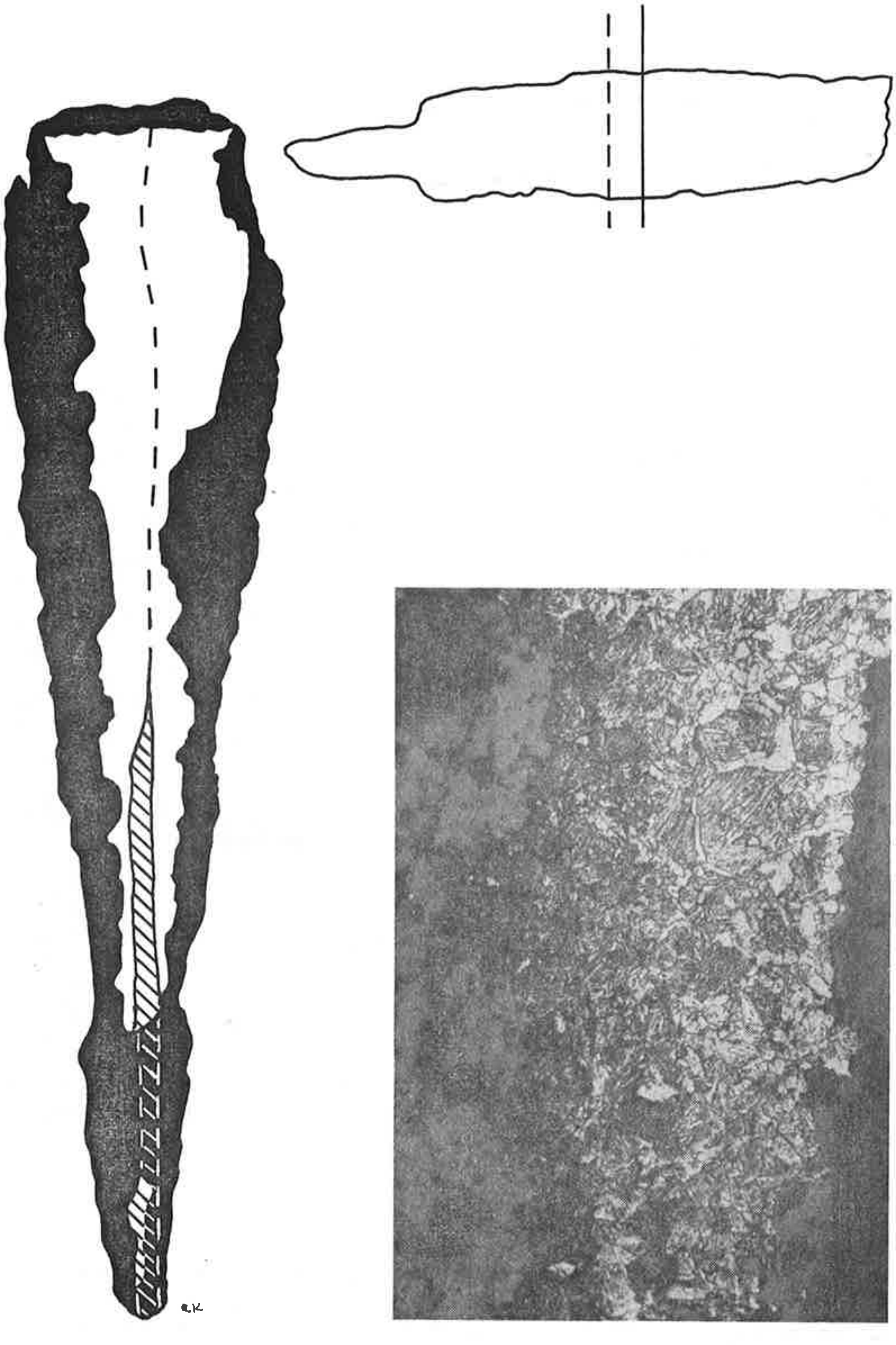
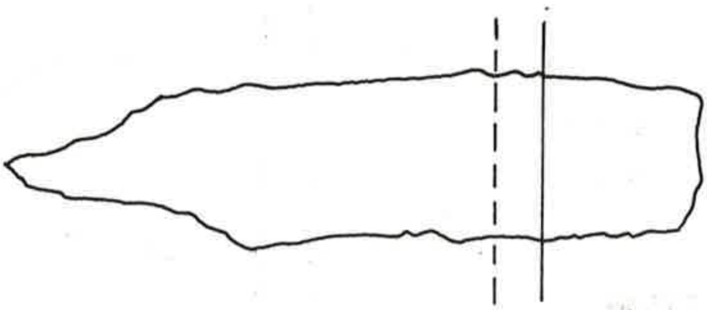


Fig 19. K 13, Aa 19, Fnr 185.
Insertion of perlitic structure, which is terminated obliquely, well welded and diffused into the surrounding structure which, at the end of the insertion, is mixed with perlitic inclusions in ferrite. Towards the ridge, the structure is homogeneously ferritic. Parallel to the single weld joint run thin slag strips. Construction type 2. a. The knife, 1:1 . b. A metallographic section, 10:1. c. A detail showing the insertion. Microphoto 200:1.



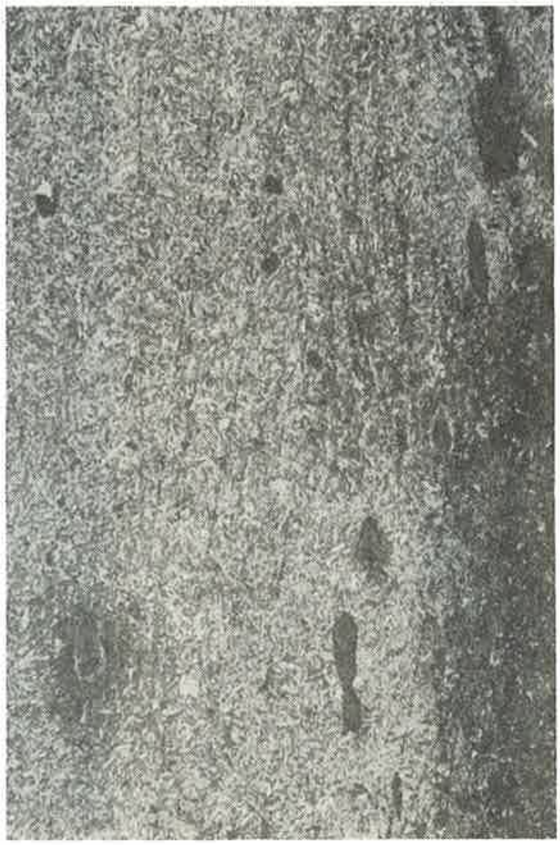


Fig. 20. K 15, Q 18, Fnr 1.
A big knife with "thin, flat blade". The knife is divided by a clearly visible weld joint into an edge part of fine grained martensite and a ridge part, whose structure is more mixed. Towards one edge of the ridge part there is a layer of martensite similar to that of the edge. It has been caused either by a plating of steel or as remains of a surface hardening, which has extended around the entire knife but which, on the opposite side, is corroded away. The whole knife is of "steel". Construction type 3 a. a. The knife, 1:1. b. A metallographic section, 10:1. c. A detail from the ridge. Microphoto 200:1

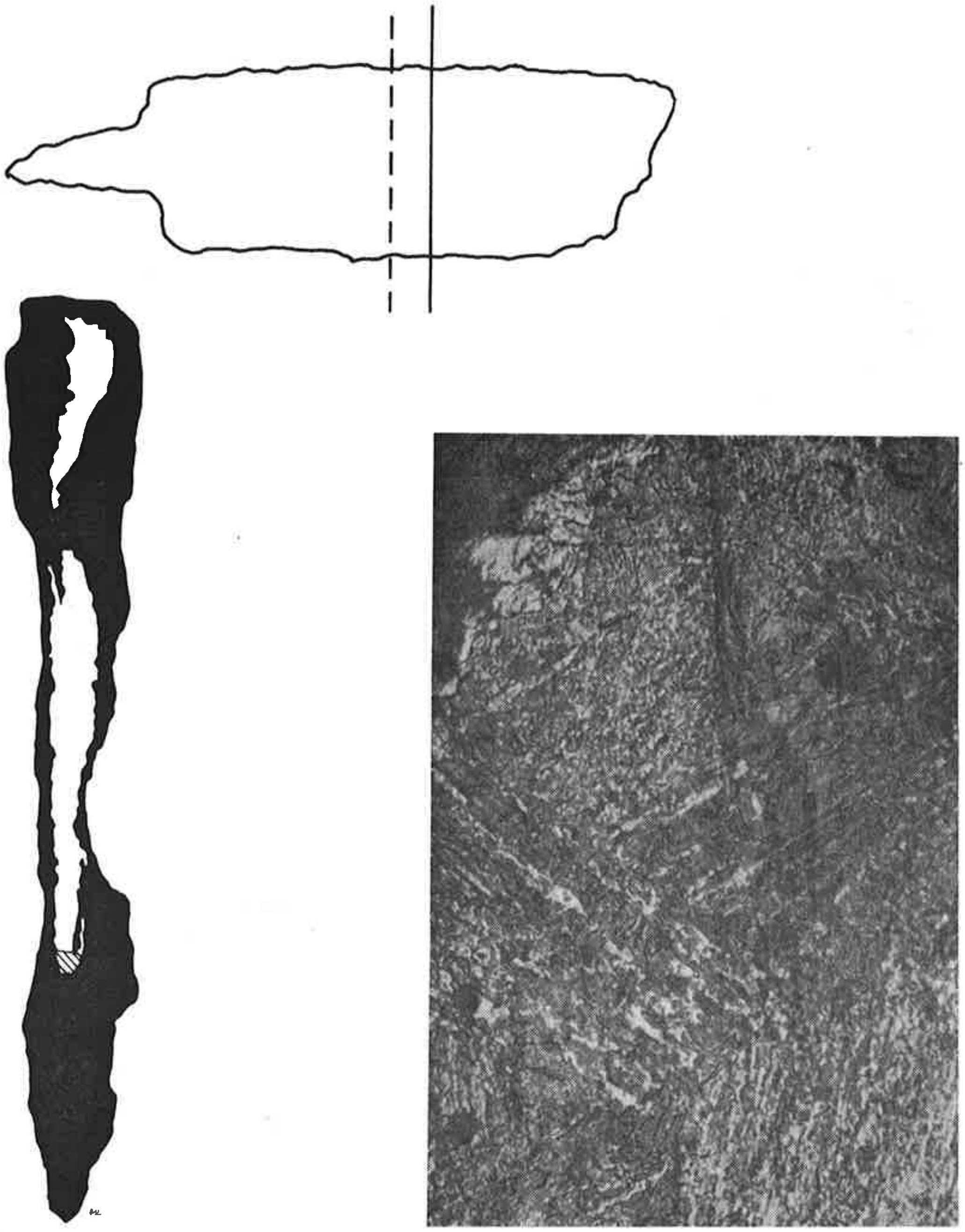


Fig 21. K 19, S 13, Fnr 57.
A big knife with a broad, thin blade. The whole knife is heavily corroded and of the edge layer there remains only a small part, whose structure is: striped perlite and cementitic network. No weld joint is visible. The knife was probably manufactured according to construction type 3. The ridge part is of ferritic structure. a. The knife, 1:1. b. A metallographic section, 5:1. c. A detail of the perlitic part. Microphoto 800:1.

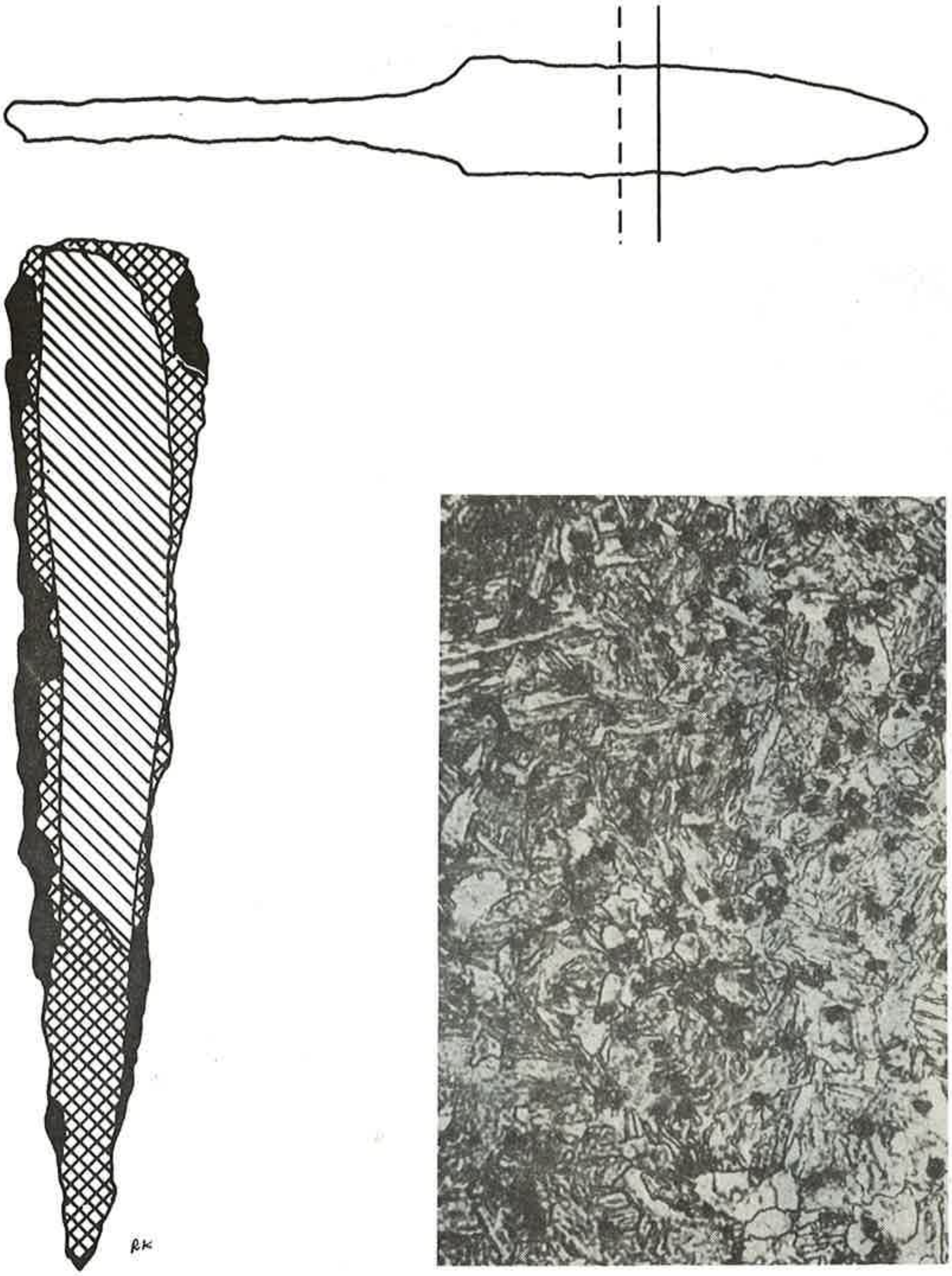


Fig. 22. K 3, N 21, Fnr 47.
Knife with slightly curved ridge. The knife altogether of steel, where the hardening has most affected the surface layer and the thinner edge. The hardening is visible as martensitic structure, partly corroded away. The rest of the knife of perlitic structure. At the point, a weld joint across the knife. Well-made with martensite on both sides. Construction type 3. a. The knife, 1:1. b. A metallographic section, 10:1. c. A detail from the edge part. Microphoto 800:1.

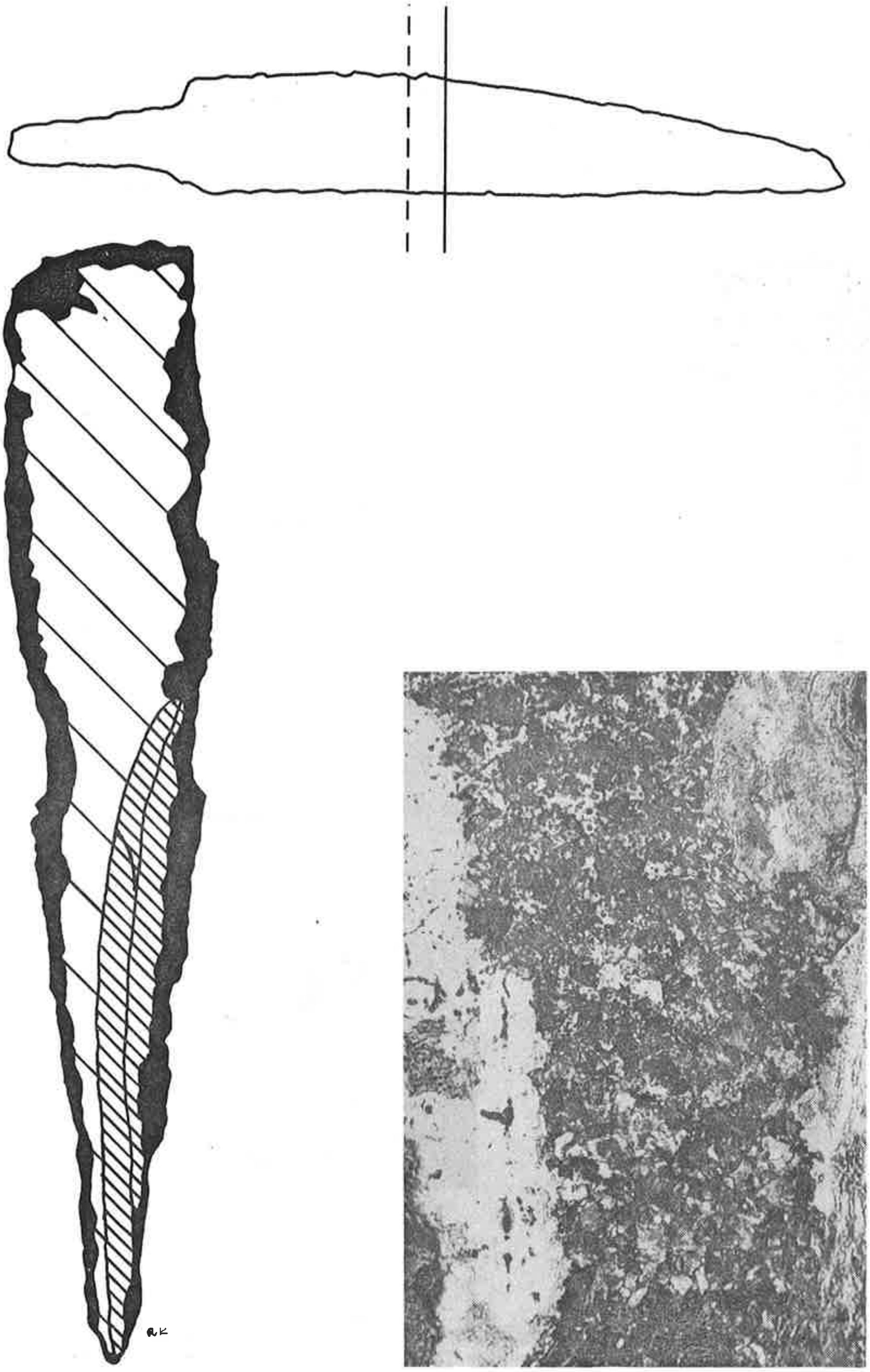
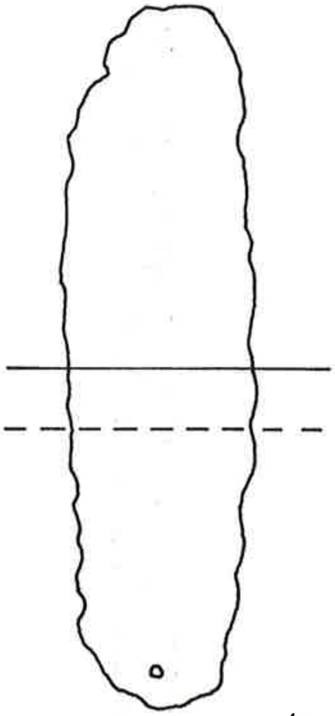


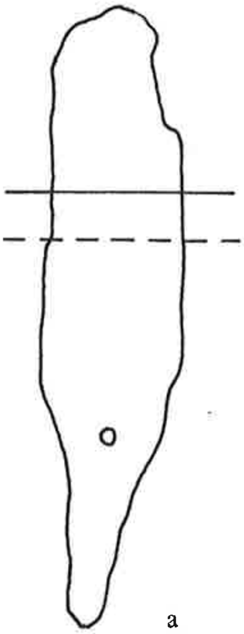
Fig 23. K 4, Z 17, Fnr 13.
A knife with curved ridge. Insertion of perlite. The rest of the knife of ferrite. Rich in slag at the ridge part. Construction type 3. a. The knife, 1:1. b. A metallographic section, 10:1. c. A detail from the perlitic insertion. Microphoto 200:1.

a

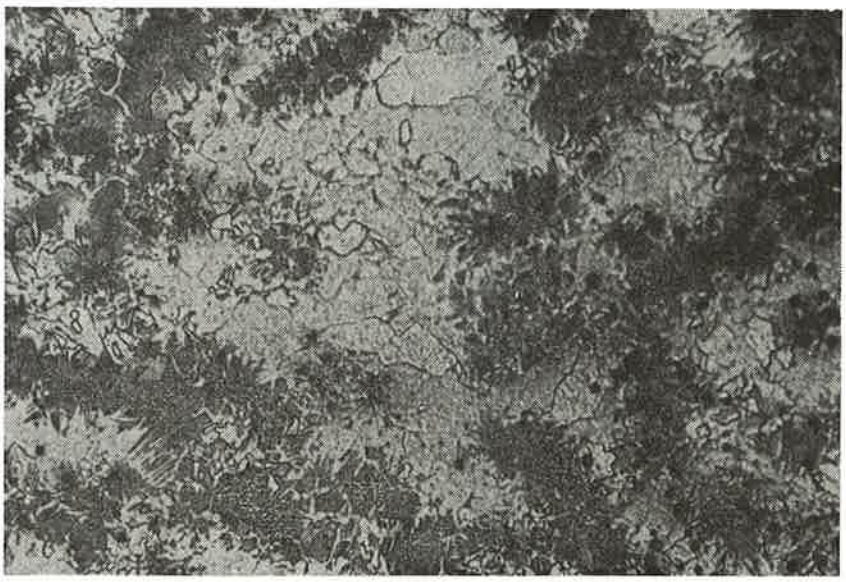


b

Fig 24. K 16, S 24, Fnr 60.
Clasp-knife with remaining nail. In the centre of the knife a weld joint, somewhat oblique. The structure of the edge part is homogeneously martensitic. The ridge-part is mixed, of perlite, which, towards one edge, is succeeded by martensite (steelknife). Construction type 3 Construction type 3a. a. *A metallographic section, 5:1.* b. *The claspknife, 1:1.*



a



b

Fig 25. K 25, X 14, Fnr 11.
Claspknife with a transverse weld joint, which divides the knife into an edge part of coarse, martensitic structure and a ridge part mixed of perlitic strips concentrically in a ferritic basic mass. Construction type probably 3 a. a. *The claspknife, 1:1.* b. *A detail from the perlitic strips. Microphoto 200:1.*

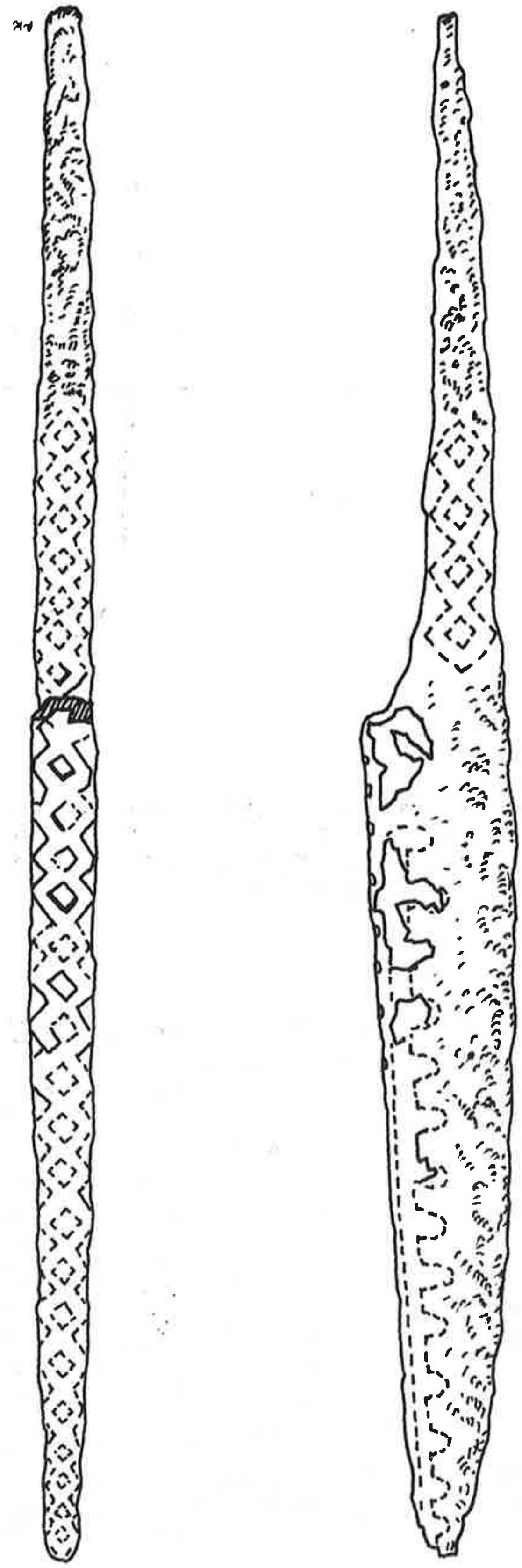


Fig 26.
A knife of type Ab with copperplaiting at the ridge and handle, in the shape of crossed bandstrips. 2:1.