Summaries

Järnmöllan in Tvååker. Introduction and background of the project

By Gert Magnussen

For almost a century the iron mill, Järnmöllan at Tvååker in Halland on the west coast in SW Sweden has been known and discussed. One of the oldest documents about water powered iron production in Europe from 1197, reveals that Järnmöllan was a donation from Absalon, the archbishop of Lund, to the friars of Sorö in Sealand. The discussions have focussed on two main hypotheses: one being that Järnmöllan was a forge, the other that it was a reduction furnace, where the smiths had produced wrought iron out of limonite ore. The interest of the site is due to the fact that the introduction of water power is consideret one of the most important steps towards an increase in iron production and industrialised society.

Though the few written documents known from the 13th century was thoroughly analysed, the question of the nature of Järnmöllan remained unsolved. In the 1980s, however, surveys for ancient monuments in the area of Tvååker, revealed some ten sites with ancient slags. From the medieval documents the area of Absalon's donation could be reconstructed. Within the suggested location one larger site with large slag heaps was found. Could this site be the one mentioned in the medieval documents? If so. would it be possible to shed some new light on the old question about Järnmöllan, the, in written sources, oldest known water powered iron production?

In the 1990s a iterdisciplinary research group was set up lead by Hans Andersson, professor in archaeology. The other members were the archaeologists Gert Magnusson, Bo Strömberg and Jens Vellev, the human geographers Per Connelid och Catarina Masher, the historian Rikke Agnete Olsen and the metallurgist Vagn Buchwald. The fieldwork was carried out 1993-95. The source material consisted of four different types: the written document, the remains of furnaces and other constructions in the river valley, the reconstruction of the landscape and the metallurgical analyses. Our intention was that these materials cooperately would lead to a new understanding of the Järnmöllan at Tvååker.

The village of Tvååker and the property of the cistercian monastry at Sory

By Kai Hørby and Rikke Agnete Olsen

A new transcription, reading and translation of the pages concerning the property in Halland in the book of donations of the monastery of Sorø. The new reading combined with a detailed survey of maps of the area and a thorough visit to it has made it possible to suggest the size of the property.

Sorø at Tvååker

By Rikke Agnete Olsen

The Cistercian monastery at Sorø on Sealand was kind of family institution for the so-called Hvide family which fostered among other mighty men the archbishops Absalon and Andreas Sunesøn. Absalon endowed the monastery with much land, among that part of Tvååker in Northern Halland to make it possible for them to get timber for their buildings.

The gift was not very clearly described; the monks soon came into conflict with the local peasants and Absalons successor and cousins son Andreas Suneson had to specify the quality of the gift. The original documents concerning the transactions are not preserved, but a renewed study of the entry in the Register of the property of the monastery, made at different times but in the middle ages does make it possible to draw the borders of the property and to see that the monks farmed their land and cut their timber. Their lands were close to iron producing areas, but they did not make iron themselves.

About »Sorø Klosters Gavebog« (the book of donations of the monastery of Sorø) – and about production of iron and salt in Halland

By Jens Vellev

The article discusses the famous reports of letters from around the year 1200 in the book of donations of the monastery of Sorø. The reports deal with the winning of iron and salt in the areas around Tvååker, which is located near Varberg in Halland. Older printed publications of the texts are discussed, and the antiquarian/archaeological research made so far is presented. A seperate paragraph treats a trial related to an iron pan produced in the area. The pan was brought to Læsø, where it was used in one of the many salt huts on the island. A final chapter deals with a number of experiments made with winning of iron. The experiments were made in order to get a better understanding of the extensive, but still puzzling process, which has been used for centuries to produce malleable iron from bog iron.

Landscape changes in early Medieval Halland: farming system, iron production and the expansion of a monastic estate in the parishes of Tvååker and Sibbarp

By Catharina Mascher & Pär Connelid

This article deals with the landscape and settlement history in the parishes of Tvååker and Sibbarp in central Halland, with focus on the dynamic period c. AD 900-1300. During the early Middle Ages, several dramatic changes in the agrarian society and landscape occurred in the investigated area. Among the most important landscape changes were the dissolution of prehistoric farming and land ownership systems together with a re-organisation of the settlement structure. Just like other parts of western and southern Sweden, the county of Halland is rich of traces from prehistoric farming. Most notable are the extensive cairn fields, which in many places date back to the late Neolithic Period, and the large coaxial field systems that were established during the late Iron Age.

The prehistoric farming system, represented by the cairn fields, was characterised by a dynamic land use. Small plots of arable fields lay spread in a vast grasslands, mainly used for fodder production. Some fields were manured and intensively tilled, while others were managed with a fallow rhythm. From recent investigations, we know that the settlement in some cairn fields consisted of several households managing the land together. The cairn fields are mainly found in the highland regions, rich of woodland. Traces of prehistoric farming in the coastal zones and in the today heavily cultivated plain areas, are much more hard to detect.

During the late Viking Age, new ways of regulating disposal rights to land were implemented on ground. Large systems with regularly divided strip fields were established on the best land, often in the former cairn fields (and their equivalents in the plain areas). This radically new and systematic dividing of land can be seen as an effect of important changes in the contemporary society. At this time, the Danish kingdom became more consolidated and powerful in many respects. The strict system with land divisions presumably meant better methods for an authority to control property, land use, taxes and the flow of agrarian products.

The incitement to control land and property could be realised through a socio-political system with a powerful (royal) elite and their local representatives.

Around 1200, the strip field-systems lost their initial function as new, more intensive, cropping patterns were introduced. These changes must be seen in the light of the new social, political and economic orders that emerged in the Medieval society. Several of the larger settlement units were dissolved and some farms either moved to new places on the former outlands or were abandoned. As the importance of animal production continuously grew during the Middle Ages, significant areas of arable were turned into grazing and meadow land.

Also, the iron production that flourished in the area during the period c. 900-1200 AD, rapidly decreased in the early Medieval period. The iron work was located around the archaeologically documented water mill by the streamlet Sandabäcken, situated on the land belonging to the historical farms Ugglehult and Dövared. According to the investigations, an important amount of iron was factored here. Soil for the iron melting and wood for the charcoal needed to run the ovens, was most likely collected in the nearby area. It is assumed that the iron production was controlled by people based in the local agrarian society. One hypothesis is that some (powerful) farmers themselves ran the iron work along with their ordinary farming activities. For some reason, the iron production disappeared from the area c. 1250. At this stage, the foundation of a monastic estate had also entered the scene in Tvååker.

In the year 1197, Absalon, the bishop of Lund, donated an episcopal estate (*villa* or *grangie*) in Tvååker to the cistercians at the abbey of Sorö on Zealand. Only five years later, 1202, a dispute concerning the extension of the monastic estate took place and the archbishop Sunesen personally had to confirm the boundary and define it's outer landmarks. From the (sometimes vague) descriptions of important boundary localities in the document from this event, the estate can be roughly reconstructed. In the document, two of the sites mentioned are the "iron mill" and "south iron works". According to our analysis of the document, and in view of the landscape history in the area, it seems likely that the iron mill at Sandabäcken was located just outside the monastic estate. It also seems to be the fact that the monks never were engaged in the iron production at this particular mill.

As mentioned above, the iron production decreased c. 1250, shortly after the cistercians had established their estate in Tvååker. If there is an *a priori* connection between these two events, we still don't know. Presumably, the expansion of the cistercians in the area, led to changes in both economical and judicial matters for the neighbouring farmers. The donation of land to the monastery at Sorö, probably meant that important resources were lost for the people involved in farming and producing iron. Further, it's likely that the donation also meant changes in the social hierarchy of the area, which could have led to a withdrawal of people with the economic interests (both capital and manpower) that guaranteed the iron production.

The article stresses the importance of analysing the three components discussed above – that is, changes in land management, the rise and fall of the iron production and the foundation of a monastic estate (*grangie*) in the Tvååker-Sibbarp area – in a broad historical-geographical context. Seen together, as parts of a big puzzle, these three components can throw new light on the complex early Medieval society in Halland and Denmark.

The archaeological investigations at Tvååker in Halland

By Strömberg

The first archaeological investigations at Tvååker were undertaken in the 1920s by Carl Sahlin and John Nihlén. They were focusing on the small rapids at Järnmölle farm, but did not find any remains of iron production on the site. Nihlén discovered, however, some furnaces at Högsryd nearby and a slag heap at Järnvirke. Another archaeological survey was not undertaken until 1987, when yet another seven sites of iron production sites were registrated and described, among them the site at Ugglehult/Dövared.

When the project started in 1993 one of the important issues was to investigate whether any slag could be found at Järnmölle, in order to determine if this could be the site of the iron mill mentioned in the medieval documents. However, no slag was found in situ, which led to the conclusion that the iron mill had been situated elsewhere.

Södra Järnvirke and Järnvirke were other sites of interest At Södra Järnvirke a slag heap measuring 9×4 meters and 0,8 meter height had been discovered in 1987, When excavated, a pair of bloomery furnaces were found along its south east side. Constructed with slag tapping, they were similar to the bloomery furnaces that have been found in Västergötland dating from the 11th and 12th centuries and coherent with the radiocarbon dating at Södra

Järnvirke, The largest slag heap, measuring 22×9 meters and 1 meter in height, was situated in the vicinity of Järnvirke. The analysis of the slag and the burned clay from the furnace inclining showed that the furnaces there had been of the same type.

The largest archaeological excavation was undertaken at the Ugglehult/Dövared site. Between a narrow road on the west side and a low stone wall on the east side the site is situated by the rapids of the Sanda stream. The stone wall is indicated on a map from 1727. Here a large slag heap, a pond and a pond wall, the remains of a mill as well as a smithy with three hearths and the foundations of a water wheel in the rapids were found. The radiocarbon analysis dated the iron production to the 11th to the 12$_{th}$ century. In the beginning of the 14th century a (flour) mill was founded in the same place and the pond wall was rebuilt into a higher construction.

A 7×6 meter building with its contents on the shore of the rapids together with the majority of the slags proved that hearths had been used for bloomery iron production and that bellows had been powered with a water wheel. A lot of smithing slag and hammer scale that was spread over the site, showed that a forge also had been part of the production unit.

This water powered smithy is, as far as wee know, the oldest known and exavated site of its kind in Europe. Probably far from being the only one of its kind at the time, we can only hope that water powered iron production sites would be found in for instance Germany, France or Italy. This would make a better understanding possible of one of the most important innovations in the history of metallurgy, the water wheel technology, A technology that opened up iron production for a world wide industrialisation.

8Medieval direct iron production at Jernvirke and Ugglehult, Tvååker, Halland

By Vagn Fabritius Buchwald

The archaeological excavations in 1993-1995 at Jernvirke, RAÄ 85, and Ugglehult, RAÄ 84, East of Tvååker, Halland, have yielded a large number of slags and ore, but very few iron objects. About 80 objects were selected for thorough structural and analytical studies. It is shown that the slags from Jernvirke belong to the ancient bloomery process where clay-built twin furnaces have been operated with hand-bellows. The slags are similar to slags from earlier or contemporary clay-built furnaces, both in chemical and structural aspects, and examples from other localities are given. The specific gravity is 3.0-3.6 g/cm^3 and the slags are generally quite dense. The yield of iron has been calculated to be about 19 kg per 100 kg slag present on the site. The iron blooms were soft wrought iron with less than 0.1% carbon.

The slags from Ugglehult are of a new type due to the introduction of water-powered bellows. They are slightly more porous and have specific gravities of 2.8-3.4 g/cm^3. They are similar to slags from later water-powered furnaces in southern Sweden of which examples are given. It became customary to use double bellows, but we do not know whether this was already the case at Ugglehult. The furnaces have not been identified, but they may have been similar to the stone-built furnaces of later centuries, as e.g. described at Nornäs, Sweden, 1851. The yield of iron was considerably improved relatively to Jernvirke, as deduced from the increase in the ratio SiO_2/FeO of the surviving slags. The iron blooms were slightly carbon-enriched wrought iron with 0.1-0.2% carbon.

In an attempt to estimate the charcoal consumption and the influence on the surrounding forests various assumptions had to be made. In one scenario, that appears quite likely, it is shown that the large slag heaps around the “modern” Ugglehult furnace may have accumulated over 50 years, corresponding to a production rate of some 200 blooms, each of 10 kg per year. This required coppicing for charcoal in a forest area of 14 ha. In this scenario the consequences for the forest caused by the iron production were apparently minor, so when the iron production at Ugglehult declined and stopped in the 13th century it must have had other causes.

Iron production at Tvååker in Halland. A concluding discussion about Järnmöllan

Gert Magnusson

A water powered iron production, Järnmöllan, an iron mill near Tvååker village in Halland was mentioned 1197 in a deed of gift from the archbishop Absalon to the Sorö monastery in Sealand. The original document has been lost, but several copies from the 13th and 15th centuries are still existant. The main issues of the project were to discuss where Järnmöllan was situated, when its was working, what technique that was used and by whom it was run. In order to discuss the technique used at Järnmöllan in early medieval times, the dating of the remains of the iron production at Södra Järnvirke, another locality mentioned in the medieval document, as well as the nearby site at the stream of Sanda on the border between Ugglehult and Dövared were important.

The work in the project has followed several steps. The first was a close reading of the Latin text of the medieval documents, which led to the realisation that the iron production at Järnmöllan never seemed to have been a part of Absalons property. The water powered technique was most certainly developed within the farming community. An inmportant question was if the modern locality named Järnmölle not far from Tvååker could be the medieval production site. However, no slags were found at Järnmölle or its vicinity and the rapids, no more than about a meter height, seemed too small for such a site. Neither did the test excavations that were undertaken reveal any remains of iron production.

Through the slag finds at Järnvirke and Ugglehult/Dövared, it was concluded that at least two different techniques had been in use, namely a water powered forge combined with a water power bloomery production. At Järnvirke two bloomery furnaces were found by a large slag heap, along with another unusually large slag heap, which also was excavated. No bloomery furnaces were found at this second site, but the slag showed that the bloomery technique had been used there too. Neither site was situated by any stream or rapids, which implied that man power has been used for the bellows, which ruled them out as the location of the medieval iron mill - Järnmöllan. The site at Ugglehult/Dövared was a altogether different matter. By seven meter high rapids, a pond, the remains of a building with three hearths for iron production as well as slag remains of production, calotte slag from smithing and a lot of hammer scale were found. The hearths appeared very similar to those of the specialised central European bloomery iron production as presented by Agricola in the 16th century.

The dating of iron production in the vicinity of Tvååker is of great importance. According to some 20 radiocarbon dating the activity seems to have been undertaken in the 11th and 12th century and was probably closed down shortly after the donation of Absalon. Some scholars in history of technology have argued that the donation should be seen as a demonstration of the Cistercians as innovators of iron production techniques. However, at Tvååker, the results suggest that the monks closed it down and use their forests for other purposes, such as building timber.

The conclusion that has been drawn is that the iron production at Järnmöllan was founded and developed within the farming community. When the monks took over the forest, timber and charcoal became conflicting interests, with the result that the iron production disappeared after approximately 200 years as an outlaying production for the farmers at Tvååker.