Early iron manufacturing in Sweden

By Gert Magnusson

1. Introduction

The American anthropologist L. Morgan wrote in 1877 that when iron succeeded in becoming the most important material in production, this was the event of events in human history. He was referring to the dramatic development of the iron industry during the 19th century, with its fundamental transformation of human living conditions. Morgan's idea could also be shifted back 2500 years in time, when iron became the first metal to be commonly used by large groups of people.

In purely technical terms, the production of iron can be subdivided into two groups: direct and indirect production. Direct production means the direct production of a malleable iron. Indirect production means first producing, in a blastfurnace, a pig iron which then has to be refined into malleable iron.

Ironworking came to Scandinavia in the 6th century B.C. Recent radiocarbon datings in Sweden tell us that the art spread quickly to such widely separate regions as Gotland, Småland, Närke, Västmanland and Västergötland. It is worth noting that more than one technique of iron manufacturing spread throughout Sweden during this early period. We have at least two completely different types of furnace occurring more or less simultaneously. So great are the differences between work at and the construction of these two types of furnace, that they cannot be treated as variations of the same furnace. In Närke, Västmanland and Västergötland we have the claypitfurnace, while in Gotland and also in Västergötland we have the continental types of shaftfurnace. This should mean that knowledge of ironmaking came to Sweden by at least two separate innovative paths. Västergötland is the region where today we can recognise both types.

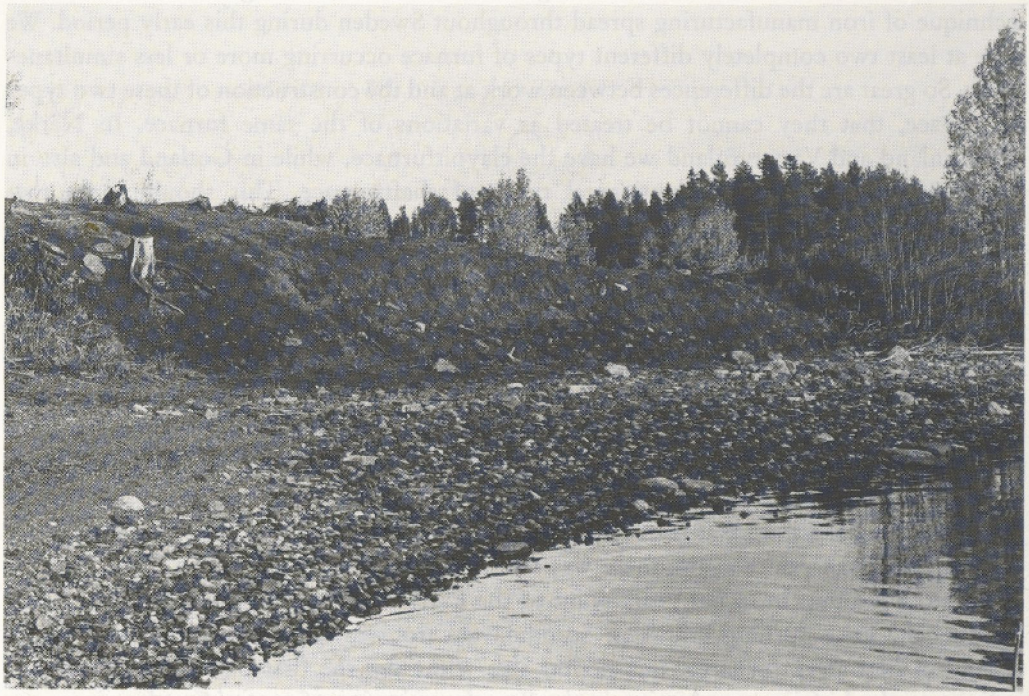
Throughout prehistory the clayed pit furnace appears to be the most common type, with all sorts of local variations. The continental shaft furnace, which in Scandinavia is mainly known to us from Denmark, disappears from Sweden, as far as we know at present, at about the beginning of the Christian Era.

It was not until the High Middle Ages that a whole variety of furnace types appeared, mostly in Jämtland. This is probably due, not so much to people there being of a more innovative disposition, but to Jämtland being the best investigated province in Sweden. In Jämtland, then, there were at least five different variants of the pit furnace, but during the High Middle Ages, once again, there was also one shaft furnace.

Research findings in recent years point to the Early Medieval Period and High Middle Ages as the great turning points in Scandinavian ironworking. In addition to a wider variety of bloomery furnaces, this period also witnessed the first blast furnaces earliest indirect method of iron production in the Bergslagen region of central Sweden.

One of the really big questions surrounding medieval technological development is, why these important innovations began to appear at that particular time. Does, for example, the

At the early sites of the Roman Iron Age the bloomery furnaces were situated at the top of the banks. Mostly there are two or more funaces dug out in slow sloop. The Roman Iron Age iron production sites give an idea of an industrial production of iron in outlying districts.



The earliest iron production sites in Jämtland are from the late Roman Iron Age; they are still situated on banks of rivers and lakes. Since a long time one have seen slags on the shores, but in the early 1970's it was possible to see that the whole sites were still at the top of the banks.

Late medieval bloomery furnace outside the village of Sveg in the county of Härjedalen. The site is typical for the more than 600 sites of this type in the middle of Sweden. Most of these sites have been in use during the period late medieval and up to the 18th century.

From the 13th century most of the sites look like this one. A very regular organized site of the working area around the furnace. The slag heaps are the most visual part of these sites.

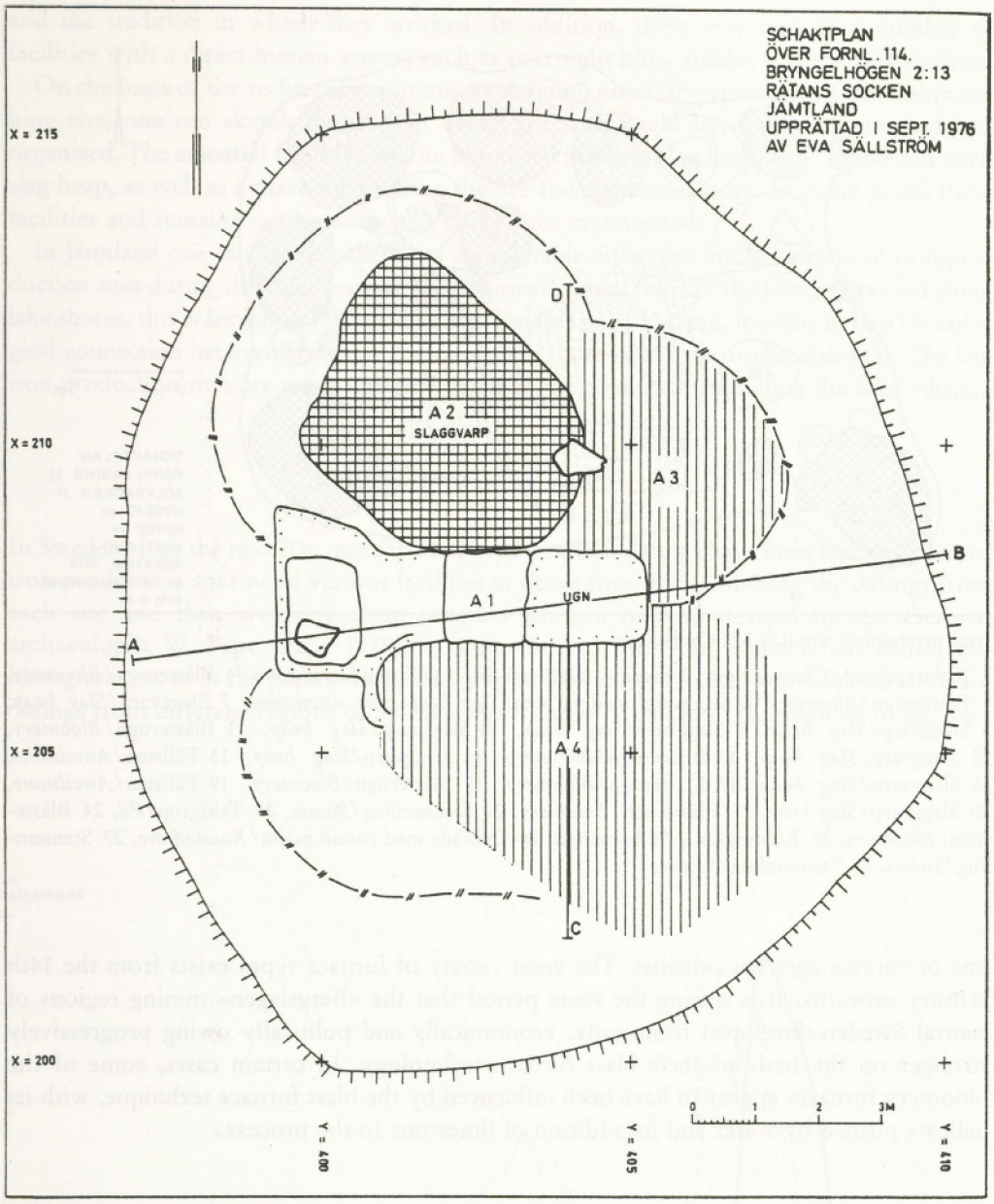
Ironproduction sites in and around the village of Klövsjö in Jämtland.

existence of blast furnace technology in one region and a multiplicity of furnace types in another indicate a general growth of metallurgical awareness? Can the multiplicity of furnace types be due to a greater realisation of the ways in which ores behave in the furnace and of their degrees of reducibility? The reducibility of different ores has been studied by the Norwegian researcher Sigmund Jacobsen (1983).

There is a place in Jämtland, Oviken 32, which differs appreciably from most others. In more than one point of view it occupies a category of its own. Here, for example, we have a special type of furnace, the shaft furnace, and the site has an unusual large concentration of furnaces and slag heaps (eight bloomery furnaces and nine slag heaps) closely adjoining to charcoal pits.

In Jämtland, this site is the only one of its kind, but in Västergötland and Småland the same type is more common. In Västergötland there are about 400 sites registered, some 25 of which have been investigated. The Västergötland sites are usually much smaller, consisting of just one, usually very small slag heap, but usually with several furnaces round about it.

Isolated furnaces have been investigated in Småland (Nihlén 1932, Hallinder 1972). The general morphology of the sites and the furnaces reported indicate that similar shaft

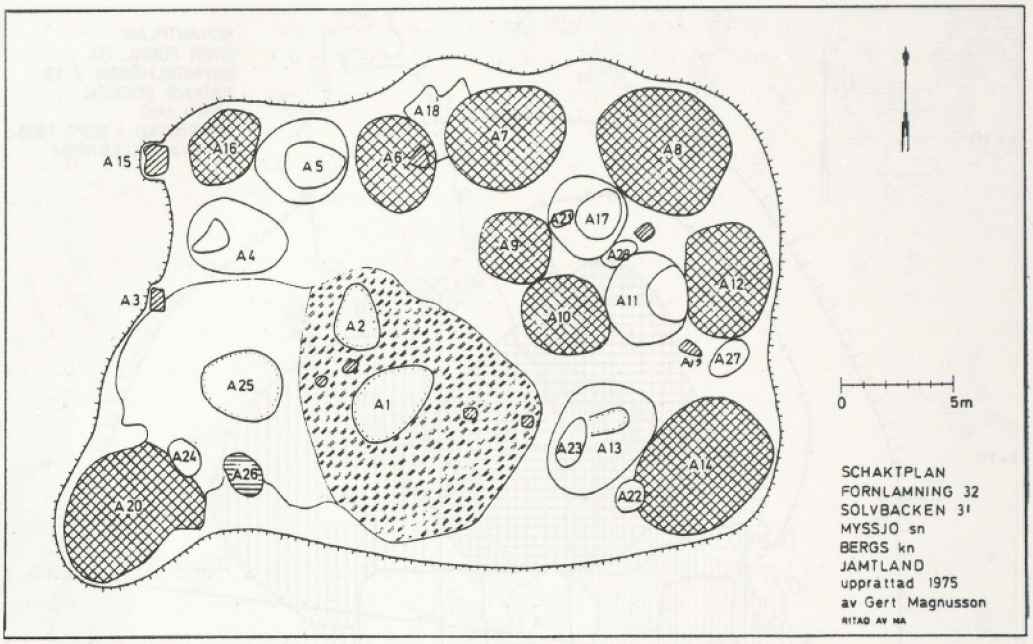


Iron production site Raä 114, parish of Rätan: A 1 = Blommery, A 2 = Slag heap, A 3 = Ore layer, A 4 = Ore layer, A 5 = Anvil stone.

furnaces were in use in Småland. Probably a large proportion of the 700 registered sites with traces of direct iron manufacturing in Småland are of this type. Here we have the really big sites, that are even bigger than the Jämtland site (Oviken 32) already referred to.

Chronologically, this type of furnace in Västergötland, Värmland, Småland and in Jämtland corresponds with the period between 950 and 1450 AD. Probably, though, other types of furnace, not yet known to us, existed at the same time.

In Jämtland, Härjedalen, in the north of Dalarna and in western Hälsingland this industry lived on until the 18th and 19th centuries. It appears in the historical sources as



Iron production site Raä 32i Ovikens sn

1 Kolningsgrop/*Charcoal pit*, 2 Sentida täktgrop/*Pit*, 3 Fällsten/*anvilstone*, 4 Blästerugn/*Bloomery*, 5 Blästerugn/*Bloomery*, 6 Slaggvarp med fällsten/*Slag heap with anvilstone*, 7 Slaggvarp/*Slag heap*, 8 Slaggvarp/*Slag heap*, 9 Slaggvarp/*Slag heap*, 10 Slaggvarp/*Slag heap*, 11 Blästerugn/*Bloomery*, 12 Slaggvarp/*Slag heap*, 13 Blästerugn/*Bloomery*, 14 Slaggvarp/*Slag heap*, 15 Fällsten/*Anvilstone*, 16 Slaggvarp/*Slag heap*, 17 Blästerugn/*Bloomery*, 18 Blästerugn/*Bloomery*, 19 Fällsten/*Anvilstone*, 20 Slaggvarp/*Slag heap*, 21 Blästerugn/*Bloomery*, 22 Stensamling/*Stones*, 23 Täktgrop/*Pil*, 24 Blästerugn/*Bloomery*, 25 Kolningsgrop/*Charcoalpit*, 26 Område med rostad malm/*Roasted ore*, 27 Stensamling/*Stones*, 28 Stensamling/*Stones*.

one of various agrarian sidelines. The great variety of furnace types exists from the 14th century onwards. It is during the same period that the »Bergslagen« mining regions of central Sweden developed technically, economically and politically owing progressively stronger on the basis of their blast furnace technology. In certain cases, some of the bloomery furnaces appear to have been influenced by the blast furnace technique, with its bellows pushed by water and its addition of limestone to the process.

2. The technology of iron production

All ironworking involves special demands, based on the laws of nature, governing and regulating the reduction of metallic oxides. Technology has to conform to these laws of nature. Ironworking is governed by the reduction process of different types of iron oxide, and this affects the facility requirements at a place where iron is made. Archaeologists took this fact as the foundation of various theoretical structures (Johansen 1973, 86; Furingsten 1979, 250; Millberg, Magnusson 1981, 270; Hayen 1968; Serning 1979, 28).

The furnaces are functional, which of course makes them outstandingly suitable for specialised studies i. e. on technical designs. Here there are chances to see which ideas were active in the minds of the people working at the different sites, the cultural environment

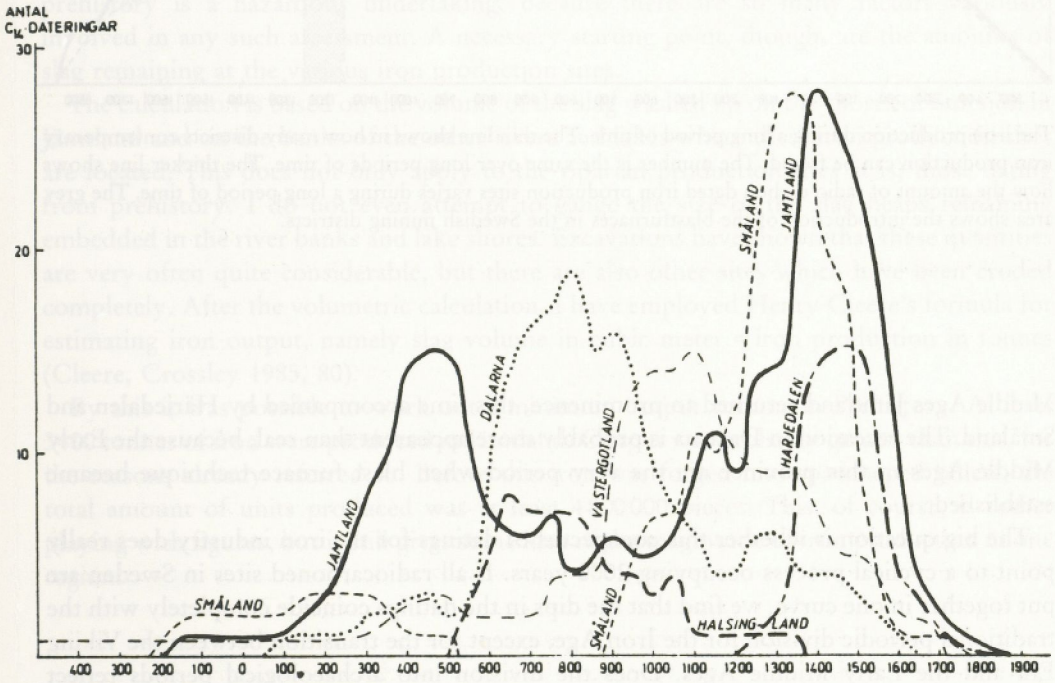
and the tradition in which they worked. In addition, there may also be a number of facilities with a direct human aspect, such as overnight huts, stables and transport routes.

On the basis of the technical requirements defining necessary operations at the ironworking site, one can sketch the way in which the sites could have been constructed and organised. The essential facilities are the bloomery furnace, slag heap, anvil stone and anvil slag heap, as well as a place for roasting the ore and a charcoal store. In many cases, these facilities and remains can be excavated at the sites investigated.

In Jämtland one can see that there is a considerable difference in the location of iron production sites during different periods. In prehistoric times, most of the sites are located along lake shores, this is similar in Dalarna. In both Dalarna and Jämtland, it seems to be a chorological connection between scattered graves on lake shores and iron production sites. The late iron production sites are more scattered in the forest country surrounding the later villages.

3. Dating of iron production

In Sweden since the mid 70s, more than 400 radiocarbon datings have been made of various iron production sites or of various facilities at those sites. By combining the datings from each site and then weighing them together using a method devised by the German archaeologist W. Pape (Pape 1979), it is possible to turn long radiocarbon series into histograms or, as in the present case, into graphs. This in turn makes it possible to compare datings from different regions of Sweden. A synthesis of this kind is presented in fig. next



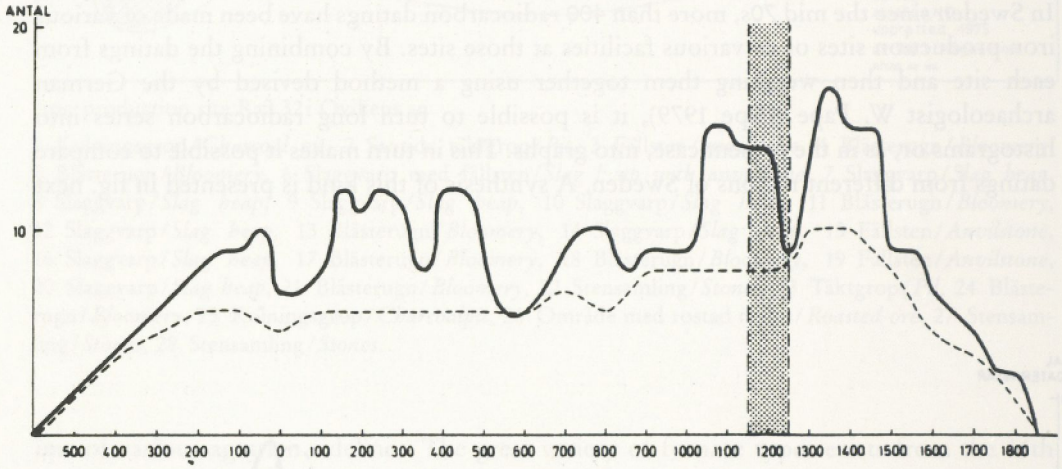
Radiocarbon datings from different parts of Sweden.

page, but without the provinces for which only a few datings have been reported. As can be clearly seen, iron production peaked in different regions at different times.

Ironworking was established in large parts of Sweden during the Early Iron Age. Judging by the facts presented here, the first period of more extensive iron production appears to have occurred during the late Roman Iron Age and during the Migration Period. This, at present, is best documented in Jämtland, but probably it also had its counterparts in Dalarna and Västergötland.

The weakness of this early horizon in Dalarna and Västergötland is probably due above all to gaps in research. The same may also be true in Småland.

Towards the end of the Migration Period the Jämtland curve declines, and this is matched by the general picture of finds for the region and for large parts of the Baltic. The dip in the Jämtland curve corresponds with a distinct upturn for iron production in Dalarna and Hälsingland. Probably this upturn comes late during the Merovingian period, culminating during the 9th and 10th centuries. A decline then ensues, and during the High



The iron production during a long period of time. The thin line shows in how many districts contemporary iron production can be found. The number is the same over long periods of time. The thicker line shows how the amount of radio carbon dated iron production sites varies during a long period of time. The grey area shows the introduction of the blastfurnaces in the Swedish mining districts.

Middle Ages Jämtland returned to prominence, this time accompanied by Härjedalen and Småland. The recession in Dalarna is probably more appearent than real, because the Early Middle Ages in this province are the very period when blast furnace technique became established.

The big question is whether this conspectus of datings for the iron industry does really point to a cyclical process occupying 2000 years. If all radiocarboned sites in Sweden are put together in one curve, we find that the dips in the datings coincide completely with the traditional periodic division for the Iron Age, except for the transition between the Viking Era and the Early Middle Ages. Does the division into archaeological periods reflect cyclical fluctuations affecting large parts of society?

4. Who made the iron?

This is a very difficult question. It has to be said that no direct equivalents of the Norwegian smiths' graves have been found in Sweden yet: Instead there have been a number of depot finds of tools, such as the Mästermyr chest. This and other cases of this kind mostly involve combinations of tools associated with different crafts, such as those of the carpenter, the smith, the horn carver etc. The archaeological material affords little evidence of true specialists. Most wrought iron work for domestic needs could be done by the people themself. This being so, who is responsible for specialised wrought iron work, for weapon manufacturing and swordthing? Were these things imported or produced at home? It is mainly by studying these objects that we can put light on this question. But most of all the iron objects we find in graves and on dwelling sites were probably made by versatile farmers.

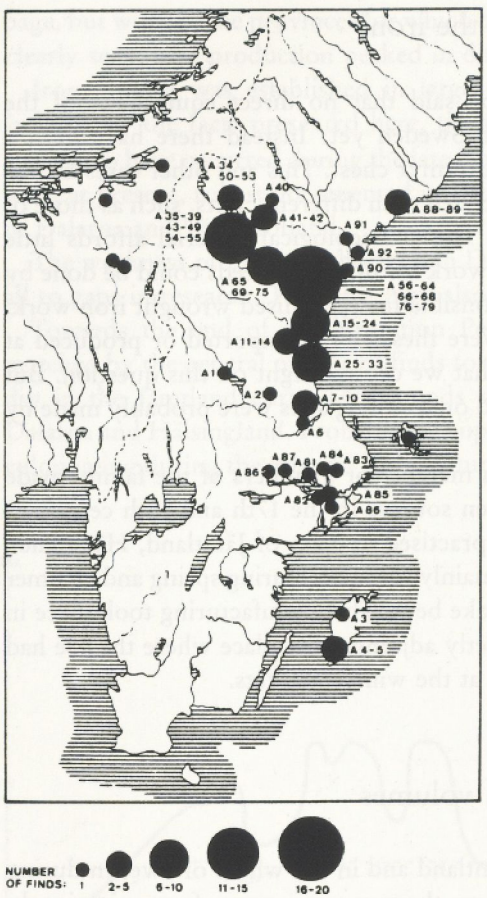
Unfortunately we do not really know which member or members of the family made iron in prehistoric times. We know from written sources in the 17th and 18th centuries, when this kind of ironworking was still being practised in parts of Jämtland, Härjedalen and Dalarna, that it was a seasonal occupation, mainly for men. During spring and summer the ore was dug out of bogs or raked up from lake beds. The manufacturing took place in the autumn, after harvest time, and always directly adjoining the place where the ore had been found. The finished iron was sold mainly at the winter markets.

5. Production volumes

Calculating the amount of iron produced in Jämtland and in the whole of Sweden during prehistory is a hazardous undertaking, because there are so many factors variously involved in any such assessment. A necessary starting point, though, are the amounts of slag remaining at the various iron production sites.

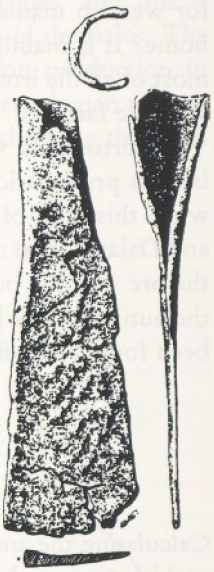
The calculation is based on the volume of the slag washed up on the shores of Storsjön in Jämtland and on the banks of the other rivers and lakes where these iron production sites are located. This does not only apply to the riparian production sites at is, those dating from prehistory. I do not even attempt to gauge the size of the slag heaps remaining embedded in the river banks and lake shores. Excavations have shown that these quantities are very often quite considerable, but there are also other sites which have been eroded completely. After the volumetric calculation, I have employed Henry Cleere's formula for estimating iron output, namely slag volume in cubic meter = iron production in tonnes (Cleere, Crossley 1985, 80).

By this it was possible to work out a minimum output volume in Prehistory. At least 3400 tonnes of iron were produced in Jämtland. Output was probably greater than this, for the reasons already referred to. Before this iron was forged into spadshaped billets, the total amount of units produced was at least 4800000 pieces. This, of course, is rather playing with figures, but it still gives some idea of the magnitude of iron production in one region.



Distribution of spade shaped billets found in Scandinavia.

A spade shaped billet.



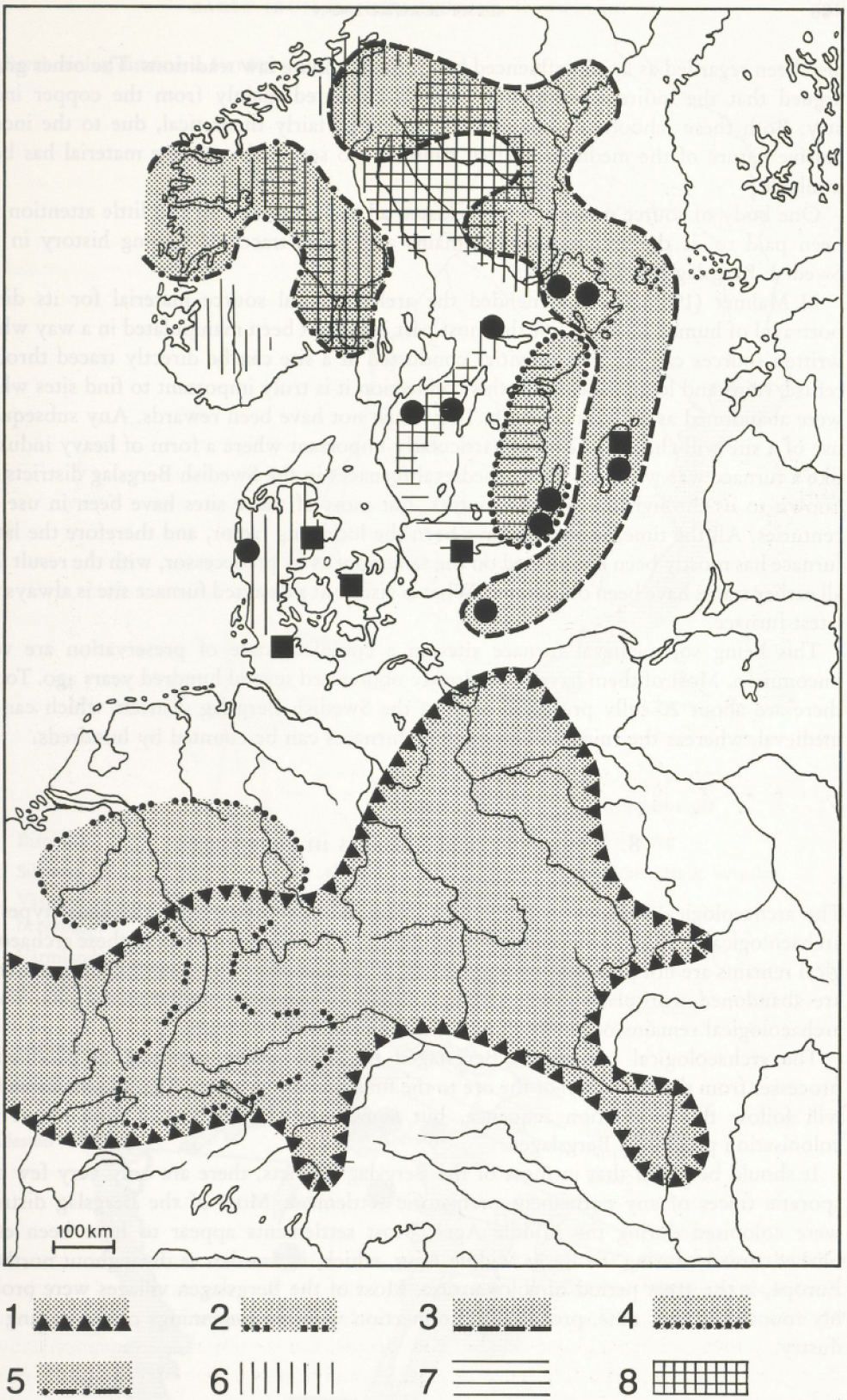
6. The role of iron

Iron transformed human living conditions fundamentally, but some time was to pass before production achieved such a volume that iron could be wasted, as it was during the Viking Era (800–1050 A.D.) and the Middle Ages.

Turning to consider consumption of iron during the Viking Era and the High Middle Ages (13th and 14th centuries), one can see that the amount of iron used during the latter period was at least 3 or 4 times greater. A new technique has made its appearance.

7. Indirect production of iron and the establishment of blast furnace

One of the big points of contention in Swedish mining history research has been the age of Sweden's »Bergslag« iron mining communities. This question, of course, is closely bound up with the origins of the first indirect production of iron from ore. Researchers are divided in their opinions. One group has been disposed to see this as an innovation coming mainly from Germany and entering the Bergslag communities of central Sweden during the 13th century. Traces of this German activity have been found above all in linguistic usage and in the terms employed in ironworking. Some of the medieval mining legislation has



Ironproduction areas and the distribution of ironbars in North Europe: 1 = Rhombic iron bars, 2 = Swordshaped iron bars, 3 = Spadeshaped iron bars, 4 = Pinshaped iron bars, 5 = Axeshaped iron bars, 6 = Prehistoric ironproduction areas, 7 = Medieval ironproduction areas, 8 = Prehistoric and medieval ironproduction areas.

also been regarded as being influenced by German mining law traditions. The other group argued that the indirect production of iron emanated mainly from the copper industry. Both these schools of thought have remained fairly theoretical, due to the inconclusive nature of the medieval written sources. No serviceable source material has been available.

One body of source material which existed all the time but that too little attention has been paid to, is the archaeological remains and other traces of mining history in the Swedish Bergslag district.

M. Malmer (1963) has commended the archaeological source material for its direct portrayal of human activity. For the most part it has not been manipulated in a way which written sources can be. The activities conducted at a site can be directly traced through refuse, ruins and lost property. In this connection it is truly important to find sites which were abandoned as early as possible. They must not have been rewards. Any subsequent use of a site will change it. This is particularly important where a form of heavy industry like a furnace was working. Many medieval furnaces in the Swedish Bergslag districts are known to us through the written sources, but most of those sites have been in use for centuries. All the time, waterfalls have been the localising factor, and therefore the latter furnace has mostly been established on the same spot as its predecessor, with the result that all earlier traces have been obliterated. What is visible at a deserted furnace site is always the latest furnace.

This being so, medieval furnace sites in a complete state of preservation are very uncommon. Most of them have been already obliterated several hundred years ago. Today there are about 20 fully preserved sites in the Swedish Bergslag districts which can be medieval, whereas the ruins of 19th century furnaces can be counted by hundreds.

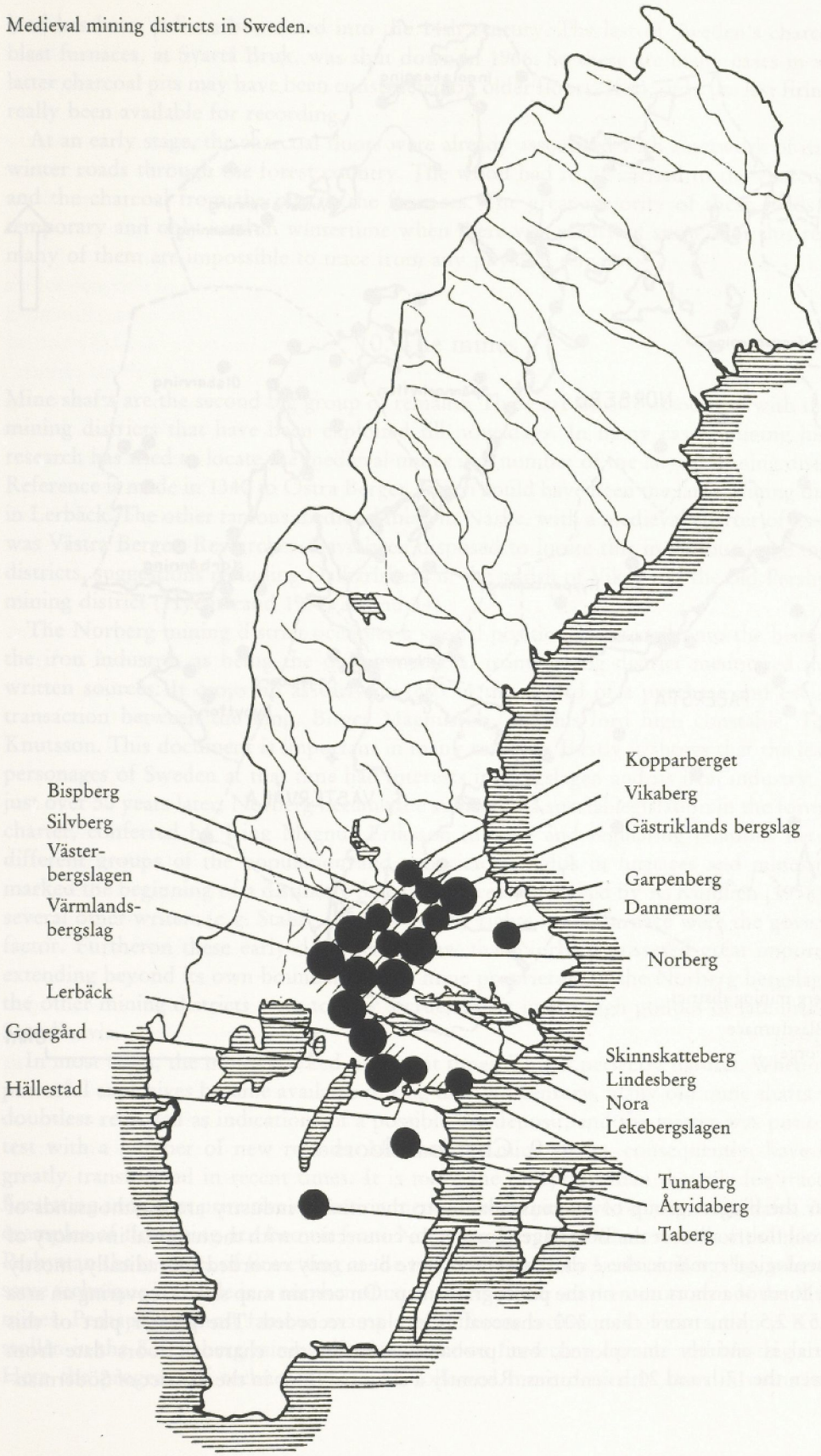
8. Archaeological remains in Bergslagen

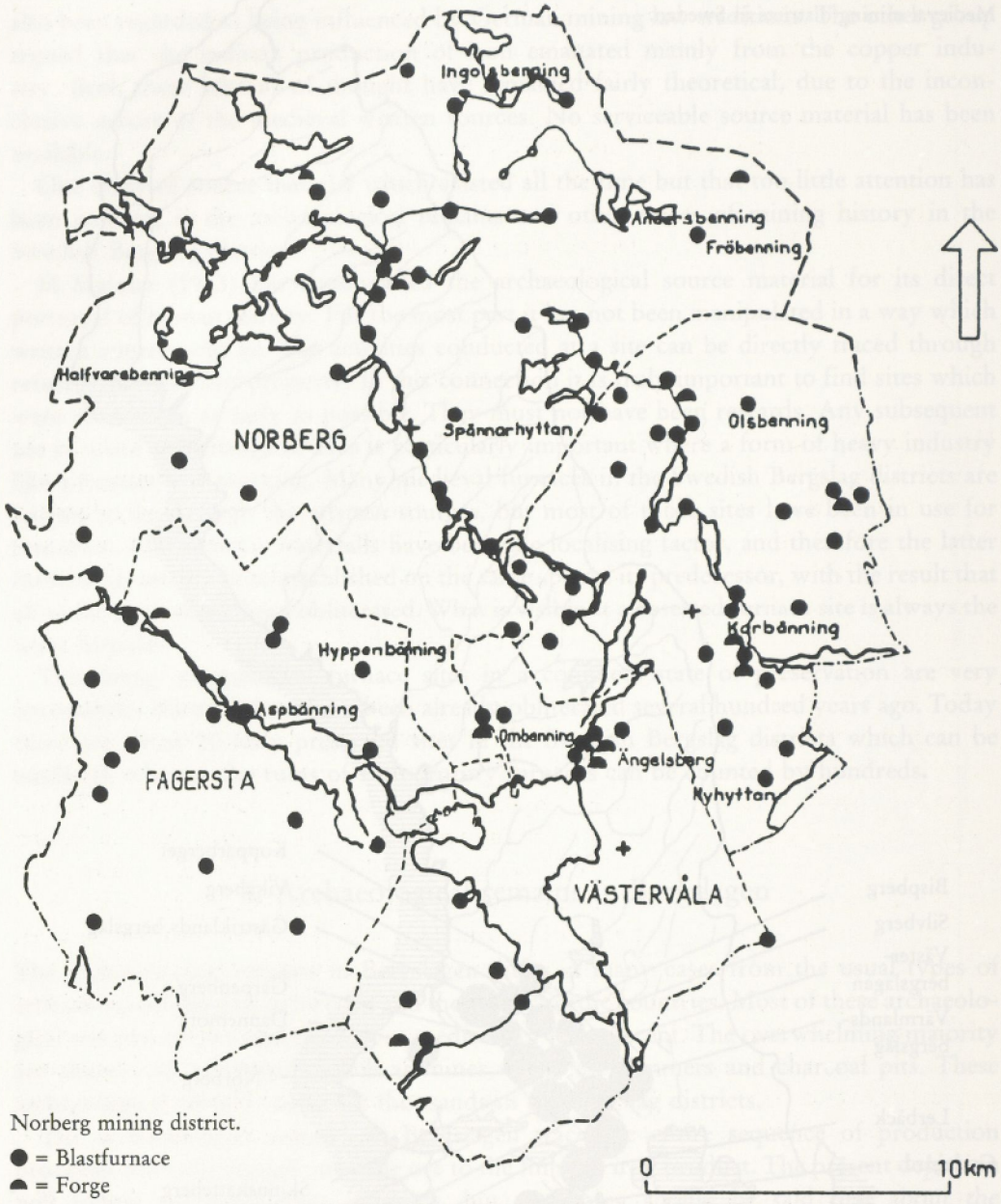
The archaeological remains in Bergslagen differ in many cases from the usual types of archaeological remains in Sweden and the other Nordic countries. Most of these archaeological remains are not prehistoric but medieval or more recent. The overwhelming majority are abandoned workplaces, such as mines, furnaces, hammers and charcoal pits. These archaeological remains occur by thousands in the Bergslag districts.

The archaeological remains in Bergslagen trace the entire sequence of production processes from the extraction of the ore to the finished iron product. The present depiction will follow the production sequence, but something should be said first about the colonisation process in Bergslagen.

It should be noted that in most of the Bergslag districts, there are only very few and sporatic traces of any permanent prehistoric settlement. Most of the Bergslag districts were colonised during the Middle Ages. Most settlements appear to have been established already during the Early Middle Ages, which, in Sweden as throughout northern Europe, is the great period of colonisation. Most of the Bergslagen villages were probably founded at that time, probably in connection with the beginnings of the mining industry.

Medieval mining districts in Sweden.





Norberg mining district.
● = Blastfurnace
▲ = Forge

9. Charcoal floors

By far the biggest group of remains relating to the mining industry are the thousands of charcoal floors all over the Bergslagen forests. In connection with the national inventory of archaeological remains, these charcoal floors have been only recorded sporadically, mostly in the form of a short note on the photografic map. On certain map sheets, covering an area of 2,5 × 2,5 km, more than 300 charcoal floors are recorded. The greater part of this material is entirely unexplored, but probably most of the charcoal floors date from between the 17th and 20th centuries. Recently a charcoal floor in the district of Söderman-

land has been radiocarbon dated into the 14th century. The last of Sweden's charcoaled blast furnaces, at Svartå Bruk, was shut down in 1966. So there are many cases in which latter charcoal pits may have been constructed on older floors. If so, only the last firing has really been available for recording.

At an early stage, the charcoal floors were already associated with a network of narrow winter roads through the forest country. The wood had to be carried to the charcoal pit and the charcoal from the pits to the furnaces. The great majority of these roads were temporary and only used in wintertime when there was plenty of snow. For this reason, many of them are impossible to trace from any physical remains.

10. The mines

Mine shafts are the second big group of remains. These are mostly associated with the big mining districts that have been exploited till nowadays. In many cases, mining history research has tried to locate the medieval mines in a number of the largest mining districts. Reference is made in 1340 to Östra Berget, which could have been the large mining district in Lerbäck. The other famous medieval mine in Närke, with a medieval charter of its own, was Västra Berget. Researchers have been disposed to locate this in various large mining districts, suggestions including Dalkarlsberg in the parish of Viker and the old Pershyttan mining district (Hyenstrand 1977, 25 and 34).

The Norberg mining district occupies a special position in research into the history of the iron industry, as being the oldest medieval ironworking district mentioned in our written sources. It crops up as early as 1303 in the record of a purchase and exchange transaction between the king, Birger Magnusson, and his lord high constable, Torgils Knutsson. This document is important in many respects. Firstly it shows that the leading personages of Sweden at that time had interests in Bergslagen and its iron industry. And just over 50 years later, Norberg became the subject of a special legislation in the form of a charter, conferred by King Magnus Eriksson in 1354 and regulating relations between different groups of the population and proprietory rights in furnaces and mines. This marked the beginning of a distinctly Swedish process, observed by K. Kumlien (1958) and several other writers (e.g. Stahre 1958), whereby rights in the furnace were the governing factor. Furtheron these early documents show that Norberg possesed great importance extending beyond its own boundaries. The mine proprietors of the Norberg bergslag and the other mining districts were to play a crucial part in the high politics of late medieval Scandinavia.

In most cases, the mines worked till recent times. This is perfectly natural. When more powerful explosives became available during the 19th century, many old mine shafts were doubtless regarded as indications of a possible ore deposit, and the matter was put to the test with a number of new rounds. Most of the mine shafts, consequently, have been greatly transformed in recent times. It is more the exception than the rule for traces of firesetting and other primitive extraction methods to be preserved in the mine shafts. A few examples of firesetting are known from Noraskog Bergslag, where some of the mines at Perhyttan show traces of firesetting at the top, and also from Lerbäck Bergslag, where the same technique is visible in a number of mine shafts of the southernmost arm of the Multna mines. Perhaps the most famous example of different techniques of extraction is Kungastollen in the Klackaberg mining district. It shows firesetting outside and blasting inside. Here the progress of technology can be followed more distinctly than in many other

places. As regards the ways in which mines were normally worked in earlier times and their usual appearance in Bergslag, a gallery, is not all that typical of primitive mining. More typical at that stage was the open mine with its long, winding or deap shafts, the depth of the mine was often restricted by the mine water.

At most mines, the surrounding workings are usually of concrete, which of course is a latter element. Older facilities are less common. What one can find is rudimentary foundations of houses, forges and powder magazines. At present we know very little about their age and the periods they represent. Adjoining them there can also be horseered gingangs.

The social environment of the mines is difficult to trace from the physical remains. For the time being, the written material remains superior for this purpose. There are, however, occasional remains which can demonstrate some of the social aspects clearly. The most interesting example is the mining village at Sala Silver Mine, dating from the 16th century, and an ore square preserved at the Klackaberg mines, above Kungastollen. In the mining village of Sala one can study the houses of 16th century workers. The archaeological finds include slag from silver refining probably an illicit activity, mentioned indirectly in contemporary judicial records from Stockholm.

In the ore square at Klackaberg, the extracted ore has been formed into equally sized piles, just over 1,2 m square and 0,7 m high. Probably this is a reflection of the mining team. The actual work of winning the ore was usually done by labourers, who also shifted the ore up to the edge of the mine, where it had to be put into equal piles. This was then distributed between the various partners and joint owners of the mine who were then responsible for getting it from the pit to the furnace. No ore square ought really to be left at all. After all, the joint owners had to pay for the entire investment which mining the ore implies, but then they have made no use of it, and nor has anyone else since that time.

11. The furnaces

Medieval mining and ironmanufacturing have been a topic of intense debate since the 1960s, above all within the Metallurgical History group of Jernkontoret. Two main »schools« crystallised out in this connection:

1. Blastfurnaces already existed in Sweden during the Early Medieval Period. The large export trade in Osmund iron from 1250 onwards was based on pig iron production in continuously operating furnaces. This pig iron was subsequently refined into malleable iron called Osmund.

An important hypothesis on this subject, propounded a long time ago by S. Lindroth (1955), was that the blast furnace might be a Bergslagen invention and of Scandinavian origin. He maintained that the idea was derived from the copper industry. Norberg, of course, is close to the Falun copper mine, which did not become a really important factor in the Swedish economy until the 16th century (Lindroth 1955, 73).

2. The blastfurnace was introduced in Sweden from Germany during the 16th century. The medieval Swedish iron industry was based on direct production of forgeable iron in non-continuously operating furnaces, otherwise known as »Stückofen«, based on continental models. Furnaces of this type were already known on the continent in the 12th century and must have been introduced into the Swedish mining industry subsequently. Swedish iron exports during the Medieval Period, accordingly, were based on iron produced directly in large lumps and then broken up in Osmund pieces.

What type of furnace once stood on the mound at Lapphyttan and what type of iron did it produce and all the other furnaces in the Swedish mining districts? The furnaces are the third group of medieval ironworking remains in Bergslagen. These are the archaeological remains which have been researched in recent years most intensely. Investigations on the medieval furnace sites of Lapphyttan, in the parish of Karbenning in Västmanland, and Vinarhyttan, in the parish of Norrbärke in Dalarna, have transformed our knowledge in many ways.

In connection with the Lapphyttan investigations it is now possible to show how complicated the very earliest furnaces were. In addition to the ruins of the furnace itself, there were traces of a roasting pit, a charcoal store, ore heap, fineries, water installations, an iron store and a settlement, the last mentioned remains include a primitive dwelling house. In principle, these facilities ought to have existed on every medieval furnace site.

Most of the 700 furnace sites in Bergslagen were in use during the 18th and 19th centuries. When they were rebuilt later, the earlier facilities were entirely obliterated. There is plenty of material for describing technological developments over the past 200 years, but the early material is a good deal scantier. The great importance of these archaeological remains for our knowledge of the earliest »industrial« ironworking would be hard to overstate. Here we have material, which, in all its details, can describe everyday life at one of the furnaces belonging to St Bridget's father, Birger Persson, »in silva suin«.

12. The introduction of the indirect process

Our inquiries at Lapphyttan have contributed completely new source material for discussions on the introductory phase of medieval mining and ironworking and the technical level and social environment of which it was both the product and the cause.

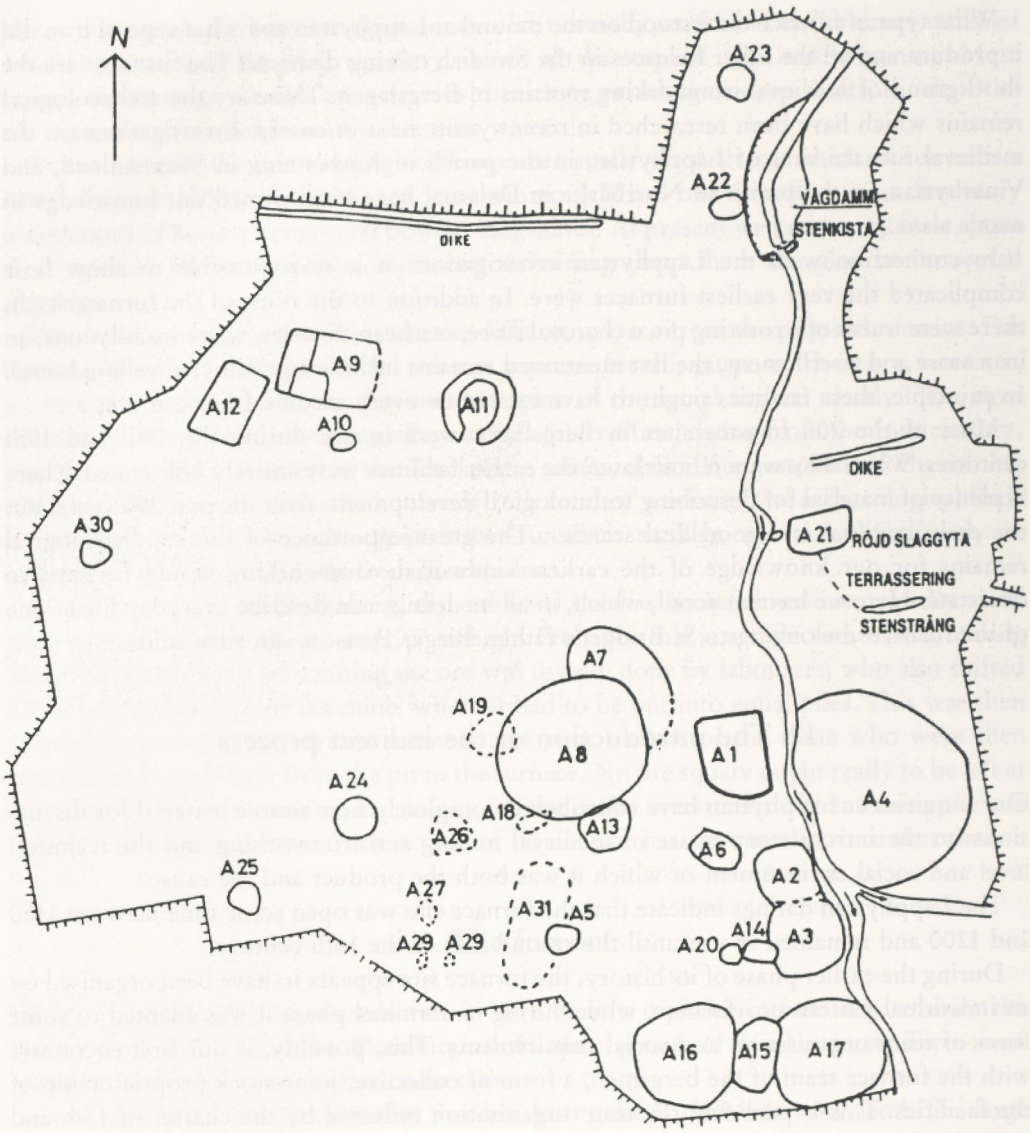
The Lapphyttan datings indicate that the furnace site was open some time between 1150 and 1200 and remained in use until the second half of the 14th century.

During the earlier phase of its history, the furnace site appears to have been organised on an individual pattern or initiative, while during its terminal phase it was adapted to some form of team organisation and social requirements. This, possibly, is our first encounter with the furnace team of the bergsmen, a form of collective, joint-stock proprietorship of the facilities. This is probably the team organisation reflected by the charter of 13th and 14th century written sources and partly expressed in the charter of 1354. This model of organisation was fully evolved in the 17th century.

The place names in Norberg Bergslag, and especially those ending with Benning, are predominantly Scandinavian. In other words, the alleged German influence during the initial phase of the mining industry is not apparent in Norberg Bergslag.

It has also been conjectured that the introduction of the blast furnace was an innovation sponsored by the social upper classes. Looking at the cadastre material of the 16th century, one find that all the furnaces were predominantly owned by bergsmen. I believe that the conversion of the Bergslag area from wilderness to industrial community was very much the work of the individual bergsmen, whose technical skill and social vision laid the foundations of prosperous development. This capacity for social organisation has been very dramatically expressed later on in the Engelbrekt rebellion, one of the few medieval rebellions of the common people to have succeeded, resulting as it did in the deposition of the ruler of the Kalmar Union, King Erik of Pomerania.

M. Malmer (1963) once broached the idea of two poles of medieval Scandinavian history.



The site of Lapphyttan

A 1 = Ruin of a blastfurnace
A 2 = Slagheap
A 3 = Slagheap
A 4 = Slagheap
A 5 = Slagheap
A 6 = Roasting pit
A 7 = A dug out area
A 8 = Charcoal floor
A 9 = Dwelling house
A 10 = Hearth
A 11 = Iron store
A 12 = Stable
A 13 = Charcoal barn
A 14 = Finery hearth
A 15 = Finery hearth
A 16 = Slagheap
A 17 = Slagheap
A 17 = Slagheap
A 18 = Layer of ore
A 19 = Layer of ore
A 20 = Slagheap
A 21 = Finery hearth
A 22 = Finery hearth
A 23 = Finery hearth
A 24 = Finery hearth
A 25 = Finery hearth
A 26 = Layer of ore
A 27 = Layer of ore
A 28 = Layer of ore
A 29 = Layer of ore
A 30 = Finery hearth
A 31 = Area with layers of ore

The ruin of the blastfurnace at Lapphyttan.

Following this, one can say that there were two essential poles of medieval Scandinavian history. One of them was the feudal agrarian economy, with its natural emphasis on the former Danish provinces, and the other is the dynamic early industrial development of the Mälar Valley area. During the 13th century this resulted doubtlessly in a heavy urbanisation of the Mälar region and a shift of the political centre of gravity in this direction from the more prosperous agricultural communities of Östergötland and Västergötland. This achieved its supreme manifestation in the foundation of the national capital, Stockholm, during the 13th century.

The ironproduction in Sweden began in the last centuries BC and was technically based on the direct method and worked by the farmers. During early medieval time there was an introduction of the blast furnace, the technical background for modern steel industry.

13. References

Cleere, Crossley 1985 = H. Cleere, D. Crossley, The Iron Industry of the Weald (Leicester).

Furingsten 1979 = A. Furingsten, Tidig järnframställning i Forentorpa ängar. Västergötlands fornminnesförenings tidskrift.

Hallinder 1972 = P. Hallinder, Det småländska järnet. In: Kronsbergsboken 1971.

Hayen 1968 = H. Hayen, »Isenbarg«. Ein Eisenverhüttungsplatz in Streekermoor. Gemeinde Hatten, Landkreis Oldenburg. Oldenburger Jahrbuch 67.

Hyenstrand 1977 = Å. Hyenstrand, Hyttor och järnframställningsplatser. Jernkontorets forskning Serie H nr 17 (Stockholm).

Jacobsen 1983 = S. Jacobsen, The Reducibility of Iron Ores Found on Prehistoric Iron Production Sites. In: Jernkontorets forskning Serie H 24 (Stockholm).

Johansen 1973 = A. B. Johansen, Ironproduction as a Factor in the Settlement History of the Mountain Valley Surrounding Hardangervidda. In: Norwegian Archeological Review 6, Nr. 2.

Kumlien 1958 = K. Kumlien, Jernberget och kronan. In: Norberg genom 600 år (Uppsala).

Lindroth 1955 = S. Lindroth, Gruvbrytning och kopparhantering vid Stora Kopparberget intill 1800-talets början. Del I och II (Uppsala).

Magnusson, Millberg 1981 = G. Magnusson, P.-O. Millberg, Lågteknisk järnhantering i Skaraborgs län. Västergötlands fornminnesförenings tidskrift 1981–82.

Magnusson 1984 = G. Magnusson, Lapphyttan. En medeltida masugn i Karbennings socken. In: Karbenning – en bergslagssocken (Norberg).

Malmer 1963 = M. P. Malmer, Metodproblem inom järnålderns konsthistoria (Lund).

Morgan 1877 = L. Morgan, Ancient Society (New York).

Nihlén 1932 = J. Nihlén, Studier rörande äldre svensk järntillverkning med särskild hänsyn till Småland, Stockholm. In: Jernkontorets Bergshistoriska Skriftserie 2 (Stockholm).

Pape 1979 = W. Pape, Histogramme neolithischer 14C-Daten. Germania 57.

Serning 1979 = I. Serning, Prehistoric Iron Production. In: Iron and Man in Prehistoric Sweden. Jernkontoret (Stockholm).

Stahre 1958 = H.-G. Stahre, Magnus Erikssons Previlegiebrev för Norberg den 24 februari 1354. In: Norberg genom 600 år (Uppsala).