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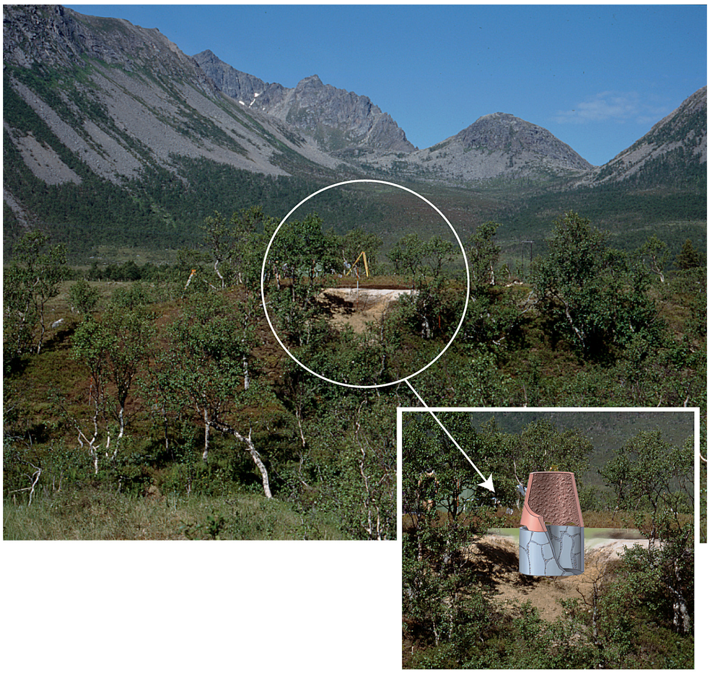
Production or Trade?

The Supply of Iron to North Norway during the Iron Age



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PREFACE

As humans are different, so are archaeologists. Some are devoted to long-term planning and work determined to reach their goal, while others follow a more random approach. I recon myself as belonging to the latter category. First, writing a dissertation was never a result of any long-term plan, and second, for most of my career as an archaeologist I have never been devoted to the intricacies of ancient iron production technology. Thinking back, my current interest in early iron making and the supply of iron may not have been mere chance. In the spring of 1981, during my time as a mag. art. student, I was assigned to write a paper on "Metal Technology" and I believe this led to my later interest in the subject. When conducting an excavation at Flakstadvåg in 1986, I heard rumors about a discovery of iron slag in the outland area not far from the settlement. This bit of information was not followed up on at the time but was never forgotten, and after more than a decade, I returned to Flakstadvåg to see if this could be verified. The discovery of the iron production site at Flakstadvåg led to a growing interest in the subject, which has led to this thesis.

During this work, I have done in situ studies of many iron production sites and been met with interest and helpfulness by many colleagues who have guided me on their "home ground". These have been Hannu Kotivuori at "The Provincial Museum of Lapland" in Rovaniemi, Finland, who led me to the sites he had excavated; Anders Hansson at "Jamtli", the regional museum of Jämtland and Härjedalen in Sweden, who guided me to many of the numerous production sites around Lake Storsjøn; Bernt H. Rundberget at the "Museum of Cultural History" at the University of Oslo, who took me on a tour of Buskerud County to study the ironworks there, and Lars Stenvik at the "Museum of Natural History and Archaeology" from the Norwegian University of Science and Technology, who took me on an extensive tour to many of the ironworks in Trøndelag. I am grateful to all of them for their accommodating attitude and the patience my many questions was met with.

This work rests heavily on the archaeological excavations I conducted at Flakstadvåg and Hemmestad Nedre. This could not have been done without the enthusiastic participation of those who assisted me in the field. During the excavation at the iron production site at Flakstadvåg in 1998, the following individuals participated:

Signhild Simonsen, Nils Inge Nilsen, Ann-Kristin Jensen, Cicilie Pedersen, Geir Are Johansen and Kristine Orestad Sørgaard. The following year, Daniel Lantho and Snorre Johannessen, both 10-years-old, helped in excavating a boathouse at Flakstadvåg. The excavations at Hemmestad Nedre were rendered possible by the help of Tina Amundsen, Harald Singstad, Nina Bergum, Dag Magnus Andreassen and Richard Binns.

Several of my colleagues at Tromsø University Museum have helped me in the process of completing this work. Those most involved have been: Sveinulf Hegstad with scanning photos, Johan Eilertsen Arntzen with making maps and helping with the intricacies of "Word" and Ernst Høgtun and Adnan Icagic with figures and photos.

Inger Storli and Bjørnar Olsen have read the manuscript in various stages of completion. Their knowledgeable suggestions, comments and criticism have been of great importance and I am grateful for this. Still, it is a given that any weak points and mistakes in this paper are solely my responsibility.

Tromsø, March 2010

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1 INTRODUCTION

The earliest archaeological fieldworks conducted in North Norway focused on collecting antiquities, conducting surveys and documenting historical monuments, but archaeological excavations soon became equally important. During the period from 1875 until 1923, approximately 3,500 Iron Age graves were documented, and close to 800 graves were excavated (Holm – Olsen 1988:4-5; Winther 1876). The motives for this extensive excavation activity were to establish a typological-based chronology, as well as confirming that the north Norwegian Iron Age settlements had been northern offshoots of the Germanic Iron Age culture.

These first 50 years of Norwegian archaeological research has been termed the "burial mound period" and little emphasis was placed on settlement and production. However, in southern Norway, iron production had long ago been documented as part of this culture and ironworks documentation has been taking place since the early 1900s (Stenvik 2003 a: 120). Even though no iron production site had been found in the north, it was assumed that iron was also produced at the north Norwegian settlements (Sjøvold 1962:48). This has been the general assumption, although no serious effort has been made to investigate this alleged north Norwegian iron production or the supply of iron. Despite the lack of empirical data, Bertelsen (1985:42) for example, took it for granted that there had been iron production in North Norway: "*…it is probable that most people would wish to learn how to both produce iron and forge tools. We expect that this took place during the centuries around BC/AD*" (author's translation).

The seemingly general acceptance of the north Norwegian Iron Age being a mirror image of the south triggered my curiosity. When I found the first iron production site at Flakstadvåg in 1998, my professional interest was awakened. Were there really a vast number of undiscovered iron production sites supplying the north Norwegian settlements with iron during the Iron Age?

1.1 Problems to be Addressed

The main purpose of this work is to consider the supply of iron to the north Norwegian Iron Age settlements. Archaeological material indicates the widespread use of iron from the Late Roman Period and throughout the Iron Age (AD 200 –

1050). Was this based on local production, on trade or both? Since 1994, new data concerning the north Norwegian iron production has been brought to light, and I have found it necessary to give a comprehensive presentation of the iron production sites that have been documented in order to shed light on this problem. It has also been necessary to undertake an evaluation of the production to search for technological traditions that may have inspired it, as well as to scrutinize the scope of this production.

It has also been important to investigate additional archaeological material relevant to understand the supply situation and the seemingly comprehensive use of iron. Especially significant here is the iron currency bars and the blacksmith's tools as indicators on trade and the knowledge of working with iron.

The reader should bear in mind the fact that archaeological research on north Norwegian iron production lags behind south Scandinavian research by approximately 100 years. For that reason, we may consider ourselves to only be at the starting point in terms of exploring how and from where iron was supplied to the northern societies during the Iron Age. Despite the limitation of the material, my preferred way forward is to systematize and scrutinize the material so far gathered, in order both to make some provisional conclusions and to prepare the ground for future research.

1.2 Geographical and Chronological Framework

The geographical framework for this work is North Norway, i.e. the counties of Nordland, Troms and Finnmark. Norway is divided into five museum districts, each with a museum which has been given the authority to excavate and store archaeological finds according to the Norwegian Cultural Heritage Act. Nordland County is split between the Tromsø University Museum and the Museum of Natural History and Archaeology in Trondheim, though I have disregarded the boundaries of museum districts and chosen to include all of Nordland, Troms and Finnmark in the analysis. Restricting the study to these counties has been done because of the need for limiting the area of research and not because these modern, administrative constructions necessarily had any significance in the Iron Age.

Figure 1 - Fennoscandia with some geographical references (Graphics: Adnan Icagic, Tromsø University Museum)

Social and technological development in North Norway has always been related to neighboring settlements in the east and south. To a certain extent, all of Fennoscandia has been brought into this discussion, but particular attention has been given to the northern part of Fennoscandia.

The Iron Age (500 BC – AD 1050) is the primary chronological timeframe for this work, although this is not to say that data originating from other periods is being disregarded. Earlier and later material is included in the discussion whenever I feel it will contribute to a better understanding of the period in question. One of the presented iron production sites dates to the Medieval Period (AD 1050 – 1500). The reason on why this is described and discussed is its potential to also shed some light on questions related to sites dated to previous periods.

I frequently refer to the Early Metal Period which is a transitional period between the Stone Age and the Iron Age AD, and roughly covers the Bronze Age and the Pre-Roman Iron Age, i.e. the period between 1800 BC to BC/AD (Carpelan 1979; Jørgensen 1986). In much of North Norway there are little or no finds from the Nordic Bronze Age. I have therefore found this term to be useful as it better fits the cultural development in northern Fennoscandia than the traditional chronology based on finds in southern Scandinavia.

1.3 Ethnoarchaeology: Relevance and Cautionary Tales

Ethnoarchaeological research has documented how religious and social conditions in traditional societies may play an essential role in the acceptance and use of iron. It is possible and even likely that such conditions influenced also people's relationship to iron in the north Norwegian Iron Age. The influence of mental structures is difficult to identify in the archaeological record, but may nevertheless have been of vital importance in the production, distribution and use of iron.

Iron production based on traditional technology has been practiced in Asia and Africa until well into the 1900s. Even though this practice mostly had terminated when the ethnoarchaeologists arrived on the scene, older people still knew about the craft which has been documented by a number of ethnoarchaeological works on both paper and film. Such studies have proved to be very informative and useful not only for understanding the technological aspects, but perhaps even more so with regard to the magical, religious and social aspects of traditional iron production that normally leaves few or no signs in the archaeological record. Even in Europe the method for making forgeable iron directly from iron ore in one process was practiced long after the Iron Age. The method was practiced occasionally in southern Scandinavia up until the 1850s with various adaptations based on the same technology (Buchwald 2000:66). However, when Scandinavian researchers began taking an interest in this technology the last ones to have carried out this craft were long gone, and information about mental structures such as rituals and ceremonies believed to be necessary for successful production was forgotten.

One can easily become dazzled by the wealth of information obtained by ethnoarchaeological studies in terms of taboos and intricate ceremonies carried out at smelting sites, but there are many possible pitfalls in using analogies from ethnoarchaeological studies since the chronological, geographical, technological and cultural frameworks are so different. Most people would agree that results from studies in Africa or Asia today cannot be directly applied to studies of the Iron Age starting more than 2000 years ago. Nevertheless, such studies are an important reminder of things in life that are easily overlooked or neglected by archaeologists. Much of the research on early iron production has had a strong focus on technology, such as natural draft or the use of bellows, furnace temperature, the height of the shaft, etc. Exploring these things are all important for acquiring an understanding of how prehistoric iron production worked, but ethnoarchaeological studies have demonstrated that there may have been much more to the craft than mere technology. In order to fully understand some of the technical solutions, we have to reach beyond the artifacts to get a closer view of the mental structures that guided the technology. For archaeologists whose interpretations lean heavily on material culture, this may seem a nearly impossible task. The mental structures that we search for are like dark matter in space which cannot be directly observed, but only by the impact it has on other, observable matter. Still, to neglect that which cannot be directly observed, or archaeologically sensed, may prove fatal if a more comprehensive understanding of iron production is sought.

Numerous ethnoarchaeological studies have focused on traditional iron production. I have chosen to pay particular attention to some African and Asian studies conducted by Barndon (1992, 2001), Haaland (2004) and Rijal (1998). In addition, I have also found documentary films by Huysecom (1995) and Saltman, Goucher and Herbert (1986) very informative in describing the social and mental framework of the process of iron production. These films and other ethnoarchaeological studies have contributed to a way of thinking about early iron production which would have otherwise been hard to comprehend. The usefulness of such studies may not be so much in the specific finds they describe, but rather in a way of thinking about prehistoric crafts which probably have to be observed to be fully understood.

1.4 The Structure of This Thesis

The discussions and presentation of the archaeological material have been divided into eight chapters. In order to better create a framework and setting for further analysis chapter 2 outlines the research history on the early use of iron and the initial phase of iron production in Fennoscandia with a special emphasis on the geographical area closest to North Norway. Chapter 3 presents the three iron production sites found so far in North Norway. These are given a thorough and comprehensive presentation and this chapter deals in great detail with the excavations and dates of the sites. Chapter 4 concerns raw material and technological aspects related to the three iron production sites, while Chapter 5 explores both the social context and economic setting in which the iron production took place. Chapters 6 and 7 look into other find categories that may shed light on the supply situation. Chapter 6 deals with iron currency bars. These have been found by the thousands in southern Norway, while few such finds have been acknowledged in the north Norwegian archaeological record. This chapter presents a comprehensive survey of these finds and discusses what they may reveal about the supply of iron. Chapter 7 presents finds related to the work of a blacksmith: smithing tools, equipment from smithies and excavated smithies, in order to shed light upon the technological knowhow related to the production of iron and working iron objects. Chapter 8, the final chapter, discusses data presented in the previous chapters in relation to factors such as ethnicity, magic, religion and social structures. Results from ethnoarchaeological studies and recent studies on the development of the socio-political organization of the Iron Age socities have been considered in explaining the seemingly small iron production in North Norway. A model is presented which explains why iron production never became more widespread and also how the supply of iron was maintained.

2 THE FIRST IRON PRODUCTION IN FENNOSCANDIA

Most research on this topic has focused on finds in the southern part of Fennoscandia, while few researchers have been preoccupied with the first iron production in the north. Historically speaking, this has been the case although the tide now seems to be turning as more information about the northernmost iron production is revealed. Research into iron production in southern Scandinavia, which dates back to the early 1900s, is part of a long lasting and strong European research tradition (Stenvik 2003 a).

For a long time, international studies related to iron production have been a major research field involving scientists from many disciplines (archaeologists, metallurgists, ethnographers, linguists and more). Archaeologists have been instrumental in bringing this research forward, although it has been greatly influenced by the natural sciences as the debate has focused on furnace types, the use of bellows, melting temperature, soft iron, hardened iron, carbonization, the phosphorous level in iron ore, etc. Being an archaeologist myself, I feel that the social aspects of iron production have often been overshadowed by a strong and continual focus on the technological aspects of iron smelting. Even so, the broad and continuous approach to the study of early iron production has led to a prolonged and comprehensive effort in exploring this important topic. Throughout the 1980s and 1990s, an increasing ethnographic and ethno-archaeological interest in this field has contributed greatly in expanding our understanding of the social, mythical and magical components of early iron production.

The first excavations of prehistoric iron production sites in Fennoscandia go back to the early 1900s (Hjärthner-Holdar 1993; Mäkivuoti 1987; Stenvik 2003 a), but in the early days research was quite random and sporadic. Research into this topic increased greatly in the 1970s and 1980s, particularly in Sweden and Norway, while early iron production was given less attention in Finland. I will briefly look into the research on iron production in other parts of Fennoscandia before concentrating on North Norway.

2.1 Finland

Research into early iron production has not been a high priority among Finnish archaeologists, and between 1894 and 1987, this has been the main subject in only eight papers (Mäkivuoti 1987:59). This changed, however, in the 1990s as prehistoric metalworking attracted more attention (Lavento 1999:75). In western and southern Finland, iron slag, forge-stones and blacksmiths tools have been found in both graves and prehistoric settlements, though to date no furnace has ever been found (Lavento 1999:76; Mäkivuoti 1987:59). In eastern Finland and Karelia, as well as in northern Finland, several ironworks have been excavated (Kosmenko and Manjuhin 1999; Kotivuori 1996; Lavento 1999; Mäkivuoti 1987; Schultz 1986). While iron production technology in southern Finland came from either the west or the south, the technology in eastern and northern Finland was due to the influence of the eastern Ananjino culture (Mäkivuoti 1987: 62-63, Figure 3) which bloomed in the Volga and Kama areas in Russia. The cultural development in northern Finland has been strongly influenced since the Late Stone Age by contact with this eastern culture, and archaeological finds document such contact in both the Bronze and Early Iron Ages (Mäkivuoti 1987:59).

The northernmost iron production sites found and excavated in Finland are the sites Kotijänkä and Riitakanranta, not far from Rovaniemi, Neitilä at the Lake Kemijärvi and Äkälänniemi a bit further south in Oulu County (Kotivuori 1996; Lavento 1999; Schultz 1986), and the oldest furnaces are dated to the Pre-Roman Iron Age (Lavento 1999:80) (Figure 2).

The dominant features on these sites are the stone box furnaces, a low rectangular structure built of stone slabs, but a type of circular "cupola" furnace has been unearthed as well. None of these have any parallel in the west (Lavento 1999:76), and are clearly an eastern inspiration related to the Ananjino influence.

The oldest iron objects in North Finland are two daggers found at Savukoski in Lappland County, dated to the 4th century BC (Mäkivuoti 1987:60) which were found on the route connecting the White Sea with the Kemijoki River (Huurre 1986:57). These first iron objects as well as the early iron production technology are all consequences of contact with western offshoots of the Ananjino culture.

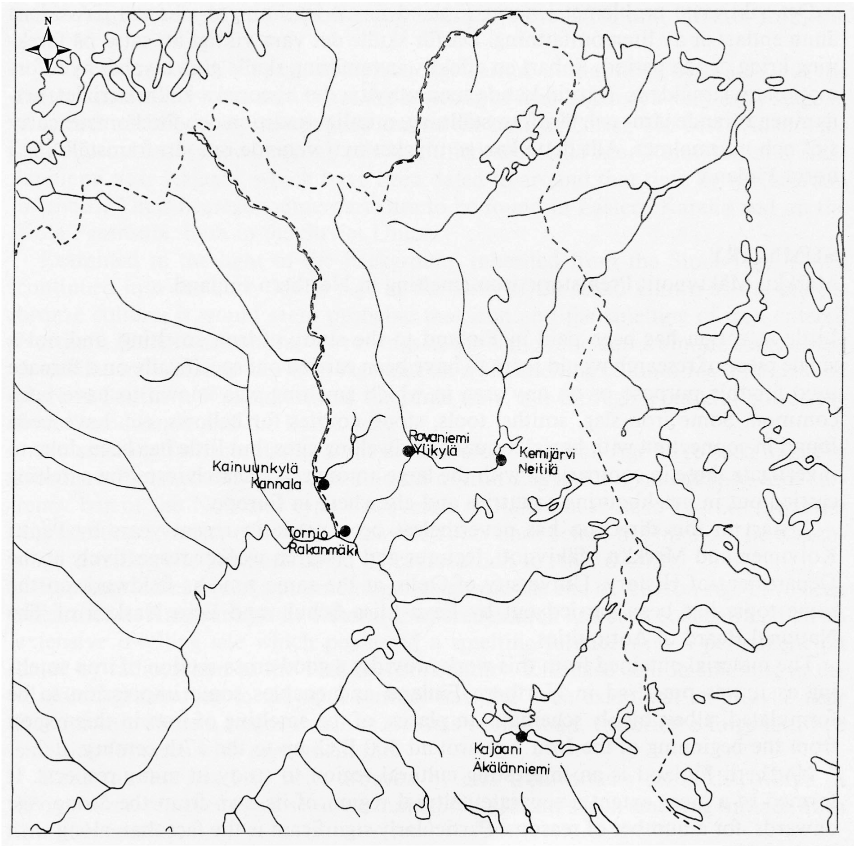

Figure 2 - Iron production sites in northern Finland (Mäkivuoti 1988:67, Figure 7)

Figure 3 - Slabstone furnace (Barentsinfo.org)

Research into early iron production in northern Finland is still in its early stages, and our knowledge is therefore quite incomplete. We do not know the scope of local iron production and whether it could satisfy local demand. Iron slag found at the Roman Period settlement Rakanmäki near Torneå during excavations conducted in 1985-1987 indicate that iron also had been produced at this site (Mäkivuoti 1988). A possible indication of this is the find of a "*clay protector for a bellows nozzle*" (Mäkivuoti 1988:42), though it has not been clarified if this had been used in the iron production or smithing process. Moreover "*... a fairly large amount of iron slag, ...*" (Mäkivuoti 1988:41) was recovered at the site as well. Without knowing how much slag was found, it is difficult to categorically determine whether this slag was a result of extensive smithing activity or iron production.

A spade-shaped iron currency bar was also found at Rakanmäki, and this is the only iron currency bar yet to be discovered in northern Finland (Mäkivuoti 1988:41). This is similar to Hallinder's (1978 a: 34) Norrland type, and it is likely to have been imported from the southern part of Norrland or central Sweden. This single find is a sign that local iron production in northern Finland did not satisfy local demand and that iron was still being imported in the Roman Period. The spade-shaped currency bars are dated from the Roman to the Viking Period, but most belong to the Migration and Merovingian Periods (Englund 2002:304; Hallinder 1978:33; Lindeberg 2009:40). The majority of the ^{14}C dates from Rakanmäki date the site to the Roman Period, yet archaeological finds and isostatic uplift date the site to the period from AD 200 – 800 (Mäkivuoti 1987:64).

2.2 Sweden

The tradition for research into early iron production in Sweden dates back to the 1920s and the activity at "Jernkontoret" (the Swedish Steel Producers' Association). It was here that archaeologist John Nilén carried out work which proved to be fundamental for later research into this topic (Hjärtner-Holdar 1993:13-14). His work was followed-up by I. Serning (1973, 1976, 1979) and later by several other archaeologists who followed in their tracks. In her doctoral thesis, E. Hjärthner-Holdar (1993:13-15) has given a short but fairly detailed presentation on the history of research in early iron production in Sweden.

Iron production in Sweden seems to go back well beyond BC/AD, and iron slag has been found at more than 30 sites dating to the Late Bronze Age (Hjärthner-Holdar 1993:38, Figure 7). Based on an estimate of ^{14}C dates from sites with iron slag, there is a 60% probability that iron was produced during the Late Bronze Age and an 80%

probability that iron was produced sometime before 350 BC (Hjärthner-Holdar 1993:94). Some of the oldest dates though, should perhaps be treated with caution since some of the finds are conducted at multi-period sites that have been used for an extended length of time.

In Sweden, eight iron objects have been found at sites dating to between the Bronze Age Periods II/III (1500 BC) and Period V (900 BC) (Hjärthner-Holdar 1993:20, Figures 5 and 32). These older iron objects do not represent the beginning of the Iron Age, but were used within the cultural framework of the Bronze Age.

Most of this research has focused on southern Sweden, i.e. the landscapes known as Svealand and Götaland (central Sweden and further south). However, in his doctoral thesis on early iron production in Jämtland County, G. Magnusson (1986) deals with the northernmost iron production known in Sweden, which took place at approximately the same latitude as in Trøndelag. A comprehensive iron production took place during both the Iron and Middle Ages, and Magnusson (1991:158) has calculated the production volume at 102 sites during the Migration Period alone to have been between 2500 and 3400 metric tons. This must have required considerable effort and was a major socio-economic task for the time period in question. Still, iron production was not limited to Jämtland, as iron was also produced in large quantities in Dalarne and further south (Magnusson 1991:155, Figure 3). The distribution depicted in Figure 4 is based on studies of iron production in Sweden, and up until 2009, no iron production site had yet been found north of Jämtland County, though a furnace was found last summer at Sangis in Kalix Municipality in Norht Sweden (e-mail from C. Bennerhag, 9. and 13. November 2009). As such, Swedish research largely coincided with the picture emerging from North Norway until the mid-1990s.

As mentioned, substantial iron production took place in Central Norrland during the Early Iron Age, while further north in the vast area of Upper Norrland, the site in Norrbotten is the only known iron production site. The excavation of this site is not complete and therefore little is known of its construction and production technology (e-mail from C. Bennerhag, 9. and 13. November 2009). However, iron found in context, together with iron slag and asbestos tempered ceramics, indicates that iron was possibly also present in the inland area of Upper Norrland from the Late Bronze

Age (Hedman 1993:165-166; Liedgren and Johansson 2005:290). As with northern and eastern Finland this inland use of iron may be due to an influence from the Ananjino culture, and a small number of molds and socketed bronze axes are also seen as a result of this (Bakka 1976: pl. 16; Forsberg 1999:252, Figure 1; Hedman 1993:166). Sites with asbestos ceramics, iron and slag are not easily dated as asbestos was used throughout the last 2000 years BC as a means of tempering ceramics (Jørgensen and Olsen 1987, 1988; Linder 1966).

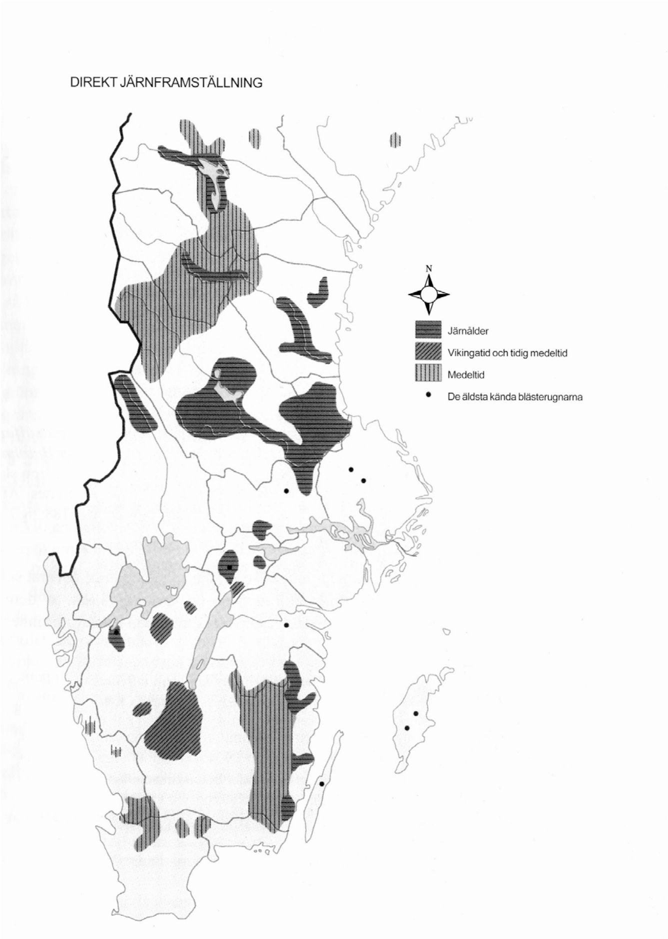

Figure 4 - Iron Age and Medieval iron production in Sweden (Englund 2002:15, Figure 3)

Several of the sites with slag, iron and asbestos ceramic are multi-period sites which have been frequently used from the Neolithic until the early Medieval Period (Hedman 1993:166). Based on the data from Upper Norrland, it seems likely that iron was present and well integrated in the culture of the hunter/gatherers in the Pre-Roman Iron Age and also possibly as early as the Late Bronze Age (Hedman 1993; Liedgren and Johansson 2005), although our knowledge about prehistoric iron in Upper Norrland is indeed inadequate (Hedman 2003:231). The presence of slag at northern inland sites demonstrates that iron undoubtedly was worked, but the question is was it also produced locally? Other sites such as Vivungi in Kiruna, Nåttiholmen in Arjeplog and a site at Arvidsdjaur are all sites with containing pieces of plano-convex slag which has been seen as an indicator of iron production (Liedgren and Johansson 2005:290). Without having information about the amount of slag and the size of the pieces of slag recovered at these sites, it is difficult to agree or disagree with these interpretations. Plano-convex pieces of slag the size of a man's hand may form in the bottom of the hearth in a smithy, and without the furnace itself, you would need much larger pieces or larger amounts of slag to postulate iron production.

In my opinion, there is no solid proof of iron production in Upper Norrland during the Iron Age, although the site in Norrbotten demonstrates knowledge about iron production in coastal settlements. Iron production sites may also be found inland; yet it still remains an open question as to whether there was a local production sufficient to answer to the local demand or if most of the iron was imported from the iron producing areas of central Sweden or northern Finland. No furnaces have been found, and the modest amounts of recovered slag are not in accordance with iron production. It is therefore likely that the slag found to date at some Norrland sites was a by-product from working slag rich in iron in a smithy (Lidman 1997; Sundqvist 1993:154, 155). At the Early Iron Age farm Gene (BC/AD-AD 600) in Västernorrland County approximately 120 kg of slag was found during excavations late in the 1970s (Ramqvist 1983:175, 181-182). This was slag from forging iron, which document that the activity of a blacksmith was an integrated part of sedentary Iron Age settlements in northern Sweden. To the best of my knowledge, no currency bar has been found in Upper Norrland but the spade-shaped iron currency bar found at Rakanmäki near Torneå (Mäkivuoti 1987:65, Figure 5) indicates that such objects could also have been transported into this cultural sphere and locally transformed into whatever object was needed.

2.3 Norway

Since the 1980s, several rescue excavation and research projects have dealt with prehistoric iron production. These projects and the history of research concerning Norwegian iron production have been described by several authors, and I see no reason for repeating this in detail (Espelund 1995; Espelund and Stenvik 1993; Farbregd, Gustavson and Stenvik 1985; Johansen 2003; Larsen 1991; Martens 1978 a, 1978 b, 1982, 1988, 1992; Narmo 1996, 1997; Rundberget 2002; Stenvik 1987, 2003a, 2003b). The possibly most thorough review of this history is presented by Rundberget (2002). This focused research yielded new knowledge and insight as far as the social implications of iron production, the technology involved and the scope of the activity. In some parts of Trøndelag and southern Norway, this was a major activity in many rural communities that is likely to have influenced the lives of many people.

Prehistoric and Medieval iron production in Norway should not be viewed as an isolated activity, but instead be understood in terms of what occurred in neighboring countries, particularly Sweden. Though Figure 5 indicates where the main iron production activity took place in Norway and Sweden, it does not take changes over time into consideration and as such does not reflect that the peaks of iron production in Trøndelag Southeast Norway and Jämtland do not coincide.

In Norway, iron production technology seems to be well established towards the end of the Pre-Roman Iron Age in North Trøndelag and further south. In total, approximately 500 iron production sites are found in the counties of Trøndelag, of which 300 date to the Early Iron Age (Prestvold 1999:53).

Stenvik (2002:51) has calculated the amount of forgeable iron produced at 40 sites in Meråker Municipality to have been 320 metric tons. These sites are dated to the 800-year period between 300 BC and AD 500, which shows an annual average production of 0.4 tons. The production peaked at AD 200, and annual production at that time could have been as high as 5 metric tons. This would have been sufficient for making approximately 5000 axes, and it is unlikely that such an amount of iron could have been locally consumed (Stenvik 2002:51).

Calculations regarding the output of an iron producing furnace vary greatly, and such estimates may be seen as little more than playing with numbers. Among other things, the production rate would have varied according to the chemical quality of the iron ore and the skill of the blacksmith. The number of iron production sites and the amount of produced slag nevertheless indicate that a considerable amount of iron was produced during the Early Iron Age. This production rate clarely exceeded local demand (Stenvik 2003 a: 124), and iron production in North Trøndelag during the Early Iron Age should therefore be understood from a regional perspective.

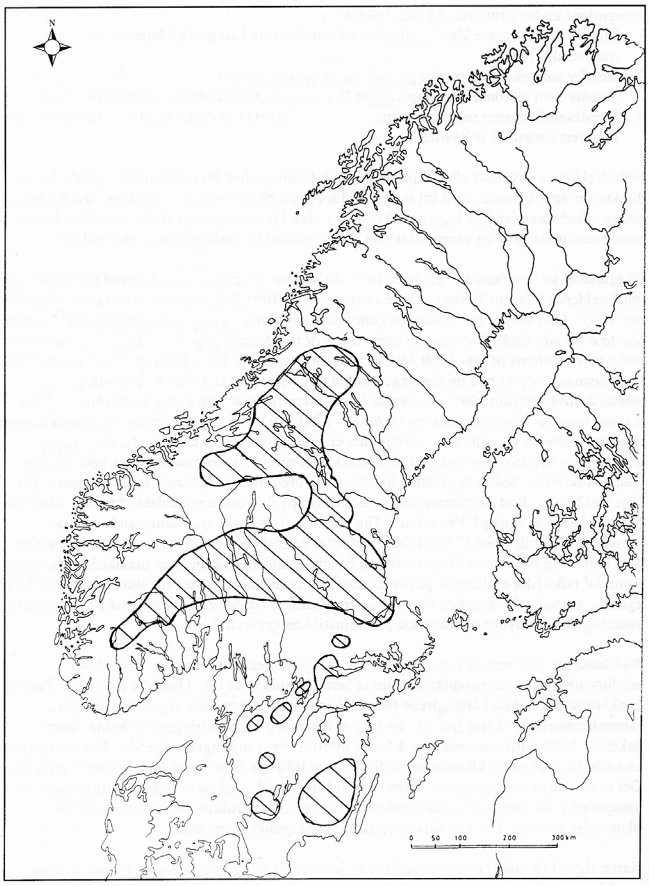

Figure 5 - The main areas for Prehistoric and Medieval iron production in Scandinavia (Narmo 1997:188, Figure 119).

2.3.1 North Norway - Outline of a Research History

No iron production site had been found in North Norway before 1994, so as a consequence, research related to this subject is close to nonexistent. There have been, however, a number of reports over the years about finds that indicate iron production in North Norway.

Very little iron dating to the first 700-800 years of the Iron Age proper has been found in North Norway, but from approximately AD 300 there is a pronounced growth in the number of iron objects. Most finds are done in graves and as few graves are older, this change in find frequency could be explained by a change in burial practice. There are a number of finds of iron, mostly unidentified fragments, and slag older than AD 300. Some of them are found at sites with asbestos ceramics, but often the context and dating are complicated and uncertain and will be discussed later in Chapter 5.2.2. The oldest dated iron objects in North Norway have been found in eastern Finnmark at Kvalnes in Nesseby Municipality and at the Makkholla site at Kjelmøy in Sør-Varanger Municipality (Nicolaissen 1912-13; Olsen 1994:132). The use of iron seems to have been a result of eastern contacts and is not related to the use of iron which is seen at the asbestos ceramic sites in Nordland and Troms.

Even though no iron production sites were known in North Norway before 1994 and with no other solid data to support their assumptions, several archaeologists have nonetheless taken it for granted that iron was produced in North Norway much as it was in the south. In "Nord-Norges bosetningshistorie" (The Settlement History of North Norway), Brøgger (1931:33) stresses the similarities between Iron Age finds in both northern and southern Norway. He maintains that the finds also reflect a similar way of living "*… where iron production, and tools and weapons of iron had the same significance as in the most pronounced farming societies in southern Norway*" (author's translation) (Brøgger 1931:35). This way of making inferences from artifact to culture has been quite common, but not always made explicit. Similarities in the material culture have often been implicitly seen as a reflection of cultural similarities. Some 50 years later, R. Bertelsen (1985:42) much falls into the same line of thinking. Without solid data to back his assumptions, he concludes that iron had been produced and worked in North Norway from approximately BC/AD but because of limited resources of firewood, north Norwegian iron production had never been as widespread and comprehensive as in the south. Therefore, the region was never self-sufficient and had to rely on imported iron from Trøndelag and elsewhere (ibid. 45).

Over the years, many archaeologists working in North Norway have referred to finds that indicate iron production, which fits with the dominant picture of iron production as an integral and necessary part of the Nordic Iron Age. However, all reports on iron production prior to 1994 must only be regarded as possible indicators of such activity as the amount of recovered slag is quite modest and the most central element in an iron production site, the furnace, was never found. Still, a few of these early reports of possible iron production sites have some credibility and below is a brief review of some of these early accounts.

As early as 1907, K. Rygh, the director of Vitenskapsmuseet (the Museum of Natural History and Archaeology) in Trondheim published finds indicating that iron production had taken place at Bø in Steigen (Berglund 1998; Petersen 1916; Rygh 1907). In 1906, he received some finds and a report concerning at least 30 mounds of sooty and fire-cracked stones, iron slag and charcoal. He concluded that: "*Without a doubt, iron has been produced at this site*" (Rygh 1907:6). Several finds dating to the Migration Period (T 7797) were found at the site and Sjøvold (1962:48) supports Rygh's statement that *"…it is likely that iron was extracted here in ancient times*" (author's translation). The site was located in an area with sand drifts, and the mounds of slag, stones and charcoal are nowhere to be seen today and have either been removed by some later activity or buried in the sand. Because of this, it is not possible to verify if there was ever an iron production site at Bø.

G. Gjessing (1943:137) who excavated the sites at Røsnesvalen and Hellarvikjæ in Træna Municipality in the 1930s, found slag at both sites and concluded that iron had been produced in both places (op. cit.). However, the amount of slag is far too small to support such an interpretation.

Harald Egenes Lund, head of the Department of Archaeology at the Tromsø Museum during World War II, conducted fieldwork in North Norway until the 1960s. He reports on finds that suggest iron production at several locations in North Norway. In 1955, Lund excavated several prehistoric graves at Glein, Dønna Municipality in Nordland. Underneath Grave 22, which is dated to the late Migration Period (Sjøvold 1962:33), Lund found some charcoal (T 17931 f) and iron (T 17931 e), while under the western part of the grave mound there were unmistakable signs of iron production (Møllenhus 1957:150). The grave was placed on top of the bloomery which thus had to be older. Even so, there are no finds from the site which document the production of iron. Other finds of slag and bog iron ore, which Lund believed to indicate iron production, were done at Bleik in Andøy Municipality, Leknes in Vestvågøy Municipality and Øvregården in Bjarkøy Municipality (Lund 1952 a and b, 1954 a and b, n.d.). During an excavation of a courtyard site with 14 houses placed in an oval circle (Johansen and Søbstad 1978:41) at Leknes in Vestvågøy, he claimed to have found slag from iron production (Lund 1954 b and n.d.). The finds from his excavation in 1951 are stored at the Tromsø Museum and what he claimed to be iron slag is actually nothing more than pieces of iron pan (Ts. 10427). An examination of the other finds from the site disclosed no objects consistent with an iron production site, and there were no finds from Øvregården to indicate that iron was ever produced. According to Lund (1954 a), he had received reports about at least eight depressions (furnaces?) at Storslettneset, southwest of the settlement at Bleik, although today no such structures are preserved to support this assumption. Some of the area has been worked by machines, which may be the reason why no such structures are to be found.

In his book about the Early Iron Age in North Norway, Sjøvold (1962:232) strongly supports the idea that the craft of extracting and working iron had been mastered with the same zeal in the north as in the south, and suggests that the absence of production sites in North Norway was due to inadequate surveying methods. Small pieces of slag found at several Iron Age sites have been accounted for as evidence of local iron production by many archaeologists. Among other places, such finds are reported from Greipstad in Tromsø Municipality (Munch 1965), Hofsøy in Tranøy Municipality (Johansen 1978 a), Moland in Vestvågøy Municipality (Johansen 1982), Toften II (Simonsen 1995) and Bleik (Jørgensen 1983, 1984) in Andøy Municipality, Stauran in Skånland Municipality (Urbanczyk 1991, 1992) and at the Late Stone Age - Early Metal Period site Virdnejavri 112 in the interior of Finnmark (Hood and Olsen 1988).

The excavation of the Migration Period farm at Greipstad in Tromsø Municipality in 1960 - 1961 (Munch 1965) uncovered quite a few fragments of burned clay (Ts. 5749 aæ, ap, aq; Ts. 5779 q; Ts. 5780 ap, ar, as, at) and iron slag (Ts. 5748 f; Ts. 5749 ah, ai, ak, as-av, ba, bb; Ts. 5779 e, f, g; Ts. 5780 ac-al, ay, l-p, t, u, w, ø; Ts. 5782 n, v, w; Ts. 6399 b). The slag was found in four of the five houses that were excavated, but most of the pieces were found in House IV and House V which led to the conclusion that there had been a smithy in House V and a kind of workshop in House IV (Munch 1965:25). Munch (1965:26) thus concludes that "*Iron was procured by extraction from bog iron ore…*" (author's translation). The amount of slag is not in accordance with iron production, but instead indicates a rather extensive smithing activity, and even though there are several pieces of slag the amount recovered is far too small to support Munch's interpretation.

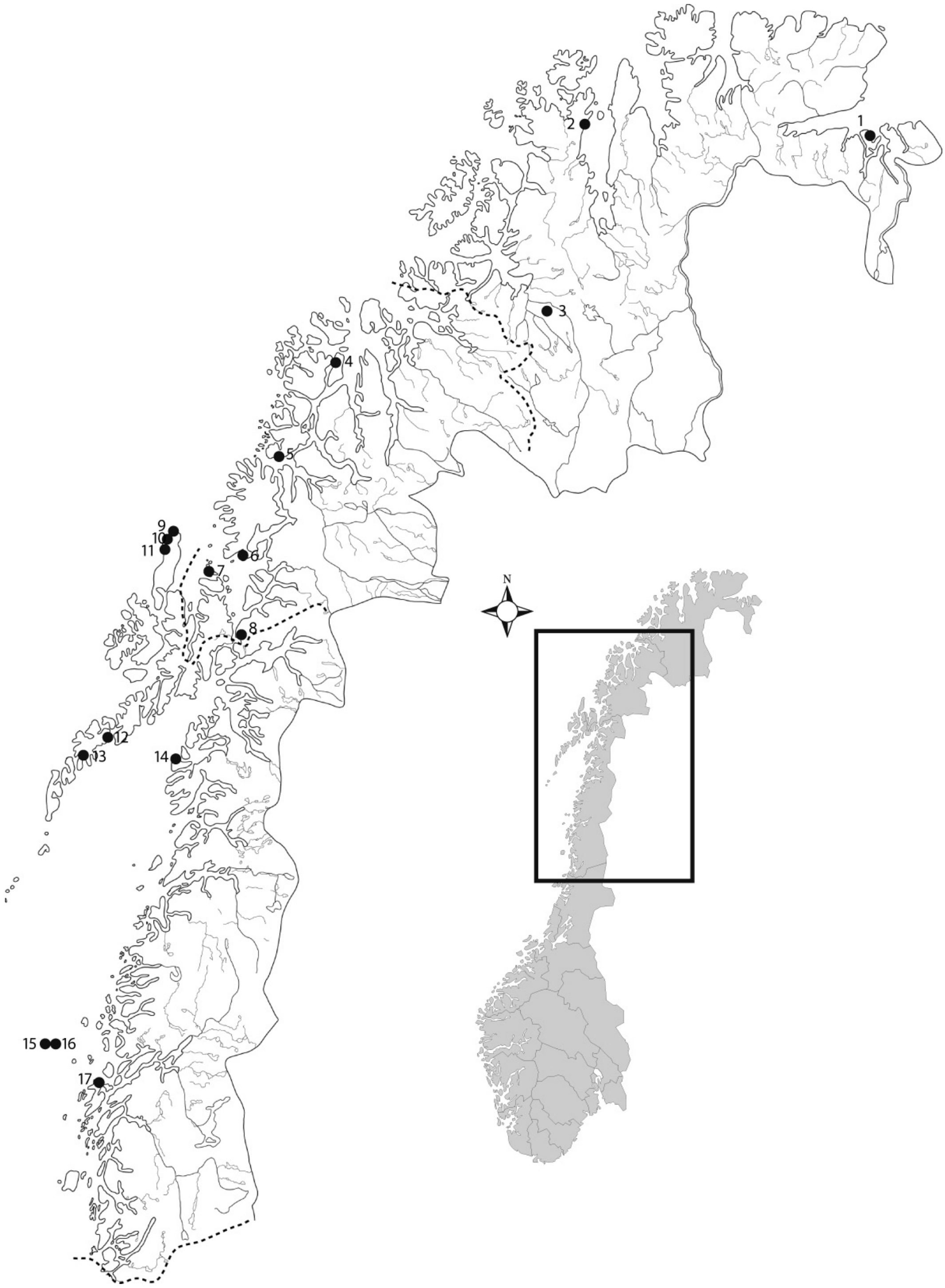

Figure 6 - Places referred to in the text (Graphics: Ernst Høgtun, Tromsø University Museum)

No.	Site	Municipality
1	Kjelmøy	Sør-Varanger
2	Indre Sortvik	Porsanger
3	Virdnejavri	Alta
4	Finnby	Karlsøy
5	Greipstad	Tromsø
6	Hofsøy	Tranøy
7	Øvregården	Bjarkøy
8	Stauran	Skånland
9	Toften II	Andøy
10	Bleik	Andøy
11	Storslettneset, Bleik	Andøy
12	Moland	Vestvågøy
13	Leknes	Vestvågøy
14	Bø	Steigen
15	Hellarvikjæ House I	Træna
16	Røsnesvalen	Træna
17	Glein	Dønna

Table 1 - Places named in the text

O. S. Johansen found numerous pieces of slag during the excavation of the Iron Age farm at Hofsøy in Tranøy Municipality. Some of the slag was stuck to small pieces of rock and burned clay, and he concludes that this is a strong indication of iron production and that some of the slag evidently had been produced in a bloomery furnace (Johansen 1978 a:6). Unfortunately, it has not been possible to retrieve these finds, so I have not been able to conduct any evaluation of the slag.

During the 1970’s, O.S. Johansen also conducted excavations at the Iron Age farm at Moland in Vestvågøy Municipality. In one of the houses dated to the period AD 200-400, a piece of slag of such a size was found that *“... it has to be a result of iron production*” (author’s translation) (Johansen 1982 a:114). This (Ts. 7736 f) is a plano-convex 270 g heavy piece of slag, 9.5 cm by 7 cm with a thickness of 3.1 cm, and a 343 g heavy fragment (Ts. 7736 ce) was found elsewhere on the same farm. This seems to be about one-fourth of a much larger plano-convex piece of slag which once weighed approximately 1400 g, and the size of the least heavy (Ts. 7736 f) piece of slag is similar to many others found in an Iron Age context and is no doubt from a smithy. The other piece (Ts. 7736 ce) had been considerably larger when unbroken, but no larger than if it had also accumulated in the bottom of the hearth of a smithy after working with slag-rich iron. For that reason, Johansen’s statement (1982 a: 114) should be modified as the amount of slag alone is too small to prove that iron was produced at the site. The total amount of slag found at Moland is more in accordance with what would have been produced in a smithy than during the process of iron production.

The Migration Period site Toften II in Andøy Municipality was excavated in 1978-1979 (Simonsen 1995). Most of the approximately 130 pieces of excavated slag (Ts. 7245, 7246) were small, only 2-3 cm crosswise, although a few pieces were somewhat larger (Jørgensen 1984:214; Simonsen 1995:20). According to Simonsen (1995:17), three pieces of slag had a diameter of roughly 20 cm, but a re-examination of the finds from Toften II revealed none of this size, and no piece of slag had a diameter greater than 9 cm. During his initial discussion of the slag finds, Simonsen (1995:17) claimed that it is possible that iron had been produced either at or close to the site. However, at the end of his paper (1995:20) he expresses no doubt when maintaining that the extraction of iron was one of the activities upheld by the people living at the site, and the finds of slag unquestionably demonstrate that iron had been worked at the site. The three largest pieces of slag are rounded on one side and flat on the other, indicating that they were formed in the hearth of a smithy. It is therefore likely that there had indeed been a blacksmith in action, though one who was processing but not producing iron. The forging of iron normally generates small pieces of slag, but even larger pieces may form in the bottom of the hearth, and minor quantities of iron slag are quite common at sites from both the Iron and Middle Ages (Johansen 1982a:114). Even though there was more slag at Toften II than what is found at most Iron Age sites, there is much less than even the smallest iron extraction would produce, and it is probable that this was generated by rather extensive smithing activity and not by iron production.

Eleven small pieces of slag (Ts. 7747) (Jørgensen 1984:211) was found at Bleik, approximately 4 km southwest of Toften II. This Iron Age farm-mound, which was partially excavated in 1980-1981, revealed no finds to indicate a local iron production, and the slag evidently came from iron being worked and not produced. This conclusion also applies to other sites with minor amounts of slag, thus causing a reason to question the conclusions of Bartolotta et al. (1988, 1990) who claim that this is production slag. The metallurgist A. Espelund (1989) questions both the methods applied by Bartolotta et al. (1988) and the conclusions reached. He also (1989:98) points to the fact that the amount of slag found at three of the sites analyzed by Bartolotta et al. (1988) (Finnby in Karlsøy, Bleik and Toften II in Andøy) is far too small to support a hypothesis about iron being produced there. This also goes for the additional four sites (Virdnejavri 112 in Kautokeino, Indre Sortvik in Porsanger, Stauran in Skånland and a sample from Bjarkøy) analyzed in their 1991 paper. The iron production site that Lund (1954 a) reported on is less than 2 km southwest of the Bleik farm-mound, but today there are no structures to be seen related to iron production.

During the excavation of the medieval farm Stauran in Skånland, several charcoal pits and quite a few pieces of slag (Ts. 8873) were unearthed (Urbanczyk 1991, 1992), which was interpreted as an indication of iron smelting (Urbanczyk 1991:124, 134). There was clearly a smithy at the site (Urbanczyk 1991: 136), although there are no conclusive finds in support of the iron production hypothesis. A charcoal pit could have produced charcoal for a smithy where the slag probably came from and most of the pieces are small, with one of the biggest being 8 cm by 6 cm and 2 cm thick. While the majority of the slag was probably produced by hammering liquid slag out of iron, this one was probably formed in the bottom of the hearth. As such, there are no archaeological finds to support the hypothesis about iron extraction at Stauran.

Even though most reports of iron production are from areas which had substantial Iron Age farming settlements, a minor amount of slag has been found in areas dominated by hunters and gatherers. On two of these sites, Virdnejavri 106 and 112, in Kautokeino Municipality in the interior of Finnmark, several pieces of iron slag (84.7 grams) (Ts. 8406 amd, cca, Ts. 8761 mp, mv, Ts. 8763 tw) have been found, of which some were fused to asbestos ceramics (Hood and Olsen 1988:113). According to Hood and Olsen (1988:113-114), it is *"…highly likely that the asbestos ceramics were employed as a lining in a furnace or similar production facility*", but they cannot "*determine whether the production phase represented is smelting or smithing.*" After having these few pieces of slag analyzed, Sundquist (1999:51) concludes that the slag is probably a result of iron being worked, i.e. smithing, and "*Still at the present time there does not seem to be any reason to suggest early production of iron in Finnmark.*"

In addition to the aforementioned sites, slag is found at many Iron Age and medieval sites in North Norway, and most of these finds are small pieces which have been assumed to be a by-product of smithing. In total, Bartolotta et al. (1988, 1990) have analyzed 16 slag samples from seven prehistoric sites in North Norway with dates ranging from the Late Stone Age to the Medieval Period. These chemical and structural analyses concluded that: "*All slag samples studied are interpreted as smelting slag from a bloomery process*" (Bartolotta et al. 1990:218). This conclusion is quite unconvincing considering the fact that no structures indicating iron production had been found at any of the sites.

2.3.2 Summing Up

The occasional find of iron slag at Iron Age sites has never led to a focused and systematic search for iron production sites in North Norway. Some archaeologists have taken a stand, a priori and without supporting data, that iron has been extracted in North Norway in the same way as in the south. Others have leaned upon the archaeological data and wishfully interpreted a few finds of burned clay and iron slag as being supportive of local iron production, though in neither case has this led to a greater interest in research related to northern iron production. A sincere interest in north Norwegian iron production did not develop before the first production site was found in 1994.

As shown above, pieces of slag are quite common in Iron Age contexts. In most cases these are small fragments, probably stemming from a blacksmith's work of forging iron. Iron objects, especially from graves but also from settlements, occur in large numbers from the Late Roman Period onward. Burial practices would have been crucial to what artifacts was deposited in graves and the number of iron artifacts therefore not a reliable indicator of whether there was a shortage of iron or if it was in abundance. Still, it remains to be explored where this iron came from. Did a hitherto comprehensive but unknown northern Norwegian iron production site exist or were the overwhelming majority of iron objects imported? To date, no iron bar deposits have been found in North Norway, only a few isolated finds, so up until 1994, the official research status was that no iron production sites and no iron bar deposits had been found, which could imply that all iron was imported either as manufactured or as semi-manufactured products. This has now been shown to be wrong, and new finds of iron production sites, blooms in graves and currency bars prove beyond any doubt that iron was produced and forged in North Norway during the Iron and Middle Ages. Numerous finds of slag indicate that iron was being worked, but whether this was locally produced or imported iron remains an open question. The scope of local iron production is still unknown, and we do not know to what extent it had to be supplemented by import.

An extensive amount of iron production has been documented in the counties of Trøndelag, both in the Early and Late Iron Age. During the Roman Period in North Trøndelag, iron production was extensive; it was organized quite professionally and must have been based on a sophisticated social organization involving most of the people in the rural district (Espelund 1996; Stenvik 1990, 1996). Estimates of the amount of iron produced clearly indicate that production far exceeded local demand, meaning that a substantial portion of the production must therefore have been exported (Stenvik 2003 a, b). As a consequence, the lack of north Norwegian finds related to iron production led to the assumption that iron must have been imported from areas with a surplus of production such as North Trøndelag.

Since 1994, a few finds have demonstrated that iron was indeed produced in North Norway during the Iron Age and Early Medieval Period (Jørgensen 1999 a). These finds give some answers, but pose many questions as well: Where did the technology come from, was the “knowhow” widely available or was the production run and controlled by a political and economic elite? If the technology was widespread, why have so few sites been found? Does the research status reflect historic reality or are there still numerous iron production sites to be found? These and other questions will be addressed in the chapters to follow.

3 IRON PRODUCTION SITES IN NORTH NORWAY

Throughout the 20th century, several archaeologists have reported on finds they believed were related to iron production. As argued above, there is little to these assumptions. The first iron production site in North Norway was found and documented at Rognlivatnet next to Misvær in Bodø Municipality in 1994. Since then, two more sites have been found and excavated at Flakstadvåg in Torsken Municipality and at Hemmestad Nedre in Kvæfjord Municipality (Figure 7).

In this chapter, a thorough presentation of the three iron production sites will be given. Finds from the excavations of two of the sites will be described in detail and the dating of all three sites will be discussed.

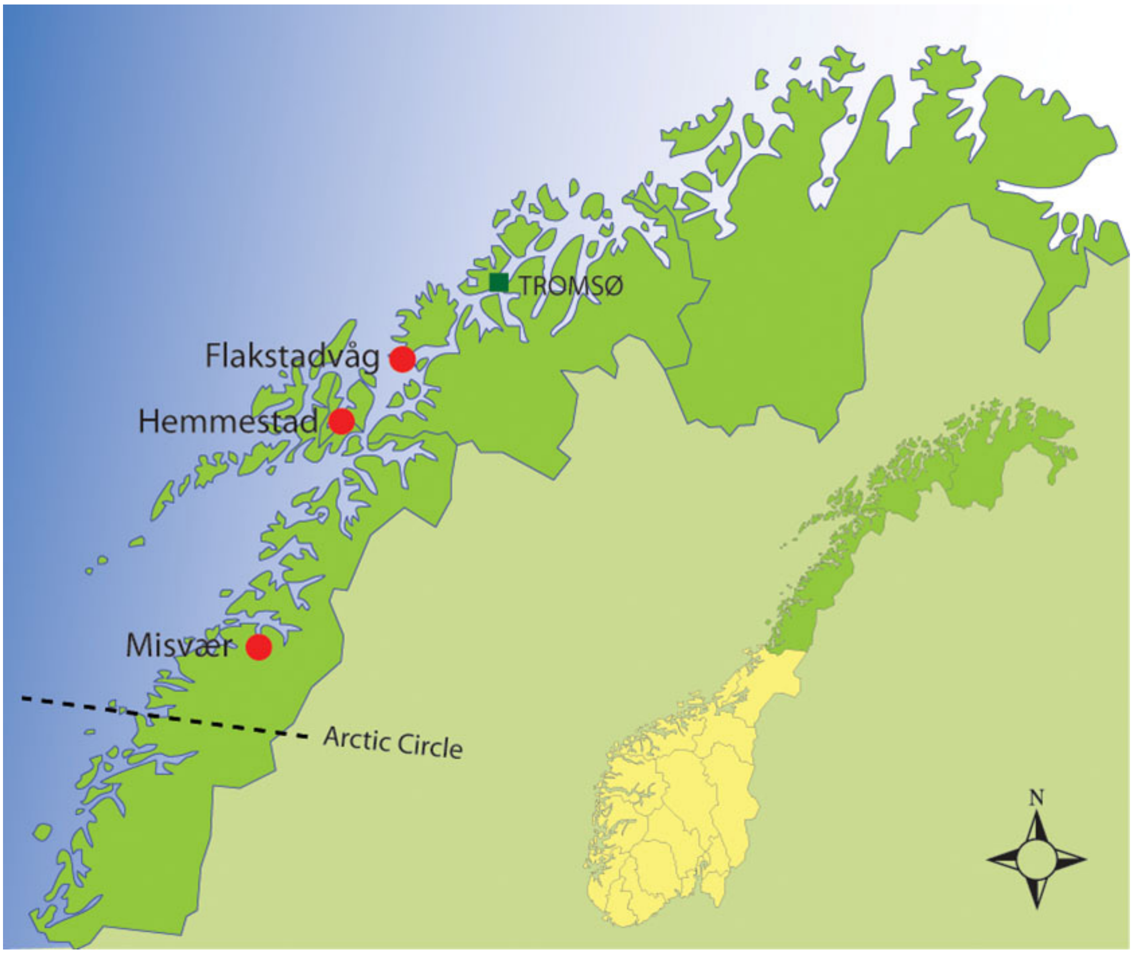

Figure 7 - Iron production sites in North Norway (Graphics: Ernst Høgtun, Tromsø University Museum)

3.1 Hemmestad, Kvæfjord Municipality

In about 1950, a farmer at Hemmestad Nedre[1] in Kvæfjord Municipality (Figure 7, Figure 8) cultivated an outland area just across from the road passing his barn (Figure 9). According to his account, he found two pits, including one that was quite shallow and filled with charcoal and another filled with slag. Nearby, he also found remnants of a turf hut, and during work in the field, he also uncovered a forge-stone of soapstone, which he laid in the slag-filled pit before covering it with a slab. Close to the pits, he found a round, black stone that he believed was used as an anvil. This was left on the shore together with stones collected from the field and has since been lost. The farmer saved a few pieces of slag and a slightly curved piece of burned clay which was glazed on one side. These finds were all indications that iron had been worked and possibly produced on the now cultivated field.

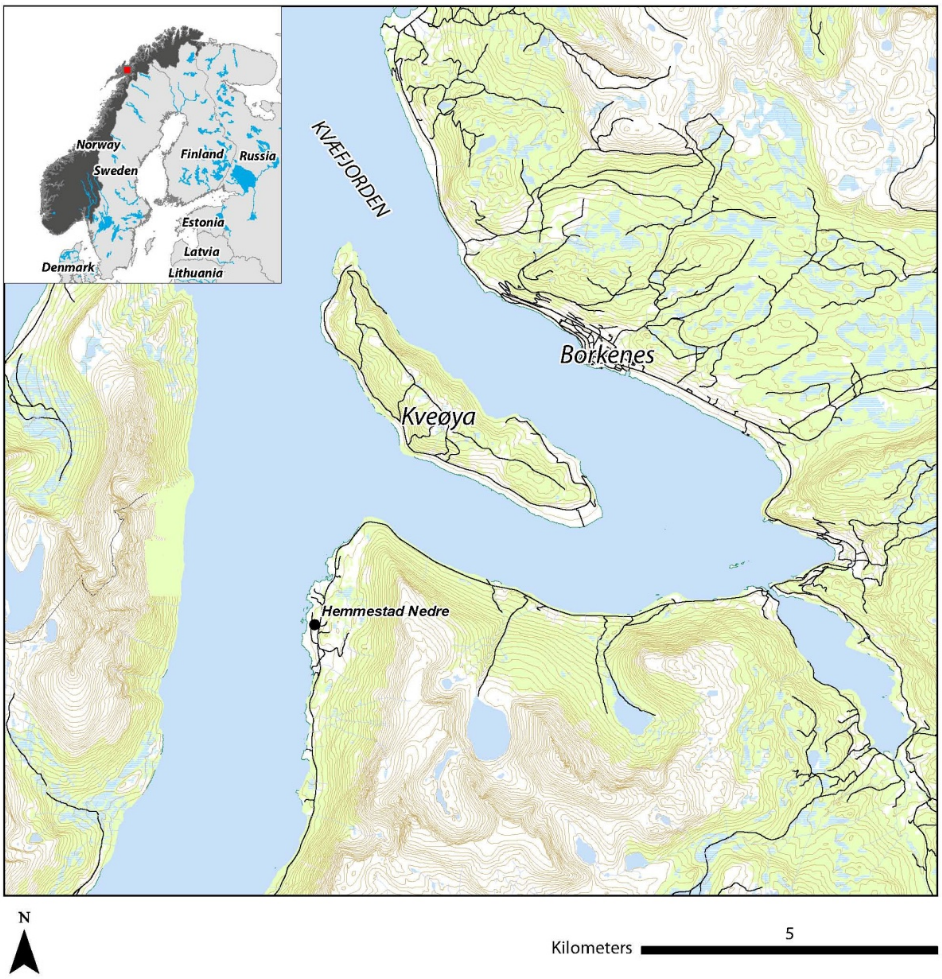

Figure 8 - Hemmestad, Kvæfjord Municipality

[1] Later referred to as Hemmestad.

Figure 9 - Hemmestad, with the iron production site in the grass field on the far side of the road (Photo: Roger Jørgensen)

3.1.1 The Search for an Iron Production Site

When I visited the farm in 1998 nearly 50 years after the finds had been collected, there were no visible traces of any prehistoric activity. To be spotted was only an even grass field slightly sloping towards the north, which during the Iron Age probably had been woodland dominated by birch. The farmer directed me to an area of the field where he believed to have made his finds. The findspot is approximately 150 m from the seashore to the north and 10 m above sea level, which due to isostatic land up-lift probably was not more than 8 m during the Early Iron Age. A small stream flows to the sea in the northern end of the field, which is rather muddy and swampy during periods of rain, and a few hundred meters to the east minor bogs were found, though none can be seen in the immediate surroundings of the field. Due to time gone since the cultivation of the field the farmer had trouble remembering exactly where the finds had been made. Years of plowing and harrowing had also rendered the field completely flat and without any visible depressions or noticeable concentrations of slag or charcoal. Thus, small pieces of slag and burned clay were randomly found all over the field. To pinpoint the 50-year old discoveries, numerous test pits were dug in the area indicated by the farmer, but without any success.

The initial lack of success made a more systematic survey strategy imperative. One much used option is the systematic stripping of the topsoil with a machine. However, due to the size of the field which measures approximately 100 m by 200 m, this solution was not viable. Magnetometry is a less expensive method that is manageable with a small work force, but is not frequently used in Norway because its reliability very much depends on the rock and soil where you are working. If the bedrock is rich in magnetic minerals, which is often the case in North Norway, the background noise will cause interference, which makes it hard to interpret the instrument readings. Theoretically, furnaces should be easily detected since sand, stone and clay minerals are magnetized when heated above 600^{o} C (Vermon, McDonnell and Schmidt 1998:181). Furnace remains and slag generate strong magnetic anomalies, and geophysical surveys have demonstrated that such anomalies, which are associated with a furnace, can be identified (Vermon, McDonnell and Schmidt 1998). The area in question has sandy soil with very few stones and little visible slag and was thereby presumed to be favorable for mapping with a magnetometer.

Richard Binns mapped the area demarcated by the farmer in 1999 using a magnetometer, a Fluxgate Gradiometer (Geoscsan FM36) (Binns 1999). The search was expanded in 2002 (Binns 2003) when most of the field was mapped except for the extreme western part, where an exit road had been built, and the northernmost part which was a very wet and swampy potato field. The magnetometer map revealed several interesting features, and the area where the furnaces were found has a magnetic signature different from that of other parts of the mapped area.

Searching for the furnaces without the magnetometer mapping would have been like looking for a needle in a haystack. Except for the furnaces, the magnetometer mapping also revealed the location of two cooking pits and unidentified, manmade structures which were later excavated, and a careful analysis of the magnetometer map indicates the outline of something similar to an Iron Age long house (Figure 10, Number 3).

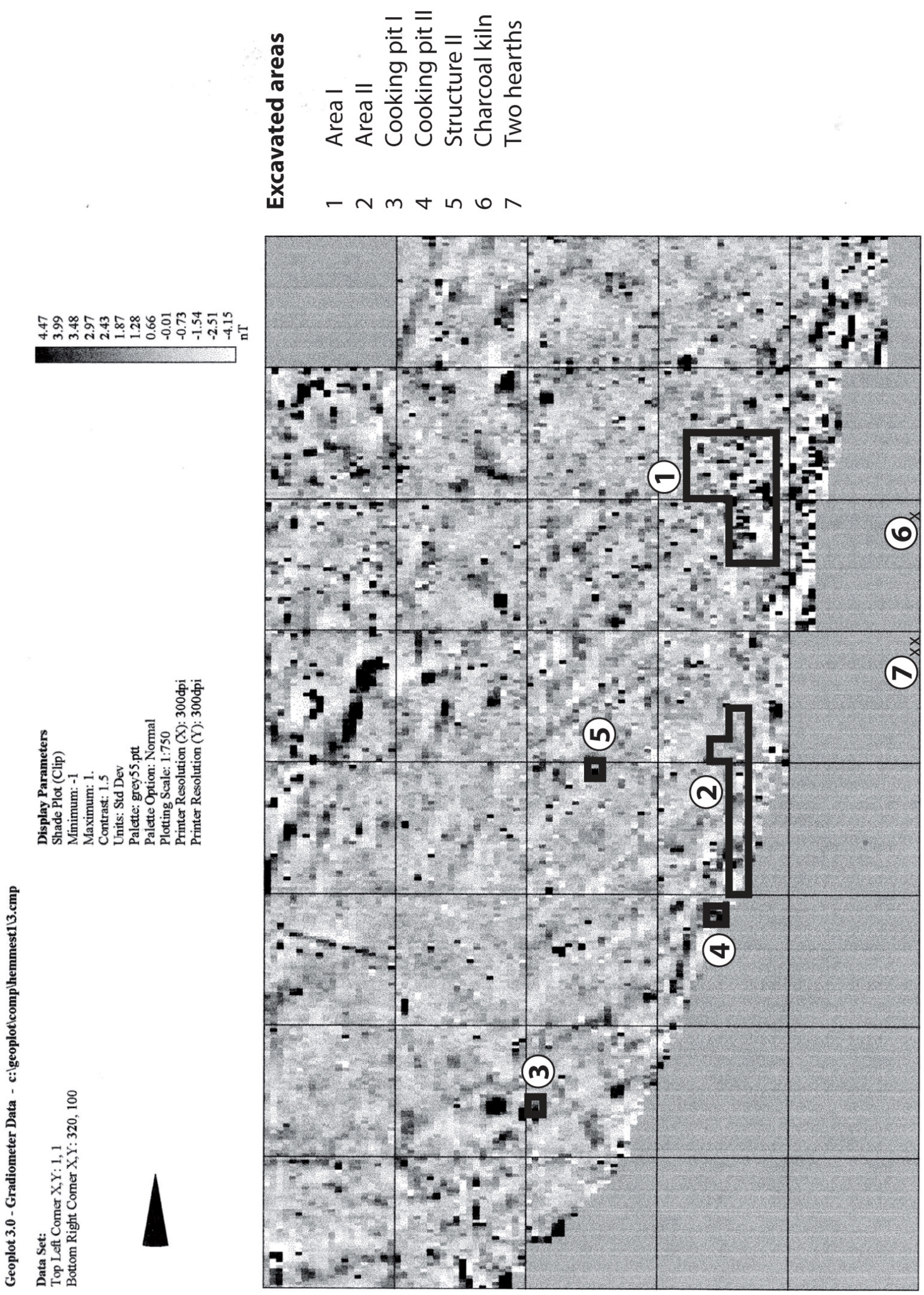

Figure 10 - Gradiometer map, Hemmestad 2002, with a 20 m by 20 m grid (Binns 2003)

3.1.2 Excavation

Furnace I was found 20 cm deep, barely below the depth reached by the plow and was placed in a shallow depression filled with clay between the furnace wall and the pit's extreme wall (Figure 11). The furnace was not built above a slag pit dug into the ground, but was placed in a pit wider than the furnace. While the furnace had a diameter of approximately 30 cm, the pit seems to have been between 60 cm to 80 cm wide. Both the furnace and the pit in which it was placed were badly preserved. The furnace was in a state of advanced disintegration due to the great heat it had endured during the production phase, freezing and thawing processes, in addition to the modern plowing and harrowing activity which had displaced stones that were part of the construction. Some of the stones that were still in place were jagged and grazed by plowing, and a remaining stone at the border of the pit indicates that the pit may have been lined with stones. The field had been leveled by plowing and harrowing, and it was not possible to decide how deep the pit had initially been, although at the time of excavation the bottom of the pit was 40 cm below the ground surface. The furnace itself, or at least its base, was made entirely of clay which was partly glazed and burned red. Next to the furnace on the northern side was an oblong accumulation of slag and charcoal that measured 0.7 m by 2 m, and a burned and crumbled flagstone lay on top of the slag heap. Between the slag and the furnace, two flagstones were raised, thus creating a 7 cm wide passage from the furnace to the slag heap. It is likely that more stones had been part of the construction of the furnace since some of the remaining in situ stones had the markings of a plow, and it is probable that stones constituting part of the construction had been dislocated by the plowing and harrowing. The pieces of slag in front of the furnace were small and could possibly have come from a smithy, but the size of the slag found in the bottom of the furnace clearly demonstrated that this construction had been made for iron production. If there had been a smithy at the site, one would have expected to find numerous hammer scales which are a highly magnetic by-product where iron has been heated and hammered (McDonnall 1983:82). As it was, no such hammer scales were found.

Furnace II was uncovered less than two meters north of the slag in front of Furnace I, though 50 years of plowing and harrowing had destroyed everything except the lower part of the furnace. Nevertheless, it was better preserved than Furnace I and seemed to be of the same size and exhibit many of the same constructional features. A circular furnace made of clay had been placed in a clay-filled pit which had probably been lined with vertically placed flagstones. The pit seems to have been approximately 80 cm in diameter, which roughly corresponds to the size of the pit in which Furnace I was placed. On the northern side of the pit, there was an oblong structure of slag and charcoal similar to the one next to the first furnace that was uncovered. At the northern side of the pit facing the heap of slag and charcoal, there was one raised flagstone similarly placed that obviously served the same purpose as the two flagstones observed between Furnace I and the heap of slag and charcoal. Much like Furnace I, Furnace II has had two raised flagstones which formed a passage from the base of the furnace toward the slag heap. However, a ditch of unknown age, though younger than the furnace, had cut into the flag-lined, clay-filled pit and had removed the eastern side flagstones, indicating a passage between the slag heap and the furnace (Figure 11). The furnace itself was built on top of a horizontal flagstone that was placed in the bottom of the pit (Figure 12). The diameter of the furnace was identical to the size of Furnace I at 30 cm in diameter.

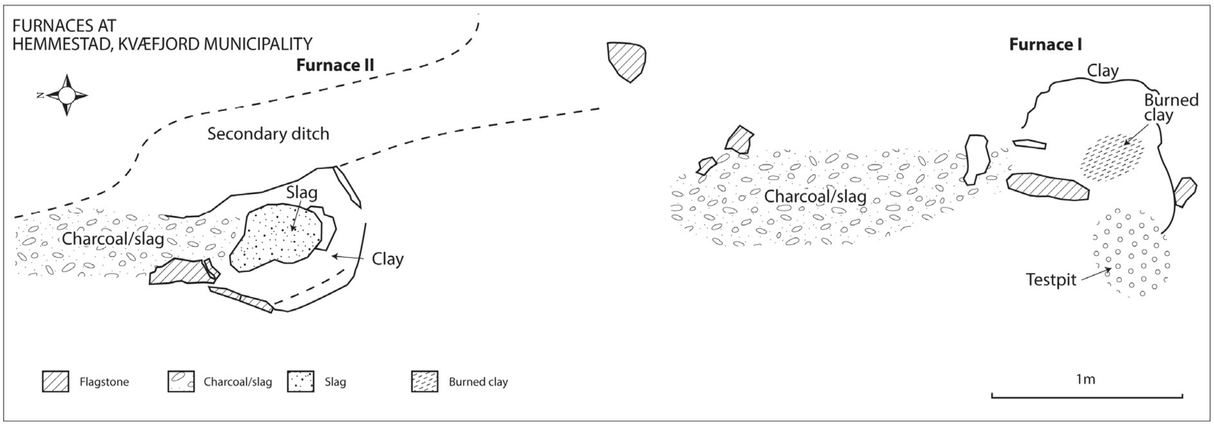

Figure 11 - Furnaces at Hemmestad (Graphics: Ernst Høgtun, Tromsø University Museum)

Figure 12 - The base of Furnace II placed on a flagstone (Photo: Roger Jørgensen)

To enhance the possibilities of uncovering more structures, a mechanical digger was brought in to remove the topsoil in the area north of Furnace II (Area I) and south of the furnaces indicated by the farmer where he had located his finds (Area II) (Figure 10). Altogether, 230 m^2 of topsoil was stripped off, and the entire upper 20 – 30 cm layer of soil which had been repeatedly plowed and harrowed, was removed. Twenty-eight kg of slag and 16 kg of shaft material (Ts. 11225 a-c) were found in this cultivated layer all over the field, and generally speaking, the pieces of slag were a good deal larger than the slag found next to the two furnaces. During the process of stripping off the topsoil, a structure of clay (Structure I) was found 3 m north of Furnace II in Area I. This roundish, unevenly shaped structure of clay had a diameter of approximately 1 m and was 3 cm – 5 cm thick, with some reddish patches indicating exposure to great heat, although most of the clay seemed to have its natural texture and color. There were no natural layers of clay in any of the excavation fields, and Structure I was therefore classified as being intentionally created. During the excavation of Structure I, one small fragment, 1.8 cm by 2.5 cm, of asbestos-tempered ceramics was found, and based on its texture, it looks much like Risvik ceramics. This type of ceramics is found exclusively along the coast between Lyngen in Troms and Sogn in western Norway (Andreassen 2002; Høgestøl 1995:135; Jørgensen and Olsen 1987, 1988).

During the removal of the topsoil in Area II, a modern ditch was uncovered. The ditch was oriented southwest – northeast and crossed the area exactly where the farmer was believed to have discovered his finds. Because of this, it is possible that the digging of this ditch had interfered with prehistoric structures of some kind, even though very few pieces of slag and burned clay were found in this area and the Gradiometer mapping did not indicate the presence of materials associated with a furnace.

Structure II was found in the middle of the field approximately 55 m southwest of the furnaces (Figure 10). It looked very much like Structure I, with an approximately rectangular layer of clay measuring only 2 cm – 3 cm in thickness. The central part of the structure seemed to have been exposed to heat as it had a reddish color, but the temperatures had not been high enough to glaze the clay, and no more finds or observations were done which might reveal the true nature of Structure II.

Due to the magnetometer mapping, Cooking Pit II was found 75 m south of the furnaces and approximately 30 m from the area where the farmer believed to have made his findings some 50 years ago (Figure 10). The cooking pit was one meter in diameter and filled with a 4 cm thick layer of charcoal and fire-cracked stones. It was nicely cut into the ground, and after being emptied, it had the near perfect shape of a shallow bowl. No stones defined the edges of the cooking pit, and the uppermost layer of charcoal and fire-cracked stones had probably been removed by plow and harrow which had repeatedly worked the top 20-30 cm layer of soil.

In the upper part of the field, approximately 115 m south by southwest of the furnaces, a structure resembling an Iron Age long house is seen on the Gradiometer map (Figure 10, Number 3). Several test pits were done, and minor sections were excavated through the walls and the presumed floor area of the house without finding any cultural layers. When scrutinizing the map, there are several structures parallel to the "long walls" of what was supposed to have been a house, which probably are traces of old beaches and these are likely to have created the impression of a house-like structure. However, in the middle of this "house", Cooking Pit I was found. It was covered with a 20 cm thick layer of soil with a flagstone lying directly on top of the cooking pit under the plowed layer. Part of the cooking pit was covered with an iron pan which must have been formed after the pit went out of use. The cooking pit was circular, 100 cm by 95 cm, and filled with a 41 cm thick mixture of charcoal and fire-cracked stones that had been cut deep into the ground as the bottom layer was 61 cm below the ground surface.

Two other pits were found in the outland area, 50 m east of the furnaces (Figure 10) and both were appeared as round, funnel-shaped depressions. The one furthest to the south was 1.3 m in diameter and 35 cm deep, while the other one, 12.8 m to the northeast, was a little smaller and only 1 m in diameter, but as deep as the other. In the largest depression, there was a thin layer of charcoal, while no such layer was discovered in the other. Both depressions were intentionally dug into the ground even though no mound of earth was seen around the pits, and the one with charcoal had probably been used as a charcoal kiln while due to a lack of charcoal remains, the other had probably never been used. In the outland area 20 m to the south, two barely visible depressions were found (Figure 10) that were both approximately of the same size, less than 0.5 m in diameter and 5 - 15 cm deep. While being probed, it was discovered that both contained charcoal, thus indicating that they were once used as hearths.

Did the magnetometer mapping and the excavations confirm the existence of the structures observed by the farmer 50 years ago? He had uncovered one house structure and two pits, one filled with charcoal and the other filled with slag. In the latter pit, he had put a forge-stone before covering the pit with a slab. No traces of the house structure were observed during the excavations but a heat-cracked slab was found on top of the slag heap in front of Furnace I, but no forge-stone made of soapstone was found underneath. However, one should take into account that half a century separated the farmer's observation and the excavation. It is possible that his memory somewhat may have failed him which makes me think that both the charcoal-filled pit and the slag pit found by the farmer may have been excavated.

The farmer had found one slightly curved shaft fragment measuring 11 cm by 14 cm which could come from a furnace with a shaft diameter of approximately 50 cm. This does not match any of the two excavated furnaces but indicate the presence of a much bigger furnace which has not been discovered yet. Be that as it may, the magnetic signature created by the two excavated furnaces was quite distinct and is not seen anywhere within the mapped area of the field. Also, the search for slag and charcoal and the extensive digging of test pits make it unlikely that there are any undiscovered furnaces or slag pits left in the field. Another possibility is that there has been one or several yet to be discovered furnaces in the outland area east of the cultivated area. This was not mapped with the gradiometer, and the remnants of the furnaces matching the largest shaft fragment from the field may have been overlooked.

3.1.3 Dating

Before the site was ^{14}C dated it was believed to have been from the Late Iron or Middle Ages (Jørgensen 1999 b: 5). This assumption was based on the find of a charcoal kiln nearby, as well as the fact that the location itself does not at all resemble the Early Iron Age iron production sites known from North Trøndelag.

In total, there are three ^{14}C dates from the two furnaces and one from the slag heap in front of Furnace I. Three of the four dates are based on a mixture of birch and pine, while the fourth, taken deep down inside of Furnace II, is based on birch only. It is uncertain as to how much the mix of pine in the other three charcoal samples has influenced the dating results. The birch sample produced the second oldest dating and indicates that the mix of pine in the charcoal samples has not seriously affected the dates. This is supported also by the fact that all four dates are relatively close in time. The intermixing of pine as a source of error in ^{14}C dates may not have been as great if the wood had come from young trees or wood close to the cortex, so it seems safe to assume that this must have been the case here.

Furnace I has been dated by two ^{14}C samples, and the heap of slag and charcoal in front of the furnace is dated to 2360±89 ^{14}C years BP (T-14762), calibrated two sigma[2] 765 – 206 BC (Bronk Ramsey 2001, OxCal v. 3.10, 2005). The other sample from within the furnace dates it to 2344±69 ^{14}C years BP (T-14761), calibrated 751 – 206 BC (Bronk Ramsey 2001, OxCal v. 3.10, 2005) which falls within the same period as the other dating. Both samples are a mixture of pine and birch and the samples coincide, indicating approximately the same period of use which is hardly a surprise, as the excavation documented that the furnace and slag heap were contemporary. The two sigma calibration range cover a time span of approximately 550 years and when trying to narrow this down by looking at the graphs of the two dates (Figure 13, Appendices 1-2), we see that the date T-14762 with a 52% probability falls within the period from 552 – 360 BC. The date T - 14761 from the furnace might, with a 60% probability, be narrowed down to the period from 539 – 359 BC. Furnace I was probably in use sometime during the early Pre-Roman Iron Age or sometime during the Late Bronze Age, although statistically, the dates are leaning toward to the early Pre-Roman Iron Age.

Another two ^{14}C samples date Furnace II. One charcoal sample (Tua-2662) taken from within the furnace is dated 2351±67 ^{14}C years BP, calibrated 752 – 208 BC (Bronk Ramsey 2001, OxCal v. 3.10, 2005) and is based on birch only. Another charcoal (Tua-2663) sample taken from under the flagstone the furnace was built on is slightly younger, dated to 2255±68 ^{14}C years BP, calibrated to 415 – 106 BC (Bronk

[2] Calibrated datings are always in a two sigma range when no different is stated.

Ramsey 2001, OxCal v. 3.10, 2005) (Figure 13, Table 2) and was a mixture of birch and pine. As mentioned above, it is a minor surprise that the sample, which is based on birch only, was dated as being older than the one that was a mixture of birch and pine. In addition, the oldest dating came from within the furnace and could not have dated older activity at the site as the youngest one taken from below the furnace might have done. The sample Tua-2662 from Furnace II is nearly identical to the two dates from Furnace I. The second dating from Furnace II, Tua-2663, largely overlaps with the other three dates. It is slightly younger but falls well within the period of the Pre-Roman Iron Age. When trying to narrow down the dating Tua-2662, the graph indicates that with a probability of 62.2 %, it falls within 540 - 364 BC (Appendix 3).

Structure I, situated three meters north of Furnace II, has not been ^{14}C dated, although during the excavation, a small fragment of asbestos-tempered ceramics was found embedded in the clay of this structure. This was probably of the Risvik type dated to the period from 800 to 400 BC (Andreassen 2002:74). It is likely that the origin of Structure I is related to iron production and should therefore be given the same dating. The fragment of Risvik ceramics found in Structure I is likely to date the structure, and suggests that Structure I was contemporary with the furnaces and thus related to the building and working of them.

Structure II is dated to BP 2120±65 (T – 16061), calibrated to 360 BC – AD 2 (Bronk Ramsey 2001, OxCal v. 3.10, 2005), and the dated sample is entirely based on birch. This dating is somewhat younger than the three oldest ^{14}C dates from the furnaces, but coincides well with the fourth and youngest dating (Tua-2663). The chronological distance to the three oldest dates (T-14761, T-14762, Tua-2662) is also minor and the calibration ranges partly overlap. During the excavation, the assumption was that Structure II was a clay deposit for the construction and maintenance of the furnaces, and I find it likely, in spite of slightly diverging ^{14}C dates, that Structure II and the furnaces were contemporary and integrated in the same production processes.

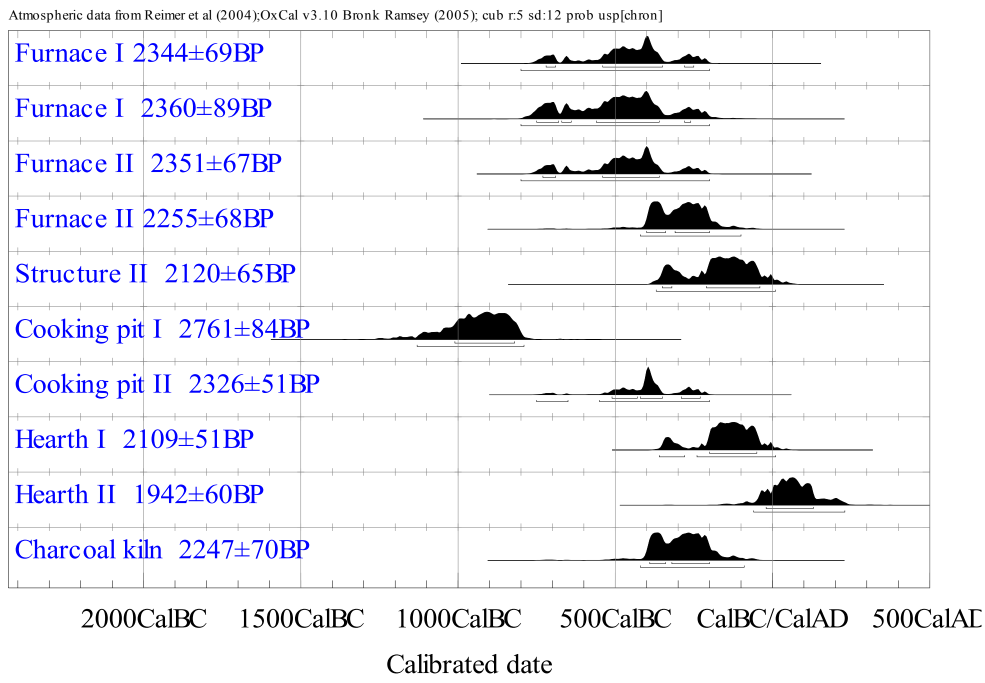

Figure 13 - ^{14}C dates from Hemmestad (cf. Appendices 1-10)

Structure	Lab ref.	^{14}C year BP	One sigma		Two sigma	
Furnace I	T-14761	2344±69	BC 718	BC 258	BC 751	BC 206
Furnace I	T-14762	2360±89	BC 745	BC 261	BC 765	BC 206
Furnace II	Tua-2662	2351±67	BC 723	BC 363	BC 752	BC 208
Furnace II	Tua-2663	2255±68	BC 392	BC 208	BC 415	BC 106
Structure II	T-16061	2120±65	BC 345	BC 48	BC 360	AD 2
Cooking Pit I	T-16060	2761±84	BC 1000	BC 825	BC 1129	BC 790
Cooking Pit II	Tua-3803	2326±51	BC 503	BC 234	BC 725	BC 206
Hearth I	T-14909	2109±51	BC 195	BC 53	BC 354	AD 3
Hearth II	T-14910	1942±60	BC 19	AD 128	BC 55	AD 229
Charcoal kiln	T-14763	2247±70	BC 390	BC 207	BC 413	BC 91

Table 2 - ^{14}C dates from Hemmestad (cf. Appendices 1-10)

The charcoal pit found 50 m east of the furnaces has been dated to 2247±70 BP (T-14763), calibrated 413 – 91 BC (Bronk Ramsey 2001, OxCal v. 3.10, 2005) (Figure 13, Table 2), and the sample was a mix of several foliferous trees. The dating is mainly within the period of the four dates of the furnaces and Structure II, and even though the middle range of the dating of the charcoal kiln is somewhat younger than the middle range of the dates of the furnaces and Structure II, I find it likely that they are contemporary. I thus also find it likely that the kiln produced charcoal, if not for the iron production itself, then for some related activity such as the reheating and forging of the bloom.

The two cooking pits found in the field are both ^{14}C dated, with the oldest, Cooking Pit I, dated 2761±84 BP (T-16060) and calibrated 1129 – 790 BC (Bronk Ramsey 2001, OxCal v. 3.10, 2005) (Figure 13, Table 2). The dating was based on a charcoal sample from foliferous trees. It is older than the dates of the furnaces and suggests that Cooking Pit I was in use prior to the furnaces, the charcoal pit and the clay structure and thus represents the presence of people in the area before the iron producers.

Cooking Pit II is ^{14}C dated to 2326±51 BP (Tua – 3803), calibrated to 725 – 206 BC (Bronk Ramsey 2001, OxCal v. 3.10, 2005) (Figure 13, Table 2), which is well within the period of the dates of the furnaces, Structure II and the charcoal kiln. Consequently, it is likely that the iron producers used Cooking Pit II, but since the sample dated was a mix of birch and pine, the latter may have contributed to making the dating older than it should be.

The two hearths found in the outland area south of the charcoal stack have not been excavated, though both are dated and seem somewhat younger than the iron production. Hearth I dates to 2109±51 (T-14909), calibrated 354 BC – AD 3 (Bronk Ramsey 2001, OxCal v. 3.10, 2005), and the sample was based on birch and pine. The second, Hearth II, was dated 1942±60 (T-14910) and calibrated 55 BC – AD 229 (Bronk Ramsey 2001, OxCal v. 3.10, 2005) (Figure 13, Table 2). Both hearths seem slightly younger than the furnaces although it is statistically possible, but not likely, that Fireplace I was used by those who produced iron approximately 70 m to the northeast.

The iron extraction at Hemmestad seems to have taken place sometimes during the Late Bronze or early Pre-Roman Iron Age, and the calibration ranges of the ^{14}C dates from the furnaces indicate that they were operated during the period between 750 and 200 BC. Other structures such as the charcoal kiln, Structures I, II and Cooking Pit I were most likely contemporary with the iron production. Upon scrutiny, the calibration curves indicate that it is more likely that iron production took place in the early part of the Pre-Roman Period rather than in the Late Bronze Age. Except for some Bronze Age dates in Sweden (Stenvik 2003 b: 78), these dates are still among the earliest of iron production sites in Scandinavia. Knowing that the extensive Early Iron Age production in North Trøndelag dates back no further than to 300 to 400 BC (Stenvik 2003 a:124), the old dates from Hemmestad are intriguing.

3.2 Flakstadvåg, Torsken Municipality

Flakstadvåg is a small community with approximately 40 inhabitants in the southwestern part of Senja (Figure 7). On my first visit there in the 1980s, I heard rumors about slag having been found somewhere in the outland area north of the settlement. Due to more pressing matters, there was no time or maybe not sufficient interest to pursue the subject and this bit of information was temporarily forgotten. In 1997, I returned to Flakstadvåg to see for myself if the rumors had any substance, and a local shopkeeper took me to a place where several large pieces of slag were seen lying in the turf. Some (Ts. 11065 a-f) weighed more than 7 kg and are the largest pieces of prehistoric slag ever found in North Norway, and slag of this size can have no other origin than being a result of iron production.

The site is located in Flakstadmyra (Figure 14), approximately 2 kilometers northeast of the settlement, in a valley surrounded by high mountains except to the south where it opens up towards the sea. The site is at a dry spot in a boggy area, 31 m above sea level, and the pieces of slag were found at the bottom of a slope next to a small creek. A funnel-shaped depression, partly eroded, was found at the top of the slope, and except for this, no other structures indicating prehistoric activity were seen.

3.2.1 Excavation

The excavation that took place in 1998 exposed two areas of the site, one in and around the funnel-shaped depression and the other down the slope where the majority of the slag was found (Figure 15). Most of the effort was concentrated on excavating the depression, which was believed to be the furnace, and the excavation also included some of the area around the depression, on the flat top above the slope and below the depression in the eroded area towards the stream. Some charcoal, although not a significant amount, was found in close proximity to the depression above the slope, and there were no major concentrations of charcoal in or around the pit, mostly just charcoal colored soil caused by a spill from the furnace. Below the depression in the eroded area, a few finds of burned and partially glazed clay and some pieces of slag were found. The slag-strewn area next to the depression seemed undisturbed, while the slope in front of the depression towards the stream was heavily eroded. In total, these two excavation areas accounted for 55 m^2, and test pits examined all the surrounding area, which was thought to be influenced by the iron production activity, but no structures of any kind were documented.

Before the excavation, the funnel-shaped depression measured 1 m in diameter at the top and was 0.8 m deep. The ground at the site is rich in iron and the funnel-shaped depression was dug into solid iron pan, though the depression was largely empty. Only a few minor pieces of slag and burned clay, as well as three to four buckets of fist-sized stones were found during the excavation. The stones seemed not to have been part of any construction but had merely fallen into the pit from the wall due to erosion. A slab without any signs of being exposed to the great heat of the furnace was found in the bottom of the pit.

Even though the depression was dug into iron pan, its shape and size had been enlarged by erosion so that the diameter at the top was probably larger than it had been during the operational period of the furnace (Figure 16), and the iron pan formed an approximately 10 cm thick layer immediately below the top soil. Even though the compact iron pan had partly withstood the erosion, the soil above the iron pan had fallen into the pit, thereby increasing the diameter of its top.

The other excavated area was opened up next to the eroded area in the slope, above where the large pieces of slag were found during my first visit at the site. The greatest concentration of slag was found in the lower part of this area (Figure 15). Some of the largest pieces of slag had a fractured surface, thus indicating that they had been broken loose from a larger slag deposit. The spread of finds in the excavation area indicate that the slag had been emptied out of the slag pit, and in doing so, the massive slag cake in the bottom of the pit had to be broken in pieces and was deposited down the slope forming a fan-shaped slag heap.

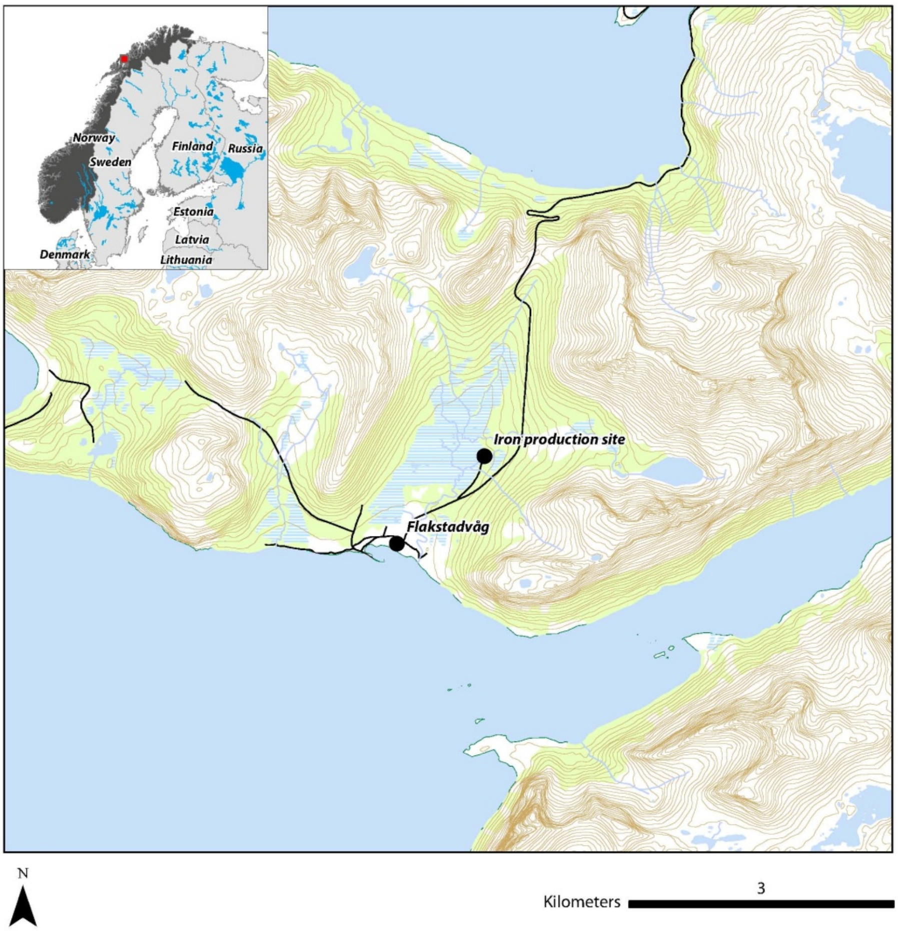

Figure 14 - The location of the iron production site at Flakstadvåg

Originally, the furnace had been placed on a flat surface on top of the slope, though in the post-production period, the small stream changed its course which caused the slag pit and the slope to erode. During this process, most of the slag had been buried in sand below the pit, in the stream or in the swampy area below. The many kilos of slag that were collected from the stream are a strong indicator of such a development, so for this reason, only a fraction of the slag produced has been recovered.

The finds at Flakstadvåg are in accordance with the finds from iron production sites further south in Norway. Although structures such as houses, depressions, iron deposits, roasting sites, charcoal kilns, etc. are often found at iron production sites, few artifacts apart from slag and construction materials from the furnace have been found, which was the case at Flakstadvåg as well. Altogether, 117 kg (Ts. 11065 a-f, Ts. 11209) of iron slag was found in the excavated areas and in the small stream at the bottom of the slope. In addition, 19.8 kg (Ts. 11209) of burned pieces of clay was recovered. Many of these were glazed on one side, indicating an exposure to high heat. Most pieces were small, although a few of the larger fragments (the size of a man's hand) were curved and were reddish on the outside and glazed on the inside. From their shape and texture, it is reasonable to assume that all these glazed pieces of clay are remains of an aboveground shaft or clay lining in the slag pit.

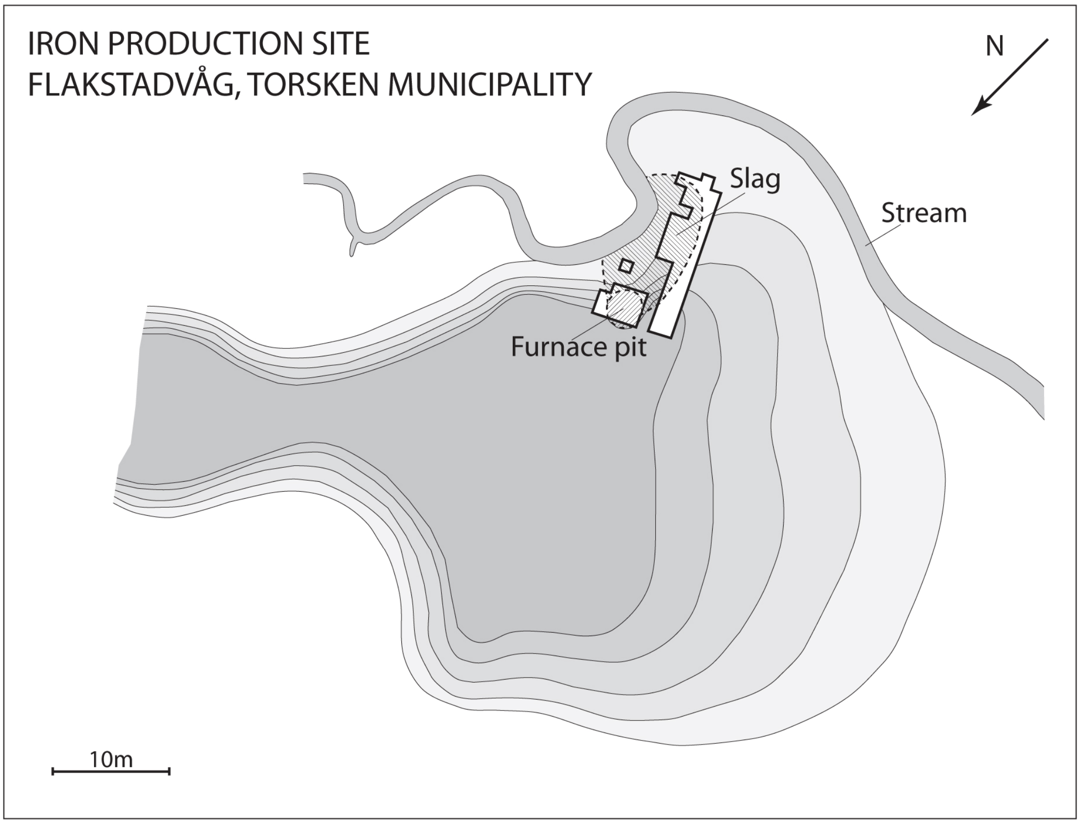

Figure 15 - The iron production site at Flakstadvåg (Graphics: Adnan Icagic, Tromsø University Museum)

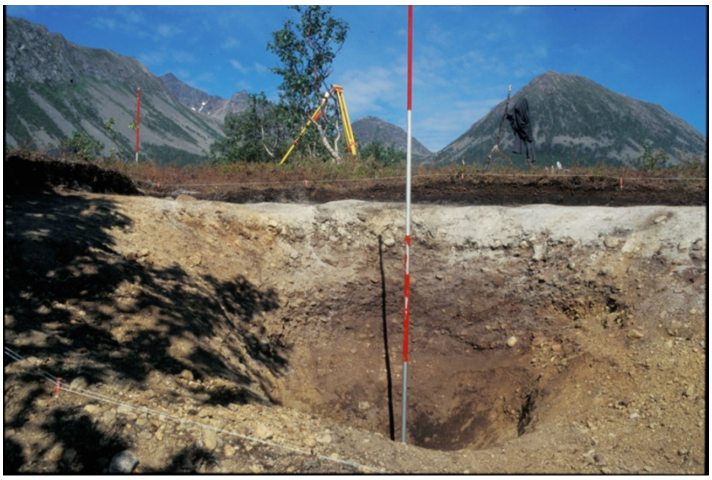

Figure 16 - The excavated slag pit (Photo: Roger Jørgensen)

3.2.2 Dating

No datable artifacts were found during the excavation, but there are two ^{14}C-dates from the site, both based on charcoal. One was collected from the top of the slope approximately one meter from the slag pit from a very thin charcoal layer surrounding the furnace which dates the iron production to 1747±37 BP (T – 13126), calibrated AD 171 – 402 (OxCal 2005, Bronk Ramsey 2001). Due to the use of a newer calibration program, this dating differs slightly from a previously published dating of the site (Jørgensen1998:50). The charcoal for the other ^{14}C date was found embedded in a large piece of slag. It was small and thus AMS dated, yelding the result 1793±34 BP (Wk – 20639), calibrated AD 130 – 334 (OxCal 2005, Bronk Ramsey 2001). These dates place the iron production sometimes between AD 130 and 402. Using the one sigma calibration range, the timeslot may be narrowed down to AD 139 – 340. Moreover, the probability suggested by the calibration curves makes it more likely that the production took place sometimes during the 3rd century than in the 2nd and 4th centuries. (Figure 17, Table 3, Appendices 11-12).

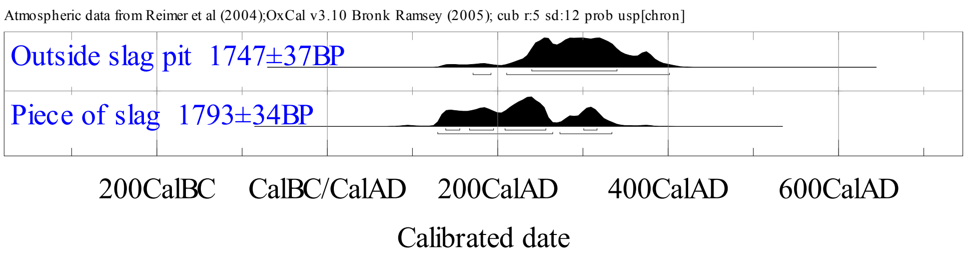

Figure 17 - ^{14}C dates from Flakstadvåg (Appendices 11-12)

Structure	Lab. ref.	14C year BP	One sigma		Two sigma	
Outside furnace	T–13126	1747+37	AD 240	AD 340	AD 171	AD 402
Piece of slag	Wk-20639	1793+34	AD 139	AD 317	AD 130	AD 334

Table 3 - ^{14}C dates from Flakstadvåg (Appendices 11-12)

Both dates are based on charcoal of pine. As already mentioned, there are serious methodological problems related to ^{14}C dates based on old pine trees. Ideally it is best to date charcoal from short-lived deciduous trees. If using pine, young trees are preferred and/or finding wood close to its cortex in order to minimize any dating error. This has proven to be a problem in cases where the furnaces have been mainly fired by pine because the choice of firewood was hardly random, as it most likely influenced how fast the furnace was heated and how hot it would become. Evenstad (1790:422) recommended the use of dry pine in the furnace type named after him. In Southeast Norway, the furnaces seem to have been fired with pine both in the Early as well as the Late Iron Age, but a shift to birch came in the Late Viking Period and was dominant during the Middle Ages (Larsen 2004:155).

The suggested dating of the site is supported by similarities to Roman Period iron production sites in North Trøndelag. These are also normally located at a dry spot in a boggy area on top of a slope or above a stream, a river or a lake (Stenvik 1990:210), and the technology applied seems to be very similar. Most probably the Flakstadvåg furnace was fired by wood and not charcoal, and the basic principles of the construction seem to have been the same. The furnace was built with a shaft of clay raised above a slag pit dug into the ground, and after the smelting was finished, the pit was emptied down the slope to prepare for another smelting. However, the site at Flakstadvåg does differ from the North Trøndelag sites in that no structures were found close to the slag pit. In Trøndelag, several depressions (between three to seven) were often placed in a “rosette” pattern around the slag pit and post holes from other structures are often found as well (Stenvik 1990:211, 2003 a:125). One other major difference is that the Trøndelag sites normally had several furnaces in production at the same time, although probably in different stages of production (Stenvik 1990:211). At Flakstadvåg, there does not seem to have been more than one furnace, though it is possible but not likely that one or more furnaces have been destroyed due to erosion. The excavated furnace had probably been placed close to the edge of the slope, and more extensive erosion in the slope area could have caused the furnace to totally disappear. This might be the case with other furnaces with a similar location, but the amount of slag recovered at the site does not suggest more furnaces than the one excavated.

The ^{14}C dating of the site to the Roman Period (possibly 3rd century), are credible in spite of methodological problems with the material being dated. Iron production in North Trøndelag peaked during the Roman Period, particularly around AD 200 (Stenvik 2003 a:124), and similarities between Flakstadvåg and the Trøndelag sites support the ^{14}C datings.

3.3 Rognlivatnet, Bodø Municipality

The existence of slag at Rognlivatnet was known to some townspeople in Misvær in Skjerstad, Nordland County years before it was known to archaeologists. After being shown some slag from the site, archaeologists Lars Stenvik at the Norwegian University of Science and Technology in Trondheim, who for decades had been working on the prehistoric iron production in the counties of Trøndelag, and Hein B. Bjerck, who was working at the time as cultural heritage officer in Nordland County, surveyed the area in 1994. In the hills high above the Misvær settlement, they found what seemed to be remnants of an iron production site that was the first ever found in North Norway (Figure 18).

Figure 18 - Rognlivatnet, located in the hills above Misvær (Photo: Roger Jørgensen)

The site is located 370 meters above sea level in a hilly and wooded area sloping towards Rognlivatnet, ca. 90 meters south of the lake (Figure 19). Some structures related to the production activity are still visible on the surface although none have been excavated. Bjerk and Stenvik (1994) has ^{14}C dated one of the heaps of slag and roasted iron ore and Johansen (2000) has conducted a thorough documentation of the two charcoal kilns which I later have ^{14}C dated. Three small piles, consisting mainly of slag and roasted bog ore, in addition to a possible house structure or a shallow drainage ditch and two very large charcoal pits, constitute the production site (Figure 20). Less than one kilometer away, there are several smaller charcoal kilns and a prehistoric sunken road as well.

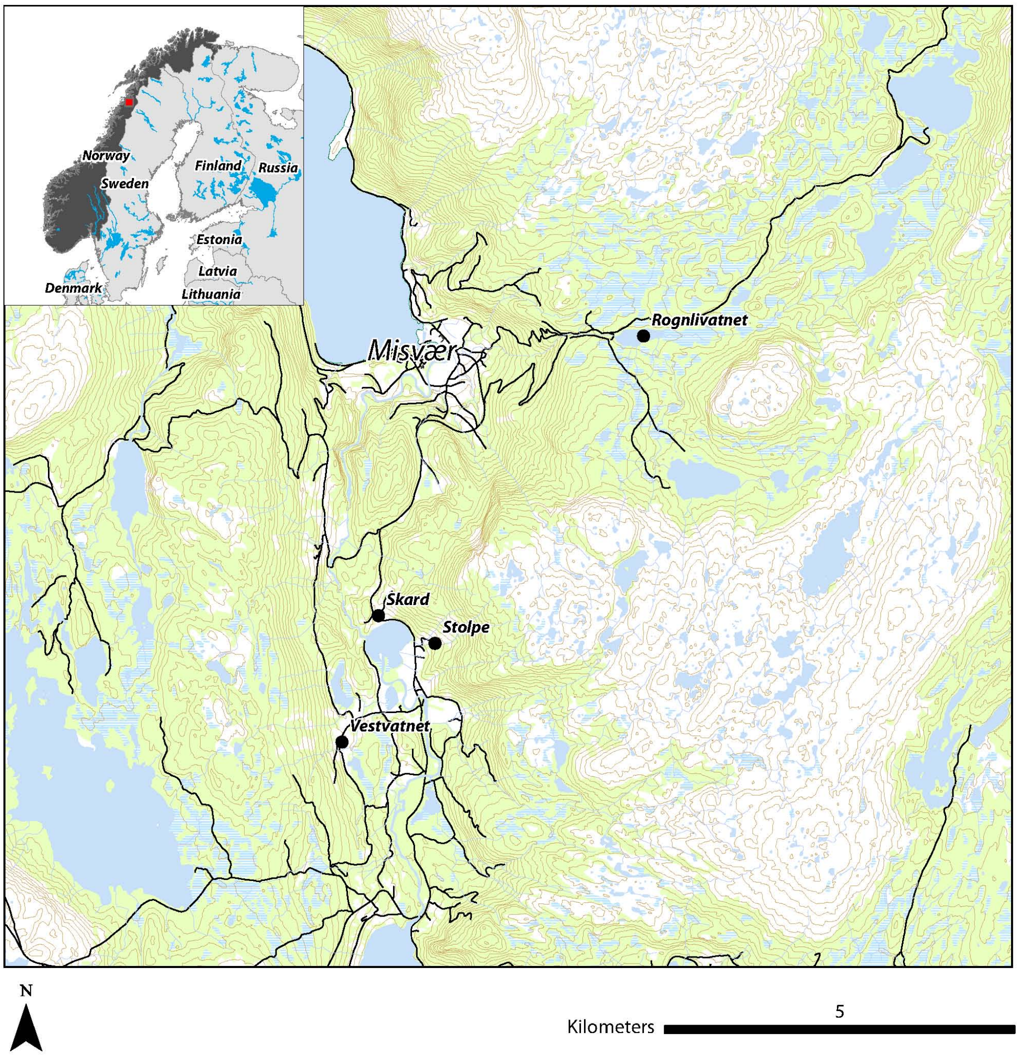

Figure 19 - Rognlivatnet and nearby prehistoric sites

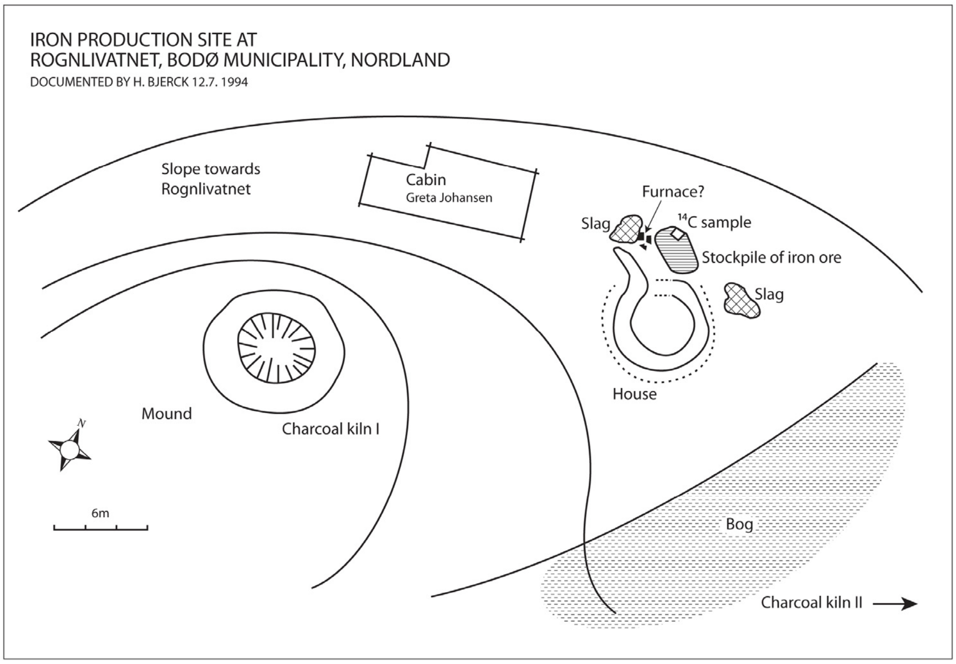

Figure 20 - Iron production site at Rognlivatnet (Graphics: Ernst Høgtun, Tromsø University Museum, based on drawing by Hein B. Bjerck)

3.3.1 Dating

In 1994, Bjerck and Stenvik collected one sample of charcoal for ^{14}C dating from what is believed to be a stockpile of roasted bog iron ore. This dates the site to 800±35 years BP (T-11811), calibrated AD 1175 – 1277 (Bjerck and Stenvik 1995; Bronk Ramsey 2001, OxCal 3.10, 2005) (Figure 21, Table 4). The dated sample was identified to be from foliferous trees (Bjerck and Stenvik 1995), and based on today's vegetation, was probably birch, which weighs in favor of the date's credibility. The practice of firing the furnace by charcoal, which was exercised in Trøndelag during the Late Iron Age and the Middle Ages, supports this.

I have ^{14}C dated both charcoal pits, and Charcoal Pit I is dated to 700±40 BP (T – 18960), calibrated AD 1251 – 1392 (Bronk Ramsey 2001, OxCal 3.10, 2005), while Charcoal Pit II is dated slightly older at 780±65 BP (T – 18961), calibrated AD 1047 – 1285 (Bronk Ramsey 2001, OxCal 3.10, 2005).

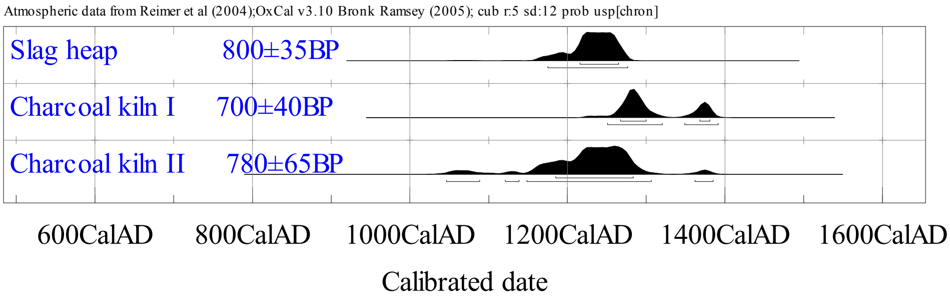

Figure 21 - ^{14}C dates from Rognlivatnet (Appendices 14-16)

Structure	Lab. ref.	14C year BP	One sigma		Two sigma	
Slag heap	T – 11811	800±35	AD 1216	AD 1265	AD 1175	AD 1277
Charcoal kiln I	T – 18960	700±40	AD 1268	AD 1381	AD 1251	AD 1392
Charcoal kiln II	T – 18961	780±65	AD 1185	AD 1284	AD 1047	AD 1385

Table 4 - ^{14}C dates from Rognlivatnet (Appendices 14-16)

All three dates from Rognlivatnet overlap within a two sigma range, thereby making it likely that the two charcoal kilns and iron production site were in operation during the same time period. There is a span between the three dates of 345 years, ranging from AD 1047 to AD 1392. If this time span is to be narrowed down, it is probable that iron was produced at Rognlivatnet sometime during the 13th century (Appendices 19-21).

The site is dated to the Middle Ages and falls outside the main chronological frame of this work. However, the scarce data regarding north Norwegian iron production and the fact that the technology applied at this site is consistent with the "old" way of making forgeable iron, thus making it an interesting case and a valuable addition to this study. Being so chronologically close to the Iron Age, it may also shed some light on the few production sites dated to the Iron Age.

3.4 Summing Up

Up until now, three iron production sites have been found in North Norway. Geographically, they are spread between Flakstadvåg in the north to Rognlivatnet in the south, which is a distance of 250 km as the crow flies. The oldest site, Hemmestad, was probably used sometime during the early part of the Pre-Roman Period, while Flakstadvåg was used during the Roman Period and Rognlivatnet, the youngest site, was operated in the Medieval Period, possibly during the 1200s. The time difference between the three sites is several hundred years, so they must be regarded as three separate incidents, and the next chapter will explore in which technological tradition they might belong.

4 TECHNOLOGICAL ASPECTS OF IRON PRODUCTION

When looking into the technological traditions related to the production of direct forgeable iron, it is evident that there are regional and chronological differences (Pleiner 2000; Stenvik 2003 a). The Norwegian iron production, especially during the Early Iron Age, were part of a European shaft furnace tradition but with local adaptations of the technology (Stenvik 2003 a:125). To illustrate this, I will briefly describe the main technological developments in Trøndelag and Southeast Norway which were areas where major iron production took place during the Iron Age.

In Trøndelag, the Early Iron Age furnaces are quite large structures with a shaft measuring close to one meter in diameter. The slag could be removed through an opening in the horseshoe-shaped slag pit and the shaft was preserved for another smelting. The iron production sites had often several furnaces in various stages of production and tons of slag, document an extensive production of iron. These furnaces were heated with wood and the production process was kept going on natural draught. Much of this changed approximately AD 600 when the large Early Iron Age furnaces are replaced by smaller furnaces which were heated with locally produced charcoal. They no longer occur in clusters of many furnaces but individually and bellows was used to secure sufficient airflow to keep the process going. (Stenvik 2003 a)

In Southeast Norway the iron production can be divided in three chronological stages based on changes in technology. (I) Early Iron Age: large, individual or pairs of furnaces with slag pits which was reused many times. The shaft had to be demolished to empty the slag pit and it had to be rebuild for the next smelting. The furnaces were heated with wood and it is likely that natural draught secured the airflow. (II) The shaft of the Late Iron Age and the medieval furnaces was not raised above a slag pit but within a frame of flagstones and it had an opening to let out the liquid slag. The shaft was significantly smaller than the older furnaces, only 0.3 – 0.5 m in diameter. It was heated with charcoal and a bellows was used to secure the airflow. (III) The medieval and post-medieval Evenstad furnace is entirely build below ground and the shaft was made of rock. Evenstad (1790:422) recommended that the furnaces were heated by dry pine and bellows were used to secure the airflow. (Larsen 2004)

The development characteristics described here are not absolute but meant as a simplified description of the main technological trends. These are not without exceptions and in Southeast Norway, for example, furnaces both with and without a slagpit have been found (Narmo 1997:112).

The main purpose with going into the technological aspects of iron production is better to understand both the background for the north Norwegian iron production and how it worked. Hopefully, a detailed study of the technological aspects of the northern iron production will identify the source of the technology applied and thus the region(s) which inspired the north Norwegian ironworks.

Iron production has been considered the high technology of the Iron Age. The intricacies of iron production have partially been revealed by experimental archaeology but still there are great problems in making direct forgeable iron in furnaces without the use of a bellows. The skills that enabled the blacksmith to transform iron ore to metal were, at least during the earliest iron producing period, mastered only by a few which gave the blacksmith a status separate from others. According to the increasing number of iron production sites more people gradually mastered the skills of the smelter. However, the knowledge of making iron could not be acquired by word of mouth but had to be learned by practicing. In a time without instruction manuals, the only way of learning the secrecies of iron production would have been to work along a master blacksmith. It is much like those learning traditional boatbuilding today. The best way to learn these skills is to practice along with a master boat builder. Consequently, passing on the skills to the northern societies could not be done verbally, but only by a north Norwegian participating in the work on an iron production site or by someone with those skills travelling to North Norway.

This chapter will focus on the technological aspects of iron production at the three sites: Hemmestad, Flakstadvåg and Rognlivatnet. Technological choices regarding: the use of wood vs. charcoal, the use of a bellows vs. natural draught and constructional features, are of particular interest. These are factors which are vital when looking into which technological traditions inspired the northern ironworks.

Apart from considering the technology, I will discuss the access to raw materials necessary to carry out the production at each site. Technological knowhow alone is not sufficient for carrying out a successful smelting and without the raw materials necessary for the construction of the furnaces and for producing iron, no smelting can take place. Any iron production will thus depend on the resources available and a short discussion about this will be related to each site.

4.1 Pre-Roman Iron Production at Hemmestad

The ^{14}C dates from the furnaces at Hemmestad indicate a period of use from the early part of the Pre-Roman Iron Age. Quite a few sites are dated to the Pre-Roman Iron Age documenting that iron production was an established and well-developed craft both in Trøndelag and southern Norway during this period (Larsen 2004; Stensvik 2003 b). Excavations in both northern Finland and northern Sweden have also documented Pre-Roman Iron production sites. The question, however, is if the iron production technology in these areas are contemporary to or even constitute a source of origin for the technology applied at Hemmestad.

4.1.1 Raw Materials

When constructing an iron production site there are certain requirements that need to be fulfilled such as the need for iron ore, fuel for heating the ore and building materials for the construction of the furnace.

During the excavation two concentrations of clay were found that were manmade structures and obviously not part of the undisturbed soil. When visiting the site a few years after the excavation, a ditch had been dug in the western part of the field. At a depth of approximately 80 cm, there was a thick layer of clay, thus demonstrating that sufficient amounts of clay were available for the building and maintenance of the furnaces.

Another key element in the production of iron would have been wood or charcoal. The woodland resources in the area may have been rich but as there is no botanical data based on pollen diagrams from nearby bogs, we do not have a sufficient amount of knowledge about the stress inflicted on the woodlands by the contemporary population. Based on prehistoric finds and historical monuments, the Iron Age settlement in the area seems to have been quite substantial (Johansen 1968, 1978 b), although most of these finds are from the Migration Period and the Late Iron Age. There is reason to believe that there was an increased need for agricultural resources during the Late Iron Age, due to rise in population and farms, as seen among other places in Vestvågøy in Lofoten (Johansen 1982 a). However, the data situation does not allow for such analysis of the earliest part of the Early Iron Age, and reliable estimates of the population cannot be made. As a result, we do not know whether the population size and the number of cattle, sheep and goat grazing in the outland areas would have been large enough to decimate the forest sufficiently enough to have created shortage of wood either for charcoal production or for the firing of the furnaces.

No bog iron ore has been found at Hemmestad, but there are some marshy areas not far from the production site though no iron ore has been observed in any of the inspected bogs. Still, there have only been visual inspections without the use of a metal probe, which were probably used by prehistoric blacksmiths when searching for bog iron ore. A purely visual inspection is not very effective since bog iron ore is most often not visible on the surface. Even if there was no bog iron ore close to the production site at Hemmestad it is reasonable to assume that iron ore was present in the vicinity and transported to the production site. Iron ore is documented in solid rock only 4 km across the fiord at Kveøya, where iron was mined between 1902 and 1914 (Poulsen 1964:48, 51).

The soil at the field where the excavation took place is very rich in iron. On the upper, southern part of the field, iron pan was found in several of the test pits and was also partly covering Cooking Pit I. There is no need to assume that the formation of iron pan has been limited to the period after the pit went out of use because this is most likely an ongoing process that has taken place during most of the post glacial period. Iron pan in and of itself is not suitable as a raw material for iron production, but the ongoing process of forming iron pan documents the presence of iron in the subsoil water which is necessary for the formation of bog iron ore. Wherever the iron ore came from, analyses of the roasted iron ore from Furnace II indicate that the producers did have access to good quality iron ore (Espelund 2005).

4.1.2 Technology

Most constructional features uncovered during the excavation are described in Chapter 3.1.2 and will not be repeated here. Nonetheless, the shafts seem to have been entirely made of clay without any use of stone or other means of fortification. Many 2-3 cm thick and relatively small fragments of shaft material that were found during the excavation had undoubtedly been thicker when the furnace was newly constructed, but had burned off and fractured during the production process. The 16 kg of recovered shaft material (Ts. 11225 a-c) cannot be refitted, and the remains of the furnace bottoms do not provide sufficient data for a reconstruction of the superstructure. The diameter of the furnaces is known, but not the height. At Dokkfløy in Southeast Norway, one of the Viking Period furnaces with a diameter of 0.5 m had a height of 0.7 m (Larsen 2004:156). Some of the Pre-Roman Swedish furnaces seem to have had a height corresponding to approximately 1.5 times the diameter of the hearth (Serning 1979:68-70). If this were the case at Hemmestad, the shaft would have been roughly 0.5 m high, meaning that this would indeed have been a small furnace, though it is possible that the furnaces were somewhat higher than this, and that the aboveground shaft had been wider than the underground base. If so, this would have allowed more room for iron ore and charcoal/wood, and the shaft itself would have been much more stable.

The 30 cm wide shaft furnaces at Hemmestad would probably have been much easier to heat with charcoal than wood. The small interior space would have had very little interior room for wood, iron ore and slag, so only using charcoal therefore seems to have been the most suitable method for heating.

The charcoal kiln at Hemmestad has a ^{14}C date contemporary to the furnaces, but it is uncertain as to whether it had the capacity to produce charcoal for one, let alone two furnaces. The “Evenstad furnace” required 3-3.5 barrels of charcoal for each smelting (Evenstad 1790:432), and studies of the Evenstad furnace conclude that the consumption of charcoal per kilo of produced iron was between 29.5 and 59 liters (Narmo 1996:146; Pettersson 1982:107-108). Narmo (op. cit.), however, thinks that the consumption was closer to 30 liters of charcoal per kilo of produced iron. Nevertheless, there are great uncertainties associated with these numbers as others maintain that 100 kg of charcoal is needed for the production and refinement of one kilo of iron (Crew and Salter 1993:11). The charcoal pit had a volume of approximately 300 liters, and a newly burned and unopened charcoal kiln may have had a total volume at least 1.5 times this size, which would have yielded a production volume between 400 to 500 liters. This demonstrates that even a small charcoal kiln would have had a production volume sufficient to produce small amounts of iron. Even though no more charcoal kilns were found in the immediate surroundings, it can not be ruled out that several more lie undetected in the outland area. The farmer reported on having found one pit filled with charcoal when clearing the field but this could have been one of the cooking pits. The small size of the furnaces and the fact that charcoal from a contemporary charcoal kiln seems to have been available, makes this the most likely heating source. Most Early Iron Age furnaces in southern Norway seem to have been fired with wood as the great amount of charcoal kilns are dated to the period from AD 800/900 to throughout the Middle Ages. However, a few charcoal kilns are dated to the Early Iron Age (Larsen 2003 a:181) which indicates that some Early Iron Age furnaces in the south may have been fired with charcoal as well.

Imprints in shaft fragments and in slag may reveal details regarding the construction and the technology applied. On the inside of the previously referred to shaft fragment found by the farmer, an imprint of a wooden stick indicate that there had been several vertically raised wooden sticks in the bottom of the furnace. Numerous finds from the Continent document that slag pits often had been filled with dry wood or straw bundles at the beginning of the process (Pleiner 2000:149). Imprints in slag may often reveal the type of heating material that had been used. There are also imprints in the slag at Hemmestad, but the recovered pieces of slag are too small to decide whether they are from charcoal or small pieces of wood. The narrow shaft strongly indicates the use of charcoal as a more voluminous wood seems to have been less suitable for heating the furnace. In addition, the charcoal from the pit may have served other purposes. When the bloom was extracted from the furnace, it would have needed at least some treatment to be purified of the embedded slag which was done by the reheating and hammering of the red-hot bloom.

At Hemmestad, no finds have this far revealed any clues as to whether or not a bellows had been used during the production phase. None of the pieces of burned clay had a shape to indicate that the furnace shafts had ventilation holes at the base, and no fragments of tuyeres were found that would indicate the use of a bellows. A narrow shaft furnace would not need to be as high as a wider furnace in order to work on natural draft alone, and the modest diameter of the furnaces at Hemmestad would not have required a very high shaft to have worked by natural draft alone. Still, to create a sufficient amount of natural airflow, the shaft would necessarily have to be a certain height to achieve such a “chimney” effect. A 30 cm wide shaft could not have been very high without becoming unstable, but the solidity and stability of the shaft would depend on the thickness of the walls. The only shaft fragments found in the field were 2-3 cm thick, which would have been far too thin to carry the weight of even a quite low shaft. The shaft wall would surely have been thicker, but only the layer of clay closest to the inside of the furnace is preserved, and the less burned and hardened clay on the outside of the shaft has disintegrated.

The question of whether a bellows was used cannot be given a definitive answer. The furnace may have worked by natural draft alone, although the small diameter of the furnace and the possible presence of a forge-stone may indicate that a bellows was used. As mentioned above, the farmer claims to have found a forge-stone of soapstone, when cultivating the field. His generation of farmers was familiar with the work taking place in a smithy, and there is ample reason to trust his observation even though the forge-stone had disappeared.

Some ocher-colored roasted iron ore was found at the base of Furnace II that had been spilled when feeding the furnace during the production phase. Chemical analyses done by metallurgist Arne Espelund (2005) confirmed that that this is indeed roasted iron ore. Three samples of slag have also been analyzed (Espelund 2005, 2006), one from each of the two furnaces and one from Structure I, located north of the furnaces (Table 5).

	FeO	Fe2O	MnO	SiO2	Al2O3	P2O5	CaO	MgO	BaO	TiO2	K2O	Sum	R
M 2		84.16	2.0	7.96	3.26	0.394	0.51	0.56	0.02	0.09	0.31	99.24	8.12
S.o1	79.96		1.93	10.6	4.00	0.215	0.95	0.70	0.10	0.13	0.43	99.08	6.44
S.o2	60.8		1.96	23.00	8.18	0.291	1.78	2.00	0.04	0.26	1.11	99.57	2.28
S.o3	58.07		12.31	16.3	6.35	0.364	1.71	1.17	0.39	0.19	0.68	98.334	3.60
S/M2			0.98	2.89	2.51		3.91	3.57					

Table 5 - Analyses of slag and iron ore from Hemmestad (Espelund 2005) (M2 is roasted iron ore, S.01 is slag from Furnace I, S.02 is slag from Furnace II and S.03 is slag from Structure I)

The slag from Furnace I turned out to have a chemical profile similar to that of iron ore:

> *This may indicate that the iron ore has undergone a pre-treatment to transform fine-grained ore to slightly bigger particles, or it could be a result of creating the iron silicate fayalite as a first step before the smelting* (author's translation) (Espelund 2005:2).

Espelund suggests that the "slag" found next to Furnace I was a product of iron ore being heated in the furnace before the actual smelting. According to Espelund, this was done to change the chemical composition of the ore in order to make it more suitable for smelting. Analyses of slag from the iron production site at Sjøholt in Ørskog Municipality in Sunnmøre grounds Espelund's hypothesis regarding the mode of production at Hemmestad. "Slag" from structure 180 at Sjøholt has been analyzed and even though it morphologically appeared to be slag, the chemical structure was closer to iron ore (Espelund and Johannessen 2005:160). Based on x-ray diffraction and microprobe analysis of surface-grinded samples, Espelund and Johannessen (op. cit.) suggest that what appeared to be slag was in fact a semi-manufactured product, heated to change its chemical profile to improve its quality, i.e. some type of roasted iron ore.

Based on the results of his chemical analyses, Espelund believes there was a similar mode of production at Hemmestad. He suggests that Furnace I was used for the pre-processing of iron ore, and that the smelting had taken place either as a second stage in the same furnace or in Furnace II. The fact that no place for roasting iron ore was found at Hemmestad speaks in favour of this hypothesis, although this of course may be due to the confinement of one invention and / or post-depositional disturbances.

Espelund's suggestion that iron ore was roasted inside Furnace I may therefore have some credibility. Yet, the furnaces' construction and the morphological appearance of the slag do not indicate that the two furnaces served different purposes. The recovery of spilled, roasted iron ore around Furnace II, however, documents that this furnace had been fed fine-grained iron ore, which was morphologically very different from the "slag" found in front of both furnaces. Finding roasted iron ore only at the base of Furnace II may indicate that only this furnace had been used for iron extraction. Furnace I and the pit in which it was placed were heavily damaged by modern farming activity, which could have dispersed any remnants of spilled roasted iron ore. The structures looked nearly identical and appeared to be two furnaces built for the same purpose, i.e. for producing iron. It was not visually possible to distinguish the slag from Furnace I from that of Furnace II. It is true that the small pieces of slag found in front of both furnaces are somewhat different from slag found scattered around the field, as well as slag from the production sites at Flakstadvåg and North Trøndelag (Figure 22). The latter difference probably only indicates that the mode of production at Hemmestad was different from the Roman Period production.

Small pieces of slag at Iron Age sites are often associated with smithing activity. However, the well-defined, oblong heap of slag in front of both furnaces is not likely to be the result of hammering slag-rich blooms. No scales from hammering were found and the pieces of slag are too large to be the product of hammering blooms. The question of whether iron was produced in one or both furnaces cannot be given a definitive answer but the roasted iron ore spilled around the base of Furnace II and the slag found at the front and inside the furnace, confirm that iron smelting had taken place. The two furnaces looked very much alike and based on visual observations alone, I find it difficult to agree with Espelund that the furnaces had served different purposes.

According to chemical analyses (Table 5), the amount of iron produced has been as high as the production of slag, thereby indicating an iron – slag ratio of 1:1. This also indicates a very successful production, which is in accordance with analyses from several other iron production sites (Espelund 2004). During the Early Iron Age, the iron – slag ratio seems to have been much higher than previously assumed. Even though earlier estimates concerning the iron – slag ratio have varied significantly (Espelund 1995:28; Espelund and Stenvik 1993:135; Furingsten1981:139; Rosenqvist 1983: 135-137, 1988:173; Serning 1976:58-59, 1979:65), the amount of slag produced is supposed to indicate the amount of iron produced. Due to many years of cultivation activity, slag has been dispersed all over the field, and it is not possible to calculate how much is buried in the soil. As a consequence, the production of slag, as well as the total amount of iron produced, will remain unknown. In total, 28 kg of slag (Ts. 11225a-c) was recovered during the excavation, and with an iron-slag ratio of 1:1, at least the same amount of iron was produced.

Figure 22 - Slag found next to the furnaces (Photo: Adnan Icagic, Tromsø University Museum)

The analyses of the slag and roasted iron ore demonstrate that the blacksmiths had access to an iron ore of good quality and that production was successful. One may speculate as to why the production was seemingly so limited and why it was apparently terminated after what seems to have been a short production phase. Assuming at the time the production took place that iron was a valuable and much sought after raw material, it is odd that only two furnaces were built and that what appeared to be a successful production was terminated after only one or a few smeltings.

4.2 Roman Period Iron Production at Flakstadvåg

The Roman Period is a time when a large increase in iron production took place, particularly in North Trøndelag. This production far exceeded the local demand, and regional and/or long distance trade was therefore probably crucial in maintaining the production at such a high level (Stensvik 1997, 2003 b). The site at Flakstadvåg was established in the Roman Period at a time when production flourished in North Trøndelag and Southeast Norway. There are similarities as well as differences in the production technique between these two regions, but they are both variations based on a common European technological tradition (Stenvik 2003 b:124).

4.2.1 Raw Materials

The raw materials necessary for the construction of a production site and to carry out a smelting were probably available in close proximity to the Flakstadvåg site. Even though no clay deposits were uncovered during the excavation, it is more than likely that clay is present in the swampy area where the production site is located.

Today, both birch and pine are plentiful in the surroundings, though the area could have been somewhat deforested due to a contemporary settlement's need for firewood. It is possible that local settlements had decimated the forest, but the existence of the smelting site demonstrates that firewood indeed was available, at least for awhile.

A 20 cm thick deposit of bog iron ore was found roughly 80 m from the furnace pit which covered an area approximately 10 m by 15 m. It may not sound like an impressive deposit, but this source of iron ore contains approximately 30 m^3 which would have been sufficient enough for many smeltings. Chemical analysis has proven this to be good quality ore with a chemical composition well suited for ancient iron production (Espelund 2005: Table 1). Iron deposits form quite rapidly and there is no way of telling if this was the deposit that was used during the production, or if it may have formed during the approximately 1700-year long post-production period.

Bog iron ore was normally roasted in an open fire before being used in the production process, but no such roasting place was found in or near the production site.

4.2.2 Technology

Some of the pieces of burned clay which were found during the excavation were the size of a man's hand. They were slightly curved, 2 – 4 cm thick, and were reddish and glazed on the inside (Figure 23). No constructional features such as air inlets, etc. are seen on any of these which would have been thought to be fragments of the shaft which had been raised above the depression or slag pit. Another less likely possibility is that these fragments come from a clay-lined pit, but there are no impressions of soil or stones to indicate that they had been part of an underground construction. Findings of similar burned and glazed, slightly curved pieces of burned clay at other iron production sites (Stenvik 1985:111) support the idea that this had been a shaft furnace with an underground slag pit.

An estimate of the diameter of the furnace based on the curved pieces of burned clay indicates that the shaft might have been approximately 0.8 meter in diameter. There is considerable uncertainty related to this estimate since it is based on a fragment measuring only 11 cm by 16 cm. In any case, this estimate falls well within the estimated size of Early Iron Age furnaces in North Trøndelag which seem to have had a diameter varying between 0.7 m – 1.2 m (Farbregd, Gustavson and Stenvik 1985:108, 111, 2002:39- 40, 45). The pieces of shaft material recovered at Flakstadvåg are too small for formulating a more accurate estimate of the diameter or to determine how high the shaft might have been, and none of the burned clay fragments have any markings or impressions of air inlets or of tuyeres being used. In Trøndelag, the Roman Period furnaces seem to have been between 1.2 to 1.5 m high (Stenvik 1997:253). It is possible that the North Trøndelag furnaces had been based on the use of natural draft and not the use of a bellows (Stenvik 2003 a:125), but it is uncertain as to whether this was also the case at Flakstadvåg.

Except for perhaps some local variations, the morphology of the recovered shaft fragments indicate that the furnace at Flakstadvåg had been quite similar to the ones found in North Trøndelag. Local adaptations notwithstanding, this type of furnace is part of a European shaft furnace tradition (Stenvik 2003 a:124) also found in North Trøndelag and Southeast Norway during the Early Iron Age (Larsen 2004:141).

Some of the largest pieces of slag have impressions of wood. The technique for firing the furnace with wood seems to have been common in both North Trøndelag and Southeast Norway during the Early Iron Age (Larsen 2004:141; Stenvik 2003 a:124). The use of wood instead of charcoal for firing a furnace is supported by the fact that no charcoal kiln has been found close to the site or anywhere in the valley where the site is located.

Figure 23 - Fragment of a shaft furnace (Photo: Jorun Marie Rødli, Tromsø University Museum)

Due to the lack of information about an inner structure, it is not possible to determine the exact size of the slag pit. However, based on the current size and the assumption that the slag pit was cylindrical, the diameter of the lower part of the structure indicates a top diameter of approximately 0.8 m to 1 m. Several of the pieces of melted slag had cooled and hardened against a flat surface, thereby indicating that raised flagstones had lined the slag pit which could explain why the soil did not show any signs of being exposed to the great heat of the furnace. The flagstones had been removed because of being replaced or for some sort of secondary use, and no flagstones were found during the excavation except for one in the bottom of the pit. However, it had no sign of having been heated and its findspot was probably secondary.

This constructional feature is seen in many furnaces in North Trøndelag which have a slag pit lined with a dry stone wall so as to better prevent the pit from collapsing during the smelting. The wall in the lower part of these pits was lined with raised flagstones, while the upper part was made of smaller stones (Farbregd, Gustavson and Stenvik 1985:109; Stenvik 2002:39-40, 45), which could have also been the case at Flakstadvåg (Figure 24) .

The furnace had been placed close to the edge of a slope, which made it possible to empty the slag pit without tearing down the shaft. The massiv slag block had to be broken in pieces during this process and the large pieces of slag found during the excavation indicate that this was the “modus operandi”. After closing the slag pit and doing some necessary repairs on the pit and the shaft, the furnace could be used one or several times more.

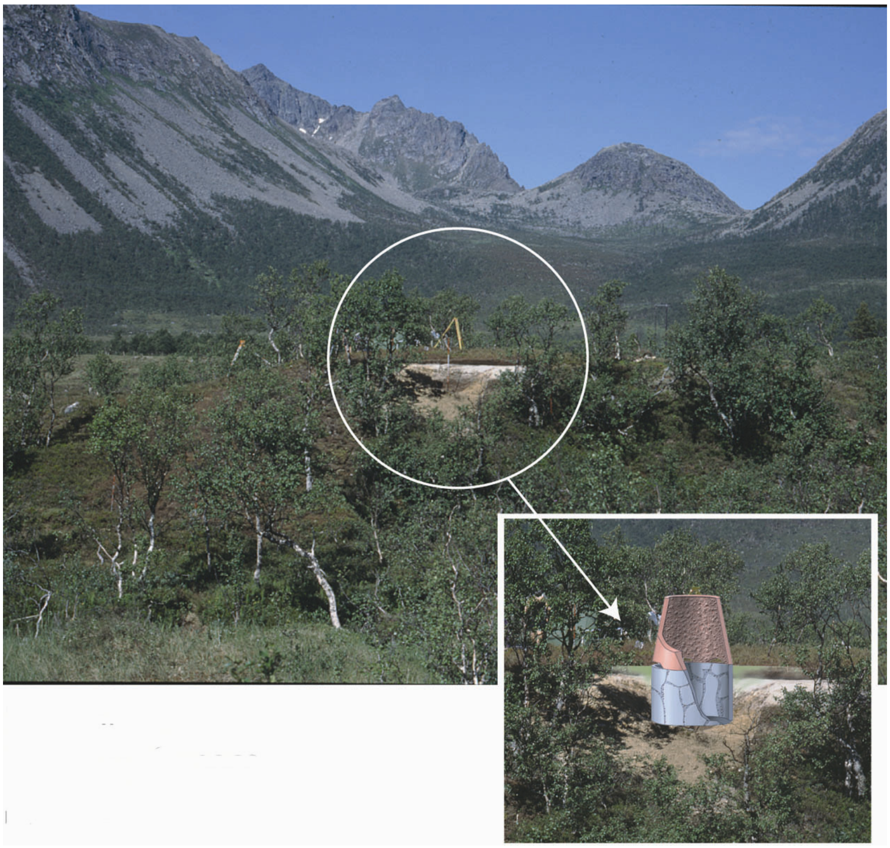

Figure 24 - Reconstruction of a bloomery furnace (Photo: Roger Jørgensen, Graphics: Ernst Høgtun, Tromsø University Museum)

At Flakstadvåg, we see that not only has the slag pit been emptied, but the flagstones that lined the pit have also been removed. This indicates that the furnace was planned to be used at least once more, and that the removal of the flagstones lining the pit may have been part of the process of preparing the furnace for yet another smelting. Natural stone does not resist very well the high temperatures that are required for a smelting, and the flagstones would probably not have withstood many smeltings. Contrary to the emptying of the slag, it is doubtful whether the stone lining of the slag pit could be replaced without destroying the shaft.

Due to the chemical structure of bog iron ore, it has to be roasted before being used in a furnace and this was often done in an open fire, with the result being that charcoal was spread all over the site. At Flakstadvåg, a very thin layer of charcoal was found in the immediate surroundings of the depression, but the amount was surprisingly low. The roasting place could, however, have been placed some distance away from the smelting site which would have thus reduced the contamination of charcoal and ashes. Another possibility is, as earlier discussed, that the bog iron ore may have been roasted inside the furnace before the smelting took place (Espelund and Johannessen 2005:162, 164) which would have reduced the spread of charcoal and ashes in the area.

It is, however, a puzzle as to why the iron production at Flakstadvåg was so limited and why it was terminated. Even though some of the slag had disappeared into the stream and some is buried in the sand due to erosion, the amount of slag indicates that there was probably no more than one or two smeltings. In North Trøndelag, in situ slag found in slag pits after the last smelting vary between 50 to 155 kg (Stenvik 2002:37, 39), while the 117 kg of slag found at Flakstadvåg indicates that one or two smeltings were carried out. Some of the shaft fragments are roughly 2 cm thick and the heat has melted the clay almost to the surface which could be a sign of prolonged use indicating several smelting, but it could also have occurred because of a very thin clay wall. Thus, one or two smeltings could have caused the transformation of the shaft fragments as seen at Flakstadvåg. But why was the production terminated when the resources were apparently so abundant? Could the smelting have been a failure due to technical problems, problems with the raw material, or could this practice have been ended due to changes or sanctions in the society in which the smelting took place?

The bog ore and slag analyses carried out by the metallurgist, Professor Emeritus Arne Espelund at the Norwegian University of Science and Technology, are unambiguous regarding the production and the raw material.

	FeO	Fe_2O_3	MnO	SiO2	Al2O3	P2O5	CaO	MgO	BaO	TiO2	K2O	Sum	R
Ore		95.44	0.03	1.59	1.49	0.039	0.07	0.11	<0.01	<0.01	0.04	98.81	45.0
Slag	65.24		0.44	25.24	5.36	0.098	0.92	0.41	0.01	0.14	0.96	99.04	2.17
S/O			14.7	15.87	3.60		13.14	3.73					

Table 6 - Analyses of slag and iron ore from Flakstadvåg (Espelund 2005)

The iron ore found at Flakstadvåg is of very good quality, and the slag indicates a successful smelting:

> *Two requirements have to be fulfilled to obtain such slag: 1) the level of carbon has to be under control and 2) the furnace must be of a sufficient temperature for the slag to become liquid and flow into the slag pit"* (author's translation) (Espelund 2005).

One way to evaluate the degree of success is to estimate how much iron may have been produced for each kilogram of slag. According to Espelund's analyses (2004:31), the iron-slag ratio may on average be close to 1:1, which is a far better result than what most researchers in this field used to think possible. Numerous factors such as technology, the blacksmith's skill and the iron ore's chemical composition affect the return during the production process, and earlier estimates of the iron – slag ratio have often varied between 1:2 and 1:3 (Espelund 1995:28; Furingsten 1981:139; Hagfeldt 1973:133; Haavaldsen 1997:76; Magnusson 1986:272; Rosenqvist 1988:173). The iron ore found at Flakstadvåg is indeed very pure:

> *The iron ore containing only 1.59% SiO_2 may be too pure – one could speculate whether using this ore alone might produce sufficient slag to control the carbon level in the iron produced. Should sand possibly be added during the smelting?* (author's translation) (Espelund 2005).

According to Espelund, the iron-slag ratio at Flakstadvåg was as high as 1:1, which is likely to have been considered a success by the iron producers.

Why then did iron production end? According to my survey, there was no shortage of bog ore, and firewood which is another raw material vital to the production of iron, are abundant today. According to a pollen diagram from a bog not far away from Flakstadvåg, this was also the case during the Roman Period (Vorren 1979:15). Most ^{14}C dates of the Early Iron Age furnaces in North Trøndelag have been based on pine (Farbregd, Gustavson and Stenvik 1985; Stenvik 2002), and an analysis of the charcoal found in the furnaces indicates that pine was the preferred type of wood. This also seems to have been the case in Southeast Norway (Larsen 2004:155), and birch and other types of deciduous trees seem only to have been used as supplements (Stenvik 1990:210-211). According to Evenstad (1790:422), dry pine was preferred when making charcoal for Post Medieval iron production, and it is possible that this wood was also preferred in the Early Iron Age when furnaces were fired with wood since pine seems to have been abundant according to the pollen diagram from Hofsøy (Vorren 1979:25). The charcoal samples dating the furnace at Flakstadvåg consist of pine which indicates that this was the preferred type of wood here as well. A comprehensive iron production will ultimately lead to deforestation, at least in the immediate surroundings of the production site. Nevertheless, it is not likely that the seemingly limited iron production at Flakstadvåg would have caused extensive deforestation. However, wood would have also been important for heating and cooking purposes in contemporary settlements, and when the forest is cut down, sheep, goat and cattle efficiently prevent it from regrowing. It nevertheless remains an open question whether the availability of firewood was a factor impacting on the termination of the iron production.

Another possibility is that the production came to an end due to social changes, as those who mastered the technique may have moved or died or the entire community might have undergone changes that somehow caused production to be terminated. Negative sanctions and increased import may have had a negative impact on the will to invest time and labor in local production.

4.3 Medieval Iron Production at Rognlivatnet

The Middle Ages did not bring about any significant change in production technique, though such a change took place earlier in the Late Iron Age, resulting overall in smaller furnaces and the use of charcoal as the dominant fuel for heating the furnaces.

The production site at Rognlivatnet is dated to the Early Medieval Period, and even though the site has not been excavated, there are other finds that may yield information as it pertains to production technology.

4.3.1 Raw Materials

There are several bogs in the area surrounding Rognlivatnet, and a few hundred meters to the west of the iron production site is a rather wet bog. No systematic search for iron ore has ever been undertaken there and no bog iron ore are known. However, the water seems highly ferrous according to the ocher-colored stones in a small stream that crosses the bog. By itself, a visual inspection cannot reveal information about whether there is any iron ore there or not. Even though we do not know if the production was based on iron ore from a nearby bog, this most probably was the case. The iron producers were likely to minimize the labor needed to carry out a smelt and established the production site as close as possible to the resources. However, iron ore, wood/charcoal and building material for the furnace may not have been found at the same place. If this was the case, the needed raw material had to be transported to the production site. Ethnographic examples from Africa (Haaland 2004:6), document the fact that iron ore has been transported as far as 35 km to the production place. It is also possible that rights to exploit natural resources were a factor when deciding where to construct an iron production site. According to a legislative decree in 1358 ordered by King Håkon VI, everyone in Østerdalen in Southeast Norway had the right to extract iron on common land according to tradition and common practice (Brøgger 1925:147). This right is still seen in today's legislation which gives anybody the right to mine and extract ore in outland areas, even when on private land.

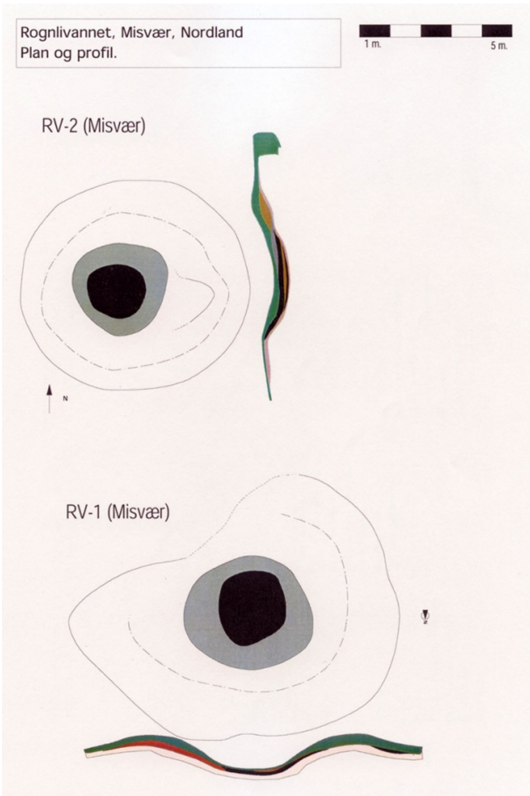

Figure 25 - Charcoal pits at Rognlivatnet (Johansen 2000: Appendix)

The site is located in a birch forest covering a large hilly area of several square kilometers, and this was possibly also the case in the 13th century. The birch forest provided firewood for both roasting the ore and heating the furnace, and two large charcoal kilns were found close to the site. Charcoal Pit I is located 27 meters southwest of the site, while the other (Charcoal Pit II) is 57 meters southeast of the site, and the charcoal pits are among the largest ever found in North Norway. The largest pit has an estimated production volume of 12.2 m^3, while the smaller would have produced charcoal equivalent to 6.3 m^3 (Figure 25) (Johansen 2000:64), and these two charcoal pits have a combined production potential of 18.5 m^3. There are several smaller charcoal pits further away from the iron extraction site that would have been less likely to be related to the production process, and the charcoal from these pits may have been used for other purposes such as forging.

None of the surveys in the area have revealed any clay deposits which may have been used for the construction and maintenance of the furnace and there has been no probing or test pitting, though there may be subsoil clay deposits close to the site that cannot be seen. Access to water would not have been a problem since a small stream flows by only 15 m east of the site.

4.3.2 Technology

Several detailed surveys of the production site have not revealed what type of furnace was used. The evidence includes no more than three small piles of slag, roasted ore, charcoal and sand in addition to a structure that could be the remnants of a house or drainage ditch, and there are no depressions or any construction to indicate the placing of the furnace. Thus, nothing conclusive can be said about the furnace and production technology, but the two charcoal kilns close to the melting site indicate that the furnace was fired with charcoal, and heating a furnace with charcoal allows for a smaller structure than using more voluminous pieces of wood. The furnace could have been a relatively small structure now hidden underneath one of the three small piles of slag, ore and charcoal, while another possibility is that the furnace was placed on top of the ground without any slag pit underneath, meaning that the slag had been tapped out of the furnace at ground level. However, the small amount of slag visible on the ground weighs heavily against such a construction, so with this small amount of slag in mind it is more likely that the furnace was raised above a slag pit. When the smelting was completed the shaft was either destroyed or moved and the slag stayed in the pit which was never emptied, and after a few hundred years, this would have hardly left a noticeable depression in the ground. Such furnaces have been found at several locations in southern Norway (Block-Nakkerud and Schaller 1979; Haavaldsen 1997:73; Larsen 2003 a:177-179; Narmo 1997:117). Such a production method leaves little surface slag and makes the furnace hard to find without stripping off the topsoil and only the removal of the turf may reveal what type of furnace was in use, how comprehensive the production was and other structures that may have been related to the production.

The site at Rognlivatnet could easily have been mistaken for a smithy. There are relatively small amounts of slag and charcoal and no visible remnants of a furnace. The amount of slag is not significant as a factor in determining whether a site had been the location for iron extraction or smithing. At Rødsmoen in Southeast Norway a total of 650 kg of slag was found in and around a smithy (Narmo 1997: 157). However, the size of some of the pieces of slag and especially the discovery of roasted iron ore at the site demonstrate that this was an iron production site and not a smithy. Additionally, the large amount of charcoal produced in the two pits closest to the melting site does not seem to be in accordance with smithing only since the need for charcoal in a smithy at a single farm is probably insignificant compared with what was needed for production. Half a cubic meter of charcoal is estimated to be equivalent to several years of charcoal consumption in a smithy (Narmo 1997:171). The combined production of 18.5 m^3 in the two charcoal kilns seems to be more than what was needed to produce the relatively small amounts of slag visible at the site. According to estimates based on Evenstad's (1790) production in the medieval and post-medieval period, between 29.5 and 59 liters of charcoal were needed to produce one kilo of iron (Narmo 1996:146).

Based on Espelund's analyses (2004:30), the iron – slag ratio could be as high as 1.7 kg iron per kg slag, which is much higher than the previous estimates of the iron – slag ratio which have been at 1:2 or 1:3 (see chapter 4.2.2). The combined production potential of the two charcoal kilns if used only once was 18.5 m^3 which corresponds to 18500 liter of charcoal. Based on Espelund's (2004:30) estimates of the iron – slag ratio and Evenstad's minimum requirement for charcoal, this may have produced 627 kg of iron and 369 kg of slag. In order to purify the bloom, it had to be reheated and hammered, a process estimated to require as much charcoal as was necessary to produce the bloom in the first place. If this process was based on charcoal from the two kilns used in the production of iron, i.e. the reduction of iron ore would have to be reduced by 50%, and only 313.5 kg of iron (bloom) and 184.5 kg of slag would have been produced at the site. It has been assumed that blooms in general were heavily "polluted" with slag, and that their weight during the post-production purifying process of reheating and hammering would have been reduced by 50% (Narmo 1997:131) to 80 % (Stenvik 202:50), which is equivalent to 156.8 kg and 62.7 kg iron. If these calculations were to be based on Evenstad's maximum use of charcoal, i.e. 59 liters of charcoal per kg of iron, we find that production would have been halved, as only 157 kg of iron and 93 kilo of slag would have been produced. A chemical analysis of blooms indicates that this has not been the case as the directly produced forgeable iron seems to have been very heterogeneous with unspecified amounts of slag (Dannevig Hauge 1946:201-203). Due to the lack of excavations, the composition of the slag mounds and roasted ore are unknown, thereby making it difficult to create an accurate estimate as far as the amount of slag at the site. However, if most of the visible mounds are slag, it is possible that they are all from one smelting.

It is possible that the charcoal produced in the two kilns was not exclusively for the production of iron as some of it may, like charcoal from the more distant charcoal pits at the mouth of Rognlivatnet, have been used in smithies at nearby farms.

Analyses of the roasted iron ore found at the site indicate a very high yield and consequently a successful production (Espelund 2004:30). Provided these calculations are correct and the smelting gave such a high yield, one might wonder why we do not find large amounts of slag from a comprehensive production. The site has not yet been excavated so we do not know how many smeltings were completed, but based on the amounts of visible slag the production was quite limited. However, the amount of surface slag is not a reliable indicator in relation to the scope of production as the furnace(s) may have had sub-ground level slag pits which were never emptied. In such cases, most of the slag will still be buried and not visible unless an excavation is conducted.

The reason for terminating the iron production could be explained by a shortage of raw materials or changes in the social environment in which the production took place. The supply of bog iron ore is an unknown factor because the deposit(s) has yet to be found. Bog iron ore often occurs in one or more minor areas in and around bogs, and the supply could be exhausted after one or only a few smeltings.

In most furnaces from this period, clay was a major building material, but the supply of clay at Rognlivatnet is an unknown factor, and easy access to firewood would also have been vital. Located roughly 400 m above and 3 km away from cultivated land and the rural settlement, the supply of wood for making charcoal would most likely have been plentiful.

Rognlivatnet is an important site since it is one of only three documented iron production sites in North Norway. Information about the furnace and technology are largely nonexistent, although two nearby charcoal kilns support the assumption that the furnace(s) was fired by charcoal. The site is located in the hills and is well away from the contemporary settlements, but should most likely be seen as related to the contemporary Early Medieval settlements in the Misvær valley.

4.4 Technological Variations

There are great variations in technological solutions when it comes to producing iron. The size and shape of the furnaces varies greatly as do the constructional details securing a sufficient draft, the means of heating the furnace as well as the location of the production site itself. These are all comprehensive problems which, when properly addressed, could easily fill a thesis. This is not the place for a full discussion on all the technological aspects surrounding prehistoric iron production, though I will briefly discuss a few technical aspects related to the three sites in question and how these relates to contemporary technology in other regions.

4.4.1 Construction

There is an immense variety of constructional elements in both prehistoric and medieval furnaces for producing iron (Pleiner 2000:273), and Martens (1978 a, b) has worked out a classification system which seems to be relevant for those found in southern Norway. The furnaces excavated in North Norway have all been shaft furnaces built in or above a pit, and the furnaces at Hemmestad were built in a pit, while the shaft at Flakstadvåg seems to have been raised on top of the ground above the slag pit. Fragments of the shafts found at both sites indicate that these have been entirely constructed of clay without any means of fortification. The site at Rognlivatnet has not been excavated, and constructional details regarding the furnace(s) are therefore not available.

4.4.2 Wood - Charcoal

The width and height of the shaft are essential elements to consider when evaluating the function of a furnace and the technology upon which it was based. Imprints of wood on slag show that wood was used in the relatively large Early Iron Age furnaces in both Trøndelag and Southeast Norway (Larsen 2004:141; Stenvik 1997:253). The great number of charcoal kilns are dated back to the Early Viking Period which is about the same time that smaller furnaces came into the archaeological record (Larsen 2004:154, 158), thus indicating a transition from the use of wood to charcoal. The use of charcoal continued throughout the Middle Ages, and this development can be seen at iron production sites in both Southeast Norway and Trøndelag. It seems more than likely that the diminished furnace size in the Late Iron and Middle Ages is related to this transition from wood to charcoal since the use of charcoal to fire a furnace makes it possible to build smaller furnaces with narrower shafts. Even so, this development from wood to charcoal is not without exceptions as some charcoal pits are dated to the Early Iron Age. Also, the small furnaces at Hemmestad was probably fired with quite modest amounts of charcoal. A small charcoal kiln that is contemporary to the furnaces was examined during the excavation, and another was reported to be found when the site was cultivated for the first time. Even though it is possible that the furnaces were fired by small pieces of wood, it seems most likely that charcoal was the primary heating material.

Slag at the Roman Period sites in North Trøndelag have imprints of wood which has led to the conclusion that the furnaces had been heated with wood. Some of the large chunks of slag found at Flakstadvåg also had imprints of wood and it is likely that wood and not charcoal was used as heating material.

At Rognlivatnet, there are two very large charcoal kilns dated to the same period as the slag heap and roasted iron ore. It is probable that the furnace(s) were fired with charcoal, which was also the preferred heating material in contemporary furnaces in southern Norway.

4.4.3 Bellows or Natural Airflow

The supply of oxygen is crucial for creating sufficient heat to produce slag. Whether this could be achieved by natural draft alone or if a bellows had to be applied to the process was mainly dependent on the construction of the furnace. It is documented through archaeological finds, ethnographic studies and experimental archaeology that, depending on their construction, furnaces could be fired and heated both with and without the use of a bellows. The size and number of air inlets, in addition to the width and height of the shaft are vital constructional elements when considering whether an air supply could have been secured by natural draft or if a bellows had to be applied to the process. In addition, there are factors such as humidity in the iron ore and heating material to be considered, although these are factors beyond the control of archaeologists.

Ethnographic examples from western Tanzania document that the Fipa people, who practiced traditional iron smelting up until 50 years ago, had several types of furnaces. One was a natural draft furnace that was 3 m high and 2.5 m in diameter at the base, and they also had a smaller furnace, only 50 cm wide and less than one meter high, operated with a bellows (Haaland 2004:6-8). It has been documented that Late Iron Age and medieval furnaces at Dokkfløy in Oppland County had an inner diameter between 0.3 – 0.5 m and a height of at least 0.7 m (Larsen 2004:141), and was operated by use of a bellows. It is believed that the Early Iron Age furnaces in North Trøndelag were based on natural draft (Stenvik 2003 a:125).

No finds at Hemmestad yielded any clues as to whether a bellows had been used or not. The Danish Skovmark furnace (Figure 27), which seems to have many constructional features in common with the furnaces at Hemmestad (Andersen, Kaul and Voss 1987:177, 179; Voss 2002), depended on a bellows to secure a sufficient amount of airflow. This was also the case with the smaller of the Early Iron Age furnaces in southern Norway (Stenvik 1997: 253, 2003 b:78). The existing data do not allow for categorical statements regarding the use of a bellows at Hemmestad, but is doubtful whether it would have been possible to maintain natural airflow sufficient for smelting slag during the entire production phase. The narrow shafts indicate that bellows were used in the production process at Hemmestad which is supported by the lost forge-stone.

The Flakstadvåg furnace seems to be of the same type as the Roman Period furnaces in North Trøndelag, and dates, location and what little is known about the construction seem to correspond very well. The furnaces in North Trøndelag seem to have been based on natural draft which was also probably the case at Flakstadvåg; however, there were no finds of tuyeres and the shaft fragments had no indication of air inlets.

The use of a bellows seems to have been the norm during the Middle Ages in Trøndelag and southern Norway, and even though we do not have any specific information about the furnace at Rognlivatnet it must be assumed that this also was the case here.

4.4.4 Production Technology, Iron Ore and Slag

The production technology supposedly applied at Flakstadvåg and Rognlivatnet is well known from other sites in the south and will not be given further attention at this time. Still, there are some features related to the production at Hemmestad that must be commented upon.

The difference in slag appearance can be explained by differences in production technology and the furnaces being used. The furnaces at Flakstadvåg and in North Trøndelag are very different from the ones found at Hemmestad, as is the slag. When directing such a focus on the atypical slag at Hemmestad, it is important to take into account that the small lumps of slag were mainly found in two heaps in front of the two furnaces, and during the excavation, larger pieces of production slag were found scattered all over the field.

The two-stage production process that Espelund suggests took place at a site in Sunnmøre (Espelund and Johannessen 2005:160) and at Hemmestad (Espelund 2005:2) has been ethnographically documented in Africa. The Fipa people in western Tanzania applied a two-stage process in which the ore is crudely smelted in a tall, natural draft shaft furnace while the slag is separated from the iron in a much smaller shaft furnace (Haaland 2004:8). Whether the product of this first stage had any morphological characteristics similar to the small pieces of slag found at Hemmestad is not known. However, a similar type of slag has been found deposited in front of the Danish Skovmark furnace (Voss 2002: 140, fig 2), which is technologically very similar to the furnaces at Hemmestad, and similar slag has also been found deposited at iron production sites in northern Finland.

In the period from 1989-1991, Hannu Kotivuori (pers. comm., September 2003) excavated two iron production sites close to the city of Rovaniemi. At each of the sites in Kotijänkä and Riitakanranta, he uncovered a so-called stone box furnace or slabstone furnace dug slightly into the ground (Figure 3) and something similar to a circular shaft furnace placed one meter to the side on top of the ground. The stone box furnace is a low rectangular structure, which in one instance at least, had been covered with a stone slab, and two vertically raised flagstones define an opening of the stone box towards the slag pit. At Riitakanranta, a round, flat stone approximately 30 cm in diameter was found in the bottom of what looked like a shaft furnace. In front of each stone box was a slag heap with small pieces of slag very much like those found in front of the two furnaces at Hemmestad. In addition, the horizontally placed flagstone under the "shaft furnace", as well as the two vertically raised stones marking the opening of the furnaces, are features that resemble the furnaces at Hemmestad. The stone box furnace is a small structure with a volume close to 30 liters. It is found in several places in Finland and Karelen, and seems to be of eastern origin (Lavento 1999:76). Kotijänkä, the younger of the two sites, is dated to the Roman and Migration Periods, while Riitakanranta is somewhat older and dates to the late Pre-Roman and Early Roman Periods (Kotivuori 1996:410). The dating of an iron production site in northern Finland to the Pre-Roman Iron Age is no isolated case. The sites Neitilä 4, which is east of Rovaniemi and Äkälänniemi, a bit further south, are both dated to the Pre-Roman Iron Age (Kehusmaa 1972:80-88; Mäkivuoti 1987:61, 70; Schulz 1986:172).

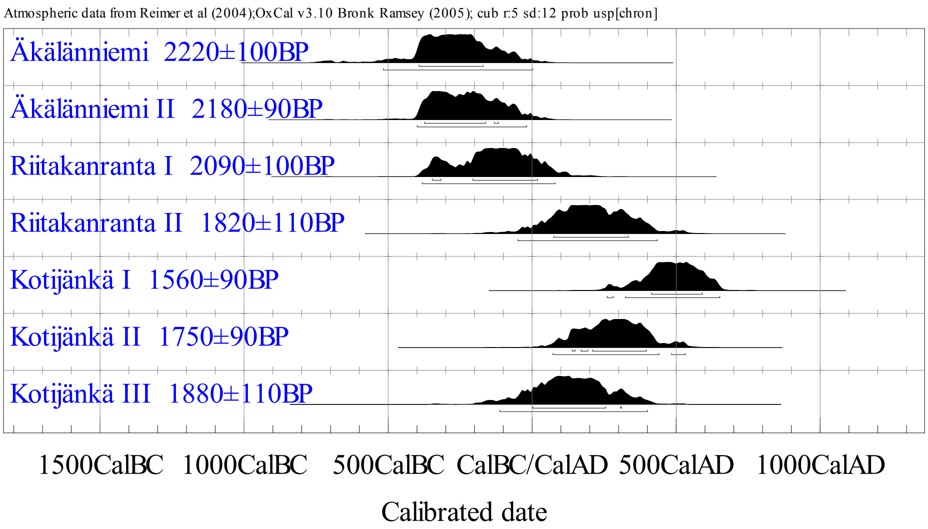

Figure 26 - ^{14}C dates from iron production sites in northern Finland (Kotivuori 1996:410; Lavento 1999:80) (Calibrations according to Bronk Ramsey 2001 and OxCal v. 3.10, 2005)

Site	Lab. ref.	^{14}C year BP	One sigma		Two sigma	
Äkälänniemi I	Hel-2098	2220+100	BC 393	BC 170	BC 516	AD 2
Äkälänniemi II	Hel-2101	2180+90	BC 373	BC 117	BC 400	BC 19
Riitakanranta I	Hel-2955	2090+100	BC 347	AD 19	BC 382	AD 80
Riitakanranta II	Hel-2956	1820+110	AD 75	AD 335	BC 50	AD 435
Kotijänkä I	Tku-034	1560+90	AD 415	AD 592	AD 260	AD 652
Kotijänkä II	Tku-035	1750+90	AD 140	AD 397	AD 72	AD 532
Kotijänkä III	Hel-3173	1880+110	AD 2	AD 311	BC 113	AD 401

Table 7 - ^{14}C dates from iron production sites in North Finland (Kotivuori 1996:410; Lavento 1999:80) (Calibrations according to Bronk Ramsey 2001 and OxCal v. 3.10, 2005)

I have no information about the chemical profile of slag from the north Finnish sites and such a comparison with slag from Hemmestad cannot be done here. Neither do I know whether Finnish archaeologists have considered the possibility that the purpose of some of the structures may have been roasting rather than smelting, and that the slag found in front of the stone box furnaces is roasted iron ore and not slag. At this current moment, I assume that the stone box furnaces were built for the purpose of iron extraction and that the assemblage of small pieces of “slag” in front of the furnaces was a product of this activity, as any other conclusion would be pure speculation.

When looking into the social context of the Hemmestad site, it is very interesting to note that distinct features related to the construction of the furnaces and the appearance of the slag are to be found in both southern Scandinavia and northern Finland. Similarities with production sites in both the east and the south open up multiple possibilities when looking for the inspiration and origin of the technology applied by the blacksmiths at Hemmestad.

4.5 The Source of Inspiration

When looking into which technological traditions the three ironworks might have been influenced by, the basis for such an evaluation is very different. Two sites have been excavated and even though the amount and quality of data is far better from those sites than the one that not has been excavated, this does not necessarily make such an evaluation any easier.

The site at Rognlivatnet has not been excavated, and we have no information about the furnace and scope of the production and this medieval iron production site has no known parallels in the north or east. Medieval iron production sites in Trøndelag have quite small furnaces which were fired with charcoal, and two large charcoal kilns close to the iron production site at Rognlivatnet indicate that this furnace was fired with charcoal as well. A lack of contemporary iron production sites in the north and east strongly indicate that Rognlivatnet is part of the same tradition of producing iron as found in Trøndelag and South Norway.

The location and micro milieu of the Roman Period site at Flakstadvåg very much resembles contemporary iron production sites in North Trøndelag. In addition, the size and placement of the furnace as well as the size and morphological structure of the slag indicate that this is a site based on the same technological tradition as those in North Trøndelag. There are also recorded Roman Period iron production sites in northern Finland, but the furnaces are very different and thus seem to belong to a different technological tradition.

Hemmestad is the site from which we have accumulated the most data, and the site was probably operated in the early part of the Pre-Roman Iron Age, a time from which we have fewer comparable sites. However, Pre-Roman sites with slightly younger dates are documented in northern Finland, northern Sweden and southern Scandinavia and the question is whether the site at Hemmestad can be linked to any of these technological traditions. Before taking a stand on this question, it will be necessary to look into both similarities and differences.

The sunken shaft furnace without slag tapping which is found at Hemmestad was commonly found on the Continent and the British Isles during the iron production period BC (Serning 1979:73), which also seems to be the case at contemporary sites in Norway and Sweden. Such constructional features place the Hemmestad furnaces in a European shaft furnace tradition, though the furnaces at Hemmestad differ from the oldest shaft furnaces found in Trøndelag which is the nearest production place to the south. The furnaces are different in size, as is the micro milieu in which they were situated. Also, the Roman Period Trøndelag furnaces were fired with wood, while charcoal is most likely to have been used at Hemmestad.

However, sunken furnaces with narrow shafts are found in both southern Norway (Block-Nakkerud and Schaller 1979; Haavaldsen 1997; Larsen 2003 a, 2003 b, 2004) in southern Sweden (Serning 1979) and in Denmark (Andersen et al. 1987; Voss 2002). Moreover, the tradition of placing a sunken furnace in a clay-filled pit bordered with raised flagstones is documented in southern Sweden (Serning 1979:73) and Denmark (Andersen et al. 1987:176; Voss 2002:139-140).

4.5.1 Norwegian Furnaces

Small-sized furnaces in southern Norway (Martens 1992:59; Rolfsen 1992:82) have been found placed either directly on the soil in a pit, on a base made of small stones and clay, or within a framework of raised flagstones (Larsen 2004:156), while slag pits measuring 0.4 – 0.5 m in diameter have been found in Agder and Rogaland (Block-Nakkerud and Schaller 1979; Haavaldsen 1997; Larsen 2003 a, 2003 b a, 2004). These furnaces are believed to be similar to the ones found in continental Europe where the pit has been used only once and the shaft possibly reused, by moving it to another, empty pit. Nonetheless, despite the physical resemblance between the furnaces of Eg in Agder and Rogaland, there are also differences. Larsen (2003:180) claim that the furnaces at Eg are of the same type as five iron production sites found in Rogaland (Håvodl, Tagholt, Skeie, Grødheim and Utsira), while

Haavaldsen (email 07.11.2006 and 14.11.2006) disagrees, claiming that only the furnace at Håvodl is similar to and based on the same technology as the Eg furnaces. In any case, Haavaldsen (email 7.11.2006), Block-Nakkerud and Schaller (1979:15), who excavated the Eg site, claim that the furnaces at Eg and Tagholt are similar to some of the Danish sites. If they all are right to some degree, this implies that there are also some similarities between the Tagholt and Eg furnaces. At the present moment, it is not possible to sort this out but it remains a fact that furnaces in Agder (the Eg furnaces), Rogaland (Tagholt, Håvodl and possibly some of the ones mentioned above) and Hemmestad resemble each other in terms of size, i.e. diameter, and that they are all shaft furnaces without slag tapping.

There are, however, vital constructional differences, as neither the Eg furnaces nor the ones in Rogaland have been placed in a clay-filled pit or have the same opening at the base as the Hemmestad furnaces. One of the ^{14}C dates from Tagholt is contemporary with the Hemmestad furnaces, while the Håvodl furnace is dated to the Early Migration Period (Haavaldsen 1997:74-75), and the Eg furnaces are dated to the Late Roman Period (Bock-Nakkerud and Schaller 1979:8). Except for the one dating from Tagholt, there are no furnaces as old as the furnaces at Hemmestad, and the size of the furnaces at Hemmestad is comparable with the furnaces at Eg in Vest-Agder and some in Rogaland, although there are technological differences. While the Eg furnaces and some of the Rogaland furnaces seem to have had a shaft placed above an underground slag pit, the furnaces at Hemmestad were typically built like a sunken shaft furnace, placed in a pit, stabilized and isolated by layers of clay.

4.5.2 Swedish Furnaces

In southern Sweden, i.e. in Närke, Hardemo Municipality in Svealand and in Essunga Municipality, Västra Götaland, Pre-Roman Iron Age furnaces have been found that bear a striking resemblance to the ones at Hemmestad. Iron production sites dated to the period 200 BC to BC/AD are typically described to be circular to oval sunken furnaces, with a low shaft and a height less than 1.5 times the diameter of the hearth. The shaft was positioned in a pit without any provisions for the tapping of slag (Serning 1979:68-70). The construction of a different type of furnace though is highly interesting:

In some cases the bowl furnaces appear to have been surrounded by a rectangular border of substantial slabs placed on edge, the space between the walls of the furnace itself and the stone border being filled with clay. Slag tapping channels have not been discovered (Serning 1979:73).

However, these are described as "bowl furnaces" (Serning 1979:73) and not shaft furnaces such as the ones at Hemmestad.

In northern Sweden an iron production site was found and partly excavated in the fall of 2009 near Sangis in Kalix Municipality in Norbotten County (Norrbottens Museum, homepage). The excavation will not be completed before the summer of 2010, but the furnace seems to have been a shaft raised on top of a slag pit (e-mail from C. Bennerhag, 9. and 13. November 2009). The diameter of the slag pit seems to be small, and the furnace is dated to 300 – 200 BC (op. cit.). According to the present information, the furnace seems to belong to a southern Scandinavian/European shaft furnace tradition which is different from the furnaces in Finland.

4.5.3 Danish Furnaces

The oldest iron production furnace known in Denmark is the so-called Skovmark furnace which does not represent the earliest iron production phase (500-300 BC), as no furnace has been found dating to this period (Nørbach1998:59). The Skovmark furnace is found in both Sjælland and Jylland (Nørbach 1998:55, Figure 2) and was dominant in the period from 200 BC to AD 200, when it was replaced by the "slaggegrube-ovn" ("slag pit furnace", author's translation) (Voss 2002:139-141). The Skovmark furnace is further described by Voss (2002:140):

A pit with flat bottom is dug 40-45 cm deep, a diameter of approximately 100 cm and filled with clay. A cylindrical furnace, approximately 30 cm in diameter, is made in the middle of the pit. An opening in the furnace, approximately 25 cm wide, is fortified with one or two flagstones where it opens up towards a working pit (author's translation).

The pieces of slag found in the "working pit" at the bottom of these furnaces are quite small (between 40 – 50 g), while in exceptional cases, pieces are as big as 500 g. The height of the furnace is not known, but the reconstruction displays a shaft which reaches approximately one meter above the ground, and the bloom could be extracted through an opening in the front (Figure 27). The furnace could be used several times as the slag pit could be emptied through the opening made in the bottom of the pit, and this construction detail is also known from the Early Iron Age furnaces in North Trøndelag. At some Danish sites, plates of clay with a narrow 2 cm wide hole have been found (Andersen et al. 1987:179). Such a hole is far too narrow for natural draught; consequently, the furnaces have most likely been operated by the use of a bellows.

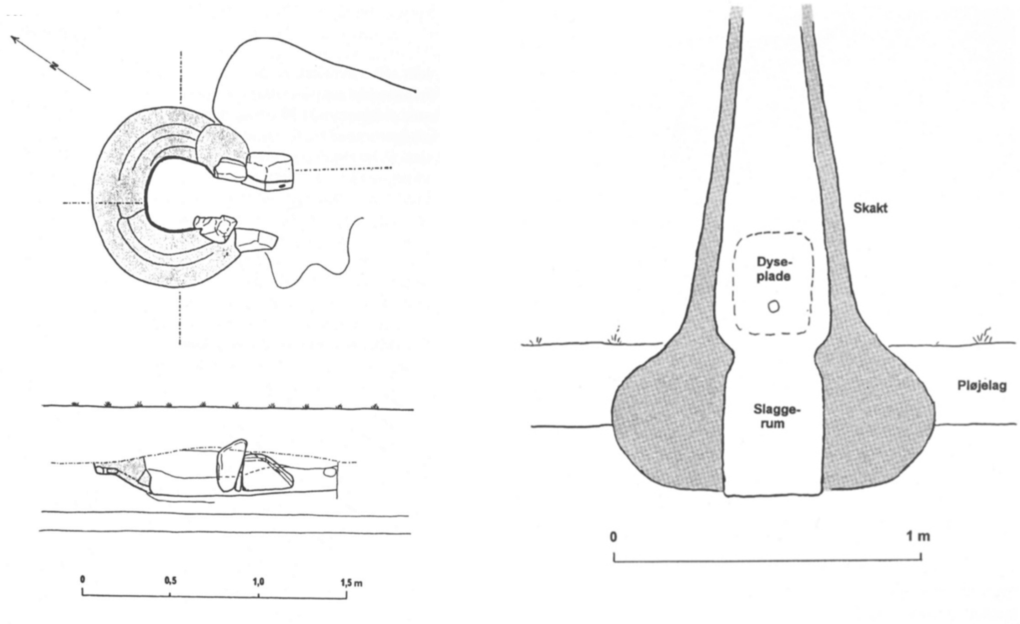

Figure 27 - The base of a Skovmark furnace and a reconstruction (Voss 2002:139, 141, Figures 1, 3)

In continental Europe and the British Isles, the low sunken shaft furnaces without slag tapping belong to the oldest type known in the Early Iron Age before BC/AD. The construction of the Skovmark furnace seems to be very close to the Hemmestad furnaces; placed in a clay-filled pit, the diameter of the furnace and the opening at the base of the furnace which is defined by raised flagstones and the small pieces of slag found in front of the furnace are all nearly identical. There is, however, a chronological problem in comparing these furnaces since the Skovmark furnace is dated to the period from 200 BC - AD 200 which is later than the furnaces at Hemmestad. Still, the constructional similarities between these furnaces strongly indicate that they are part of the same technological tradition of extracting iron from bog iron ore.

4.5.4 Summing Up

Small, Early Iron Age shaft furnaces with approximately the same diameter as the ones at Hemmestad are found several places in South Scandinavia. Building small furnaces for iron production therefore seems to have been a well established technological tradition during the Early Iron Age. It may, however, seem far-fetched to go all the way to Denmark to look for furnaces similar to the ones found at Hemmestad. The same construction details are found in furnaces at several iron extraction sites in South Scandinavia but the Skovmark furnace is the one which most resembles the Hemmestad furnaces. This indicate that not only the size but many of the constructional features in the Skovmark and Hemmestad furnaces were a common practice established in vast portions of southern Scandinavia in the centuries both before and after BC/AD. The fact that no contemporary, similar iron extraction site has been found in Trøndelag or elsewhere in Norway is, I believe, a consequence of today's research status rather than a reflection of a prehistoric reality.

The recently found furnace at Sangis in northern Sweden seems to be part of the same technological tradition as Hemmestad. Could east – west contacts have caused these similarities or were both influenced by the south?

5 THE SOCIAL CONTEXT OF ARCTIC IRON PRODUCTION

While the previous chapter dealt with technological aspects regarding iron production this will explore the social context in which this production took place. The socio-economic setting will be explored before discussing each location and the period it belonged to.

The Pre-Roman iron production will be the object of the most thorough discussion. The Hemmestad site is one of the oldest in Scandinavia, belonging to the initial phase of iron production. This period is the one least known when it comes to iron production and being located so far from any contemporary site makes it particularly interesting in regard to where the technology came from. Our insight in the social organization and settlement pattern during this period in North Norway is quite inadequate and a comprehensive discussion will be carried out in regard to the social milieu in which the production took place. The Roman Period iron production is well explored in Trøndelag and Southeast Norway and the social and settlement structure of iron production sites have been the subject of several studies. Being one of two excavated iron production sites in North Norway, the production site is well explored but without knowledge about the settlement of those who produced iron, it's social context is less known. The medieval iron production site is the one from which we have least information because it has not been excavated. The period falls outside the chronological framework but because it is one of only three iron production sites in North Norway, a short discussion about its social context will be carried out.

Over time, people have relied on a wide variety of resources in North Norway. Since the introduction of stock keeping and farming, this has played an increasingly important role in the subsistence economy of most coastal settlements north to the Tromsø area. In this geographical area, it is likely that some people mainly lived off farming and some from hunting and fishing, while most people probably practices a mixed economy. In North Troms and Finnmark, the subsistence economy during the Iron Age relied more exclusively on hunting and fishing as the northern climatic limit for ripening grain is in North Troms. However, pollen data indicate that Iron Age farming occstionally may have teken place in North Troms and Finnmark, but these were rather isolated cases and the continuous line of permanent Iron Age farming settlements does not extend north of the Lyngen Fjord (Johansen 1979; Johansen and

Vorren 1986:745; Sjøvold 1962, 1974). While agriculture thus was of little importance for the people of North Troms and Finnmark, stock keeping, on the other hand, may have been of some significance as a supplement to hunting and fishing. Reindeer herding may also have been of some importance, but it is uncertain as to exactly when the practice of keeping reindeer and reindeer herding began (Aronson 2001; Hansen and Olsen 2004; Sommerseth 2009; Storli 1994).

There has been some discussion about whether iron could have possibly been produced by hunter/gatherers (Bagøyen 1978:90; Baudou 1993; Hulthén 1991). There is no doubt that iron production was organized and carried out on farming settlements, although the location of some iron production sites indicate that this trade was also executed by people living outside the farming communities (Johansen 1973:98-99, 1983:127; Magnusson 1983:140).

5.1 Stock Keepers and Farmers or Hunters and Gatherers?

Some researchers have claimed that iron production was a very time consuming and labor intensive process that required technological knowledge and a social structure capable of organizing the great amount of work necessary (Bagøyen 1978:90; Johansen 1973:89):

> *What is characteristic of the process, regardless of the furnace type or any other variation, is the large amount of labor needed, the considerable technical expertise required, and the large amount of raw material needed ….* (Johansen 1973:93)

This is probably a fairly accurate description of, for example, iron production in North Trøndelag during the Roman Period. The large-scale, surplus production with several large furnaces in operation at the same time required a social system capable of organizing the large number of people needed to prepare and carry out the smelting (Stenvik 2003 a:124). The scope of production in North Trøndelag is reflected in the tons of slag and remains of the many furnaces which seem to have been working simultaneously or at least during the same production period. The preparation and implementation of such a smelting would surely have required a huge amount of manpower and a fairly advanced social organization. Nevertheless, the small-scale production that occurred in the north was of a quite different nature, which required neither the organization nor the same amount of manpower, it could easily be managed by a few persons.

> *In low-technical iron production the process itself does not require much labor, two men can manage easily. Thus no extensive social organization is needed.* (Magnusson 1983:142, 1984:124)

This seems to have been the case at all iron production sites in both North Norway and northern Finland, as they all demonstrate a small-scale production which did not require a lot of manpower, raw material or time. Carl von Linné (1907:64) exemplifies this in his description of an 18th century smelting in Sweden:

> *The bog ore is smelted in a manner used from time immemorial. There is a fairly small fire inside a pit like a walled-up cone, so it is not necessary for more than one woman to stand by the bellows, and while she treadles them she can go on knitting her stockings or doing something else.* (author's translation)

Apart from describing the work process, we see that iron production not exclusively was a male domain and it is thus possible that female participation in iron production rather was the norm than an exception from the rule. A few female graves with blacksmith's tools (Grieg 1920:81; Petersen 1951:74) may support this point of view.

The assumption that hunter/gatherers had neither the time nor the organization to perform such a task thus seems unlikely. The contrary is demonstrated by the hunt for wild reindeer, which took place at Gål'levarri in Tana Municipality (Vorren 1998:62-68). This is a system of 550 pitfalls covering a stretch of 7.3 km (op. cit.). The hunt would have involved a high number of people in both constructing and maintaining the hunting facilities as well as taking care of meat and hides. The amount of iron being produced at all three sites was no more than what could have been consumed locally, and the number of people involved in the production at each site was probably few and required no advanced social organization. At least 90 iron production sites in Jämtland in Sweden are dated to the period AD 300 – 600 (Magnusson 1989:14). All contemporary settlements in the area seem to have been used by hunter/gatherers, and there are no signs of farming (Magnusson 1983:140). There is, of course, the possibility that the iron production could have been carried out by expeditions from distant farming communities, though this argument seems far-fetched, as there is no reason why hunter/gatherers could not have organized and carried out these smeltings themselves.

The three northern Norwegian iron production sites are dated within a period of approximately 1700 years. People's way of life changed considerably during this very long period and it is probable that the economy at all three sites was partially based on stock keeping, farming, hunting and gathering. Even so, it is likely that farming and stock keeping played a more important part in the economy later rather than in the beginning of this period.

5.2 The Pre-Roman Iron Age

In north Norwegian archaeology, the Pre-Roman Iron Age has been seen as a transitional period with few finds or historical monuments to distinguish it from previous and later periods. This is by convention the first period of the Iron Age but there are few monuments and finds in North Norway that justify the use of the term or connect it with other periods of the Iron Age.

In recognizing the cultural differences between northern and southern Norway, both a new chronology and new terminology have been suggested. The entire period between the end of the Neolithic and BC/AD is regarded as one period and has been subsumed under the name "the Early Metal Age" or "the Early Metal Period" (Jørgensen 1986). The dissimilarity to the cultural developments in the south is not unique to North Norway. In all of northern Fennoscandia, the material culture and the cultural development during this period have been different from that of the south, leading to the adoption of a common chronologically based terminology first developed by Finnish archaeologists (Carpelan 1979:11).

Hunting and gathering was the predominant subsistence economy in North Troms and Finnmark as well as the interior of North Norway during this period, and contact towards the west and southwest seems weak compared to the cultural connection to the east and southeast (Bakka 1976; Hansen and Olsen 2004:72-73).

Up until recently, botanical data have been the only indications that the Iron Age farm was established during this period (Johansen 1979). No Iron Age long houses or graves dating to this period have been found until the last few years, when one or possibly two long houses have been excavated (Henriksen and Sommerseth 2009:26-

28; Hole 2008:26-27, 2009:17; Sommerseth, Arntzen and Henriksen 2009:48). The new archaeological finds and botanical data confirm that farms, at least in parts of North Norway, were established as early as the Pre-Roman Period.

5.2.1 Social Setting

At Hemmestad and several neighboring farms there are finds dating to the Iron Age, but none are as old as the iron production site. Our general knowledge about north Norwegian settlements dating to the Early Metal Period is fragmentary and incomplete at best, and we do not know what type of settlement was occupied by the metal producers around 500 BC. As the houses have not yet been discovered, we neither know whether they dwelt on or near the site. The two cooking pits and the two hearths are dated to the last millennium BC and the Roman Period, although only one of the cooking pits seems to be contemporary with iron production, as the other cooking pit is older while the two hearths are younger. This indicates that there were people living in the area both prior to, during and after the time of the iron production, but we have no data to suggest whether these people were farmers, hunter/gatherers or both.

At iron production sites in North Trøndelag, several furnaces seem to have been operated simultaneously, though probably in various stages of the production process. The two furnaces at Hemmestad were much smaller than the ones used in Trøndelag, and it is uncertain as to whether they were in use at the same time. The ^{14}C dates allow for such a possibility, but the deviations of the dates make it just as likely that the operational phases were years apart. In any case, circumstances related to the spatial organization and constructional features of the furnaces indicate that the two furnaces were built and operated by the same people, and a second furnace could have been built when the first had suffered irreparable damage because of strain due to smelting. Alternatively, production could have been a two-step process with pre-treatment of the iron ore in one furnace and the actual smelting taking place in the other (see chapter 4.1.2). Based on the amount of slag, the volume of iron produced was small enough to be consumed locally.

Extending the geographical scale, a somewhat better and more informative picture emerges. Kvæfjorden is an area rich in stray finds and historical monuments dating from the Stone Age through the Iron Age all the way to the end of the Middle Ages. Still, there are no monuments such as graves, houses etc. in the immediate surroundings dating to the Pre-Roman Iron Age. This is a period from which, at least in a north Norwegian Iron Age context, few finds and few historical monuments are known. However, at Hunstadneset on the island of Kveøya, 4 km north of Hemmestad, a Pre-Roman long house was excavated in the summer of 2008. Eleven post holes are dated to the Pre-Roman Iron Age (Henriksen and Sommerseth 2009:26-28; Sommerseth, Arntzen and Henriksen 2009:48) and in one of those, a small piece of asbestos-tempered ceramics was found. The oldest Iron Age object found in the region, a bronze brooch (Ts. 159) dating to the late 1st century AD, was discovered late in the 19th century at the same farm at Kveøya (Sjøvold 1962:99-100; Winther 1876).

Botanical and osteological data indicate that farming and stock keeping may have tentatively been introduced to North Norway during the Early Bronze Age, but this had little impact on the economy before the Late Bronze Age or Pre-Roman Iron Age (Valen 2007:41; Vorren and Nilssen 1982). Further south, houses dating to the Bronze Age and Pre-Roman Iron Age, with walls of interlacing branches covered with clay, seem to have been quite common in the Late Bronze Age and Early Iron Age (Grønnesby 1998, 1999 a, 1999 b; Løken 1997, 1998). Except for the house at Hundstadneset, another possible long house has been excavated at Skålbunes in Bodø (Arntzen 2008; Hole 2008). However, this house is indistinct as the post holes and traces of the walls are hard to interpret (Hole 2008:26-27, 2009:17). On the other hand, the house at Kveøya is a distinct structure and no doubt a long house, with a roof held up by two rows of internal posts (Henriksen and Sommerseth 2009:27, Figure 21; Sommerseth, Arntzen and Henriksen 2009:48).

It is possible that the iron producers lived at Hunstadneset at Kveøya and came to Hemmestad to produce iron. On the other hand, the blacksmiths at Hemmestad may have lived closer to the iron production site in similar type houses or some other kind of structure yet to be found. Only 1.4% of the cultivated field (250 m^2 of 18000 m^2) was examined by stripping off the topsoil at Hemmestad, and there is no way of telling if such structures may have been located in other parts of the field or nearby in the outland area. No house structures are to be seen on the magnetometer map (Figure

10) although modern agricultural activity may have destroyed them. Stray finds dating to the Stone Age have been found on Hemmestad and neighboring farms, and it is quite possible that there was a Stone Age settlement not far from the iron production site, but no houses or settlements have been found. There are several Iron Age grave finds from the area, but none as old as the iron production site.

At Hemmestad, only one object can be dated to this transitional period between the Stone Age and the Iron Age, which was a fragment of asbestos-tempered ceramics found in Structure I during an excavation in 1999 (Figure 28). The 3 gram fragment (Ts. 11225 e) measuring only 1.9 cm by 2.6 cm is not easily identifiable. However, the asbestos tempering is very pronounced, and the thickness of the asbestos fibers very much resembles that of Risvik ceramics (Figure 29). According to Jørgensen and Olsen (1988:65), it should be dated to the period from 1100 – 400 BC, but ^{14}C dates based on carbonized material scraped off the ceramics itself, indicate that the period of use was shorter, somewhere between 800 and 400 BC (Andreassen 2002:66, 71, Figure 7).

5.2.2 Pots, Farmers and Iron: The Socio-Economic Context of the Risvik Ceramics

In order better to understand the socio-ecomomic context of the Hemmestad site it is necessary to raise one's eyes and take a larger geograhpical area into consideration. A small fragment of asbestos tempered ceramics was found during the excavations at Hemmestad which link the settlement to contemporary finds of much wider geographical significance.

The concept of "asbestos ceramics" refers to several sub-groups of ceramics primarily used during the Late Stone Age and Early Metal Period. Asbestos-tempered ceramics found in North Norway may be divided into seven sub-types, but only four types: textile ceramics, imitated textile ceramics, Kjelmøy ceramics and Risvik ceramics are found in Nordland and Troms (Jørgensen and Olsen 1987, 1988). The textile ceramic and imitation textile ceramic are both dated to the period from 1800 BC till 900 BC (Olsen 1994:104), while the Kjelmøy ceramic is dated between 900 BC to AD 300 (Hansen and Olsen 2004:57). The asbestos tempering in the Kjelmøy ceramic, the textile and imitation textile ceramics is not as pronounced as in the Risvik ceramics which have short and thick asbestos fibers. The north Swedish specimen of Kjelmøy ceramics are somewhat different from the Norwegian pots as they contain much more asbestos tempering, leading to the suggested term “asbestos ware” (Hulthén 1991). However, asbestos was used as a tempering material in later periods as well, and during the Migration Period, the asbestos-tempered, bucked-shaped vessels were widespread within Germanic Iron Age culture. In morphological terms, the fragment of ceramics found at Hemmestad is quite different from the textile, the imitation textile and the Kjelmøy ceramics. Both the imitation textile ceramic and the textile ceramic are dated to the early part of the Early Metal Period and the Kjelmøy ceramics are the only other contemporary asbestos-tempered ceramics found in the coastal region of North Norway. Nonetheless, this type of ceramic has distinctly thinner walls, and the asbestos tempering is composed of crushed and very thin asbestos fibers. The outer surface on most fragments of Risvik ceramics has flaked off, much like the one fragment found at Hemmestad, and the morphological features and lack of any alternative identification render it very probable that this fragment of ceramics came from a vessel of the Risvik type. In his thesis on Risvik ceramics, Andreassen (2002:86) finds the fragment too small to make certain identification, but he nevertheless agrees that it is probably a fragment of Risvik ceramics. The dating of the Risvik ceramics partly overlap with the dates of the iron production, so based on the arguments stated above, I therefore find it likely that the fragment of ceramics found in connection to Structure I is of the Risvik type, and that those using Risvik ceramics and the iron producers were the same people.

Figure 28 - Risvik ceramics from Hemmestad (Photo: Adnan Icagic, Tromsø University Museum)

Figure 29 - Risvik ceramics (Photo: Adnan Icagic, Tromsø University Museum)

Hemmestad is not the only place where slag, iron and Risvik ceramics are found in the same context. At two excavated sites, Hellarvikjæ House I and Røsnesvalen which are both at Træna, slag, iron and Risvik ceramics were found together. Gutorm Gjessing (1943:137), who excavated the sites, maintains that iron had been produced at both places, yet no production site was found and the amount of slag is far too small to support such a claim. Risvik ceramics have also been found together with slag or iron at several other sites, and between Senja in the north and Træna in the south, Risvik ceramics have been found in association with iron or slag at 10 sites (Figure 30). This indicates that iron or slag have been found at approximately 30% of the sites with Risvik ceramics, and that iron as a raw material was an integral part of the material culture at these sites. However, most sites have been used during long periods and there are, with the exception of the excavated sites at Træna, some uncertainty as to whether the use of ceramics and iron, as well as the production of slag, coincide. Simultaneousness is also documentet at sites with vessels of type A which seem to have been repaired by strings of iron and with type C which had an iron collar below the rim (Andreassen 2002:86). The small amount of slag found at these sites makes it highly unlikely that it originates from iron production. Gjessing (1943:137) may have been wrong about iron being produced at Træna, but the small fragment of asbestos-tempered ceramics found at Hemmestad confirm that some people using Risvik ceramics also produced iron, and that Risvik ceramics was an integral part of the iron producer's material culture.

Whether Risvik ceramics was considered prestige objects is uncertain but rusty repair holes in some vessels indicate that the ceramics were of high value and worth the trouble of repairing instead of being thrown away. Risvik ceramics have been found at 33 sites between Saltfjellet and North Troms (Figure 31) which does not seem much knowing that the ceramics were used throughout a 400-year period. However, the number of sites dated to this period in not very high and it is thus possible that the Risvik ceramics was widespread and the dominant everyday vessel for cooking or storing food.

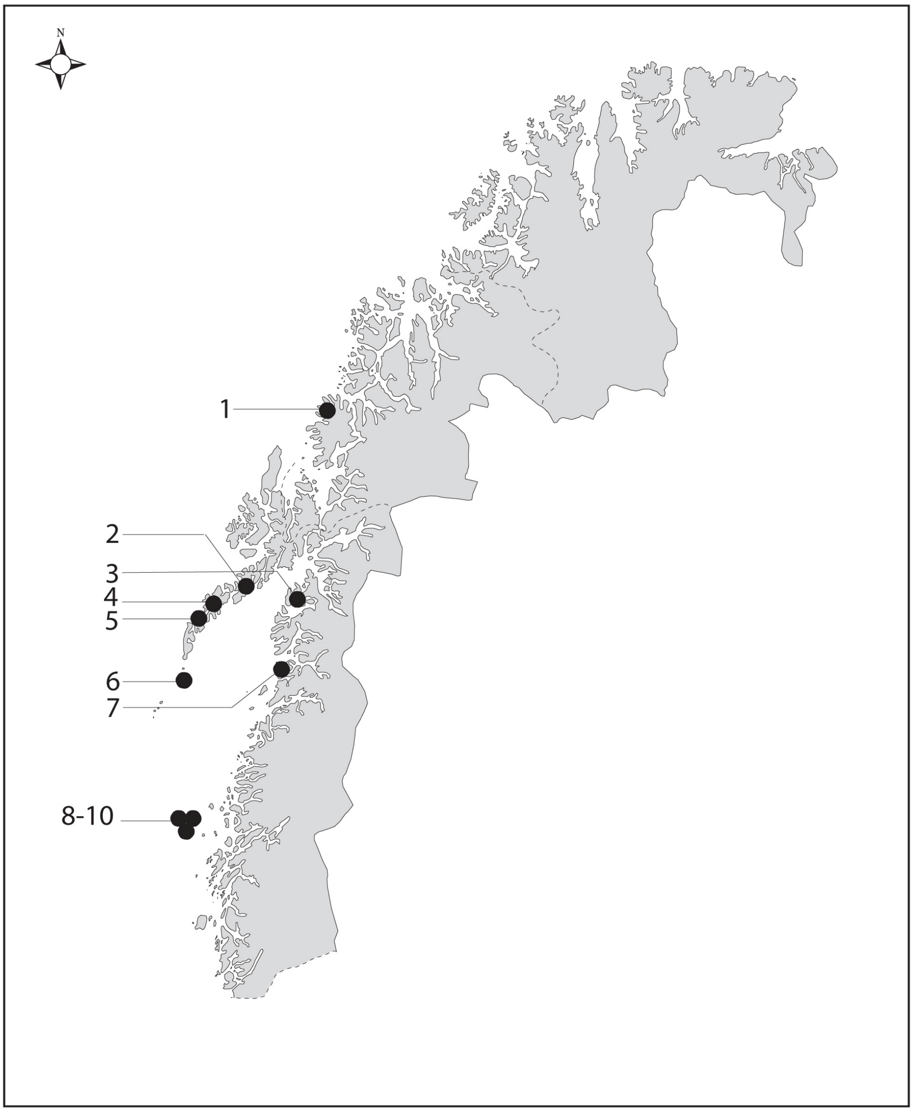

Figure 30 - Sites with Risvik ceramics and slag or iron (Graphics: Adnan Icagic, Tromsø University Museum)

No.	Site	Municipality
1	Senjahopen	Berg
2	Øvreværet	Austvågøy
3	Kolvika	Vestvågøy
4	Storbåthallaren	Flakstad
5	Nordlandet	Værøy
6	Uteid	Hamarøy
7	Fjære	Bodø
8	Røsnesvalen	Træna
9	Hellarvikjæ House I	Træna
10	Kirkhellaren	Træna

Table 8 - Sites with Risvik ceramics and slag or iron

Risvik ceramics are exclusively dated to the last Millennium BC, but the trajectories that led to the formation of this ceramic tradition may be traced back to the Middle/Late Neolithic and Bronze Age. A number of artifacts such as axes, flint daggers, bronzes and rock carvings with symbols associated with south Scandinavian Bronze Age are found along the coast of northern Norway (Valen 2007). These finds indicate contact between north and south along the coast from the Middle Neolithic until the Late Bronze Age. At the same time, as these southern contacts increase along the coast of Nordland and Troms during the Early Metal Period, the hunting societies to the north and in the interior enters networks that links them to agrarian, metal-producers in eastern and central Russia (Hansen and Olsen 2004:55; Olsen 1994).

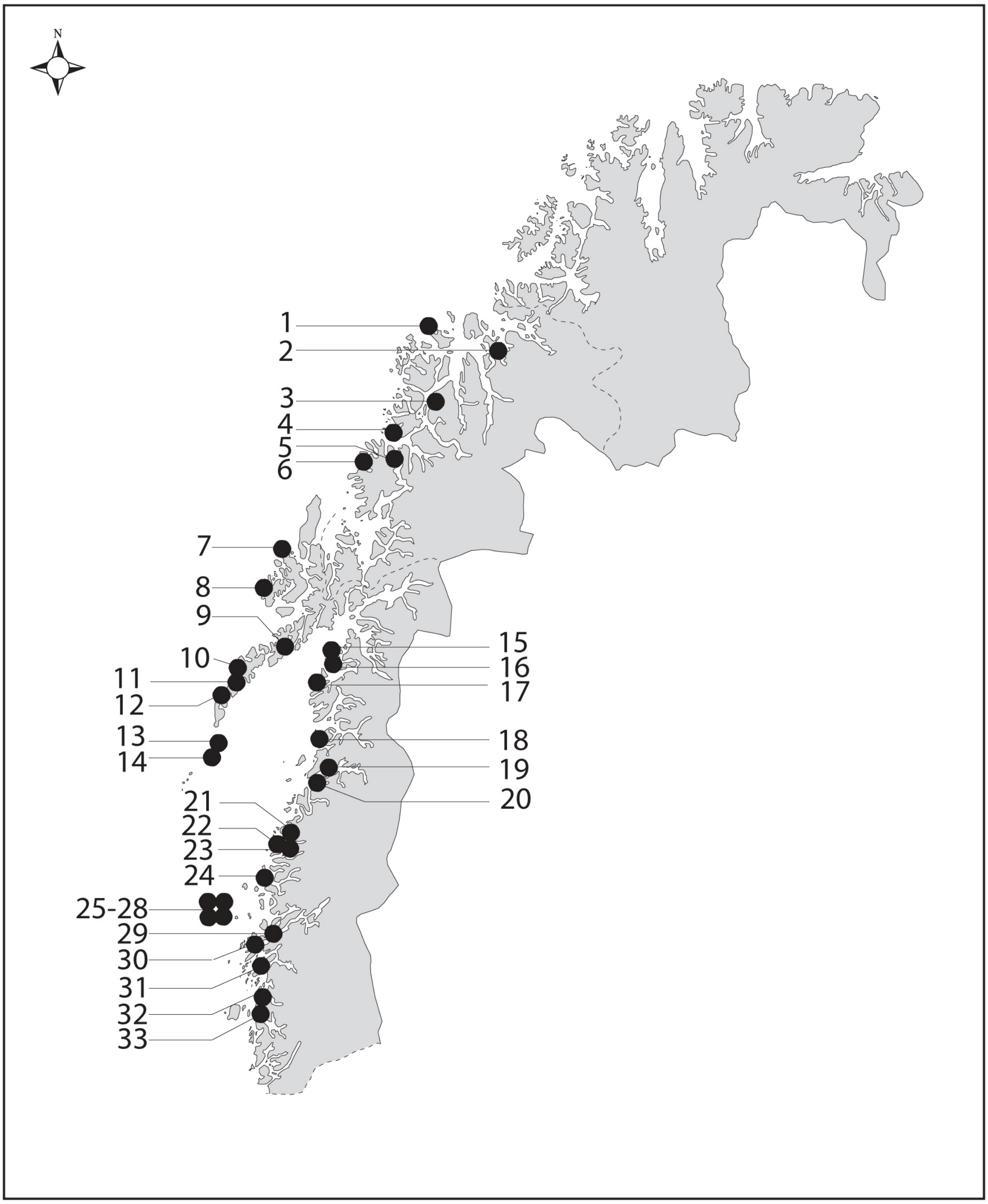

Figure 31 - Sites with Risvik ceramics in North Norway (Graphics: Adnan Icagic, Tromsø University Museum)

No.	Site	Municipality
1	Sandfjorden	Karlsøy
2	Hamnes	Nordreisa
3	Tønsvika	Tromsø
4	Sandvika	Tromsø
5	Senjahopen	Berg
6	Vang	Lenvik
7	Langenes	Øksnes
8	Tunstad	Bø
9	Øvreværet	Austvågøy
10	Utakleiv	Vestvågøy
11	Storbåthallaren	Flakstad
12	Vestre Nesland	Flakstad
13	Nordlandet	Værøy
14	Austervåga	Værøy
15	Uteid	Hamarøy
16	Dragsbukta	Hamarøy
17	Laskestad	Steigen

No.	Site	Municipality
18	Fjære	Bodø
19	Skålbunes	Bodø
20	Seivåg	Bodø
21	Skjevika	Meløy
22	Solheim	Meløy
23	Risvik	Meløy
24	Abrahamplassen	Rødøy
25	Kirkhellaren	Træna
26	Geithellaren	Træna
27	Hellarvikjæ	Træna
28	Røsnesvalen	Træna
29	Hugla	Nesna
30	Nordvik	Dønna
31	Skjeggesnes	Alstadhaug
32	Hestun	Vevelstad
33	Brødløs	Vevelstad

Table 9 - Sites with Risvik ceramics in North Norway

The socio-economic changes that take place during the Early Metal Period in North Norway, brought about a differentiation among the formerly relatively uniform hunting societies of the north. This differentiation is reflected in the asbestos ceramics, where the former uniform (pseudo-) textile ceramic tradition splits into the geographically complementary Risvik and Kjelmøy ceramics during the last millennium BC. Farming and stock keeping are now spread to more settlements along the coast of Nordland and Troms, and the contacts to the south are consolidated while the hunters to the north and east intensify their eastern contacts. This duality is thought to form the socio-economic background for the processes that led to the emergence of Germanic/Norse and Sami ethnisity in northern Norway (Hansen and Olsen 2004; Jørgensen and Olsen 1987, 1988; Olsen 1994). Risvik ceramics are exclusively found on the outer coast south of Lyngen in Troms in areas that a few hundred years later came to host Germanic farming communities, and the contemporary Kjelmøy ceramics are primarily found to the north and east in areas which were later dominated by the Sami people.

Being two contemporary and complementary ceramic traditions, both Risvik and Kjelmøy ceramics support the picture of settlements with different cultural orientation, i.e. people at the coast north to Lyngen in Troms maintaining and establishing new contacts to the south, while people north and east of this area mainly interacting with societies to the east. As a result, the first use of iron in Finnmark was the result of contact with the western offshoots of the eastern Ananjino culture (Hansen and Olsen 204:38). The early stages of iron production in northern Finland should probably also be understood in this context, and the very first metal users in Finnmark were probably part of an exchange system in which cultural influence shifted and artifacts moved.

Several finds support the idea about Risvik ceramics' southern connection. At Skjeggestad in Alstadhaug Municipality, Risvik ceramics were found in a coffin of stone slabs together with a razor and fragments of a needle, both made of bronze, and the bronze artifacts are dated to Period 3 of the Bronze Age (Bakka 1976:27, 31; Ågotnes 1976:120-122, 1986:104). At several locations, Risvik ceramics are found together with fragments of small, relatively thin-walled soapstone vessels (Andreassen 2002:82; Jørgensen 1986:72-75). In one of his early works, Shetelig (1912:52) relates the soapstone vessels in Rogaland to the Nordic Bronze Age culture, while Møllerop (1960:39) dates them to the late Pre-Roman Iron Age. Thin-walled soapstone vessels are divided into five sub-groups (Pilø 1990:93-95), of which one is morphologically close to the Risvik ceramics with a depressed ribbon below the rim. This morphological element of Risvik ceramics seems to have been transferred to the soapstone vessels as the ceramics fade out during the emergence of the soapstone vessels in the Pre-Roman Iron Age (Andreassen 2002:84). The geographical distribution and the discovery of ceramics in context with southern bronzes and morphological similarities with soapstone vessels indicate that the users of Risvik ceramics had a cultural orientation to the south.

Apart from the practical function of the Risvik ceramics, it also may have worked as a signal about similarities and dissimilarities (see chapter 8.5). The disappearance of the ceramics approximately 400 BC may have been a consequence of the ceramics having lost its function as an ethnic signal. Socio-economic changes such as an increased emphasis on farming was in itself a signal about cultural identity, which might have rendered the ceramics superfluous as a cultural signal and expression about belonging and identity (Andreassen 2002:110; Jørgensen and Olsen 1988:79). The orientation towards the south reflected in the material culture all the way back to the Neolithic grows stronger towards the end of the Early Metal Period and coastal societies north to the Tromsø area seem to be increasingly integrated into the southern Scandinavian Germanic culture throughout the Iron Age (Hansen and Olsen 2004:56-57, 133; Johansen 1990). Pollen data, as well as archaeological finds, indicate that the farm as a socio-economical unit was established in North Norway sometime in the last millennium BC, possibly in the Pre-Roman Iron Age. Graves with high prestige objects indicate a development towards an increased social stratification from the Roman Period, and the courtyard sites indicate an increased political consolidation among the Germanic settlements in Nordland and Troms (Hansen and Olsen 2004:59-60; Odner 1983; Ramqvist 1988:112-113; Storli 2006).

Major efforts were undertaken in the 1970s and 1980s by archaeologist Olav Sverre Johansen and botanist Karl Dag Vorren to map the earliest evidence of farming in North Norway (Johansen 1982 b, 1990, Johansen and Vorren 1986, Vorren and Nilssen 1982). At that time, 14 pollen diagrams documented early farming dating between 4160±80 BP and 3060±90 BP, calibrated BC 2905 – 2495 and BC 1502 – 1047 BC (Bronk Ramsey 2001, OxCal 3.10 2005; Johansen and Vorren 1986:740). Since then, more pollen diagrams have been analyzed, and there are now 22 pollen diagrams that indicate the first farming and stock keeping in North Norway (Valen 2007:33-34, Table 4). In addition, four bones of livestock and two macro fossils of grain document farming and the presence of livestock in North Norway BC (op. cit.). Together, these data indicate that farming was introduced to some regions during the Early Bronze Age. However, these first rudimentary traces of grazing and the growing of grain are not likely to have meant any major shift in the economy. Still, the new elements were a supplement to the old way of living. During the Late Bronze Age and Pre-Roman Iron Age farming achieved greater importance both in terms of subsistence and with regard to its social and cultural significance. The farm as a socio-economic unit, as we know it from AD 300 and onward, was probably established approximately 500 BC (Johansen and Vorren 1986:745). None of the pollen diagrams indicating early farming are from sites with Risvik ceramics, but they are close enough for those who settled at these sites to have had knowledge about this new supplement to the economy. At Storbåthallaren in Flakstad Municipality, both Risvik ceramics and bones from cattle and sheep/goat have been found. The bones are dated to the time of the Risvik ceramics, which supports the suggested link between farming and Risvik ceramics. In close proximity of the newly excavated long house at Kveøya, a contemporary, fossilized field has been found which document Pre-Roman agriculture (Arntzen 2009:43; Sommerseth, Arntzen and Henriksen 2009:48). It would therefore be reasonable to assume that farming was part of the economy during the period of iron production at Hemmestad.

5.2.3 Influences from East of South?

The find of Risvik ceramics document that the iron producers at Hemmestad used this ceramics and in chapter 5.2.2 I have argued for the Risvik ceramics' southern cultural connection. Being part of a southern sphere of influence does not rule out receiving cultural influences from other parts of Fennoscandia. Iron was produced in many regions of Fennoscandia during the Pre-Roman Iron Age and in this chapter, I will explore the possibilities of connecting the iron production at Hemmestad to any of these technological traditions.

The Pre-Roman iron production sites documented in northern Finland at the sites Neitilä, Riitakanranta and Äkälänniemi (Kotivuori 1996:410; Lavento 1999; Schultz 1986:172) clearly belong to the eastern Ananjino iron production tradition. Most of the furnaces are very different from those found in Sweden and Norway, with the majority of the furnaces being of the stone box type (Kotivuori 1996). Apart from the stone box furnaces at the sites Kotijänkä and Riitakanranta, there were some round structures placed approximately one meter from the slightly dug in stone box furnaces, which could have possibly been shaft furnaces, placed on top of the ground without an underground slag pit (Kotivuori pers. comm., September 2003).

Nordkalotten is vast, as are the distances between the iron production sites in question. The distance from Hemmestad to iron production sites near Rovaniemi in northern Finland and North Trøndelag is 500 - 600 km as the crow flies. Similarities in the archaeological material dating from the Stone Age and onward indicate that there has "always" been east – west contact. A few examples dating to the Stone Age and Early Metal Period are: Rovaniemi axes, textile and imitation textile ceramics, Kjelmøy ceramics and daggers with animal or bird heads, and there are also a number of finds from the Iron Age and Medieval Period which indicate such contacts (Gjessing 1939:39, Figure 1; Sjøvold 1974:360-362; Storli 1991). However, there is no indication that the eastern iron production technology manifested in the stone box furnaces, ever spread to North Norway.

Overall, the iron production technology in northern Finland and Karelen is distinctly different from that found in Norway, Sweden and Denmark with the exception of two Pre-Roman sites at Kotijänkä and Riitakanranta, where two structures resembling shaft furnaces were found (Kotivuori 1996, pers. comm. September 2003; Lavento 1999:76). The iron production in northern Finland and Karelen (Lavento 1999) seems to be slightly younger than the furnaces at Hemmestad.

The furnace found in North Sweden at Sangis in Kalix Municipality in 2009 has been dated to the Pre-Roman Period but little is known of the construction and the production technology applied (e-mail from C. Bennerhag, 9. and 13. November 2009). It seems to have been a small shaft furnace raised above a slag pit (op. cit.) and thus part of a southern rather than an eastern technological tradition.

When looking to the south for similarities in production technique, it is a problem that North Trøndelag, which is the closest iron producing area, seems to have applied a slightly different production technique than which is seen at Hemmestad. Not only is the micro milieu different but the furnaces are bigger.

When searching for geographical areas and technological traditions that might have inspired the production at Hemmestad, the nearest iron production sites are more than 1000 km to the south. The Skovmark furnace has been singled out as a "prototype", but it is a problem that the Hemmestad furnaces seem to be older. Be that as it may, there are several iron production sites in southern Scandinavia and further south which are approximately the same age as the furnaces at Hemmestad. As such, there is no problem when associating the date of the Hemmestad site with a southern technological tradition. Similarities with production sites in southern Norway, southern Sweden and Denmark strongly indicate that impulses from these southern areas influenced and initiated the iron production at Hemmestad.

5.3 The Roman Period

Archaeologically speaking, the first century AD is not substantially different from the previous period. In all of North Norway, there are no Iron Age artifacts of South Scandinavian origin from the 1st century AD and only two dating to the 2nd century (Resi 2005; Winther 1876). From the 3rd century there is a steady rise in the number of finds and monuments from the Germanic Iron Age, with new types of monuments appearing on the scene such as graves and courtyard sites, and these structures indicate processes of increasing social stratification and possibly a chiefdom-like centralization of power. At the end of the period, finds and monuments document that the coastal settlements north to Mid-Troms were an integral part of the Germanic Iron Age culture (Johansen 1979; Odner 1983; Sjøvold 1962). The number of archaeological finds of iron increases greatly as does the import finds of southern origin, thus indicating that the northern Germanic coastal settlements were part of a well-developed system of exchange with people in the south. During this period, North Troms also seems to be a transitional zone between the Germanic coastal settlements partially based on agriculture and stock keeping in the south and Sami hunter and gatherers in the north, and the distribution of historical monuments demonstrates this. South of this area, there are long houses, grave mounds, cairns, courtyard sites, etc., while no such structures are found in the north. On the other hand, slab-lined pits, which are believed to have been used in the production of oil, are numerous along the coast of North Troms and Finnmark (Hansen and Olsen 2004:76, Figure 9).

5.3.1 Social Setting

The Iron Age farm, with its long houses built of wood, turf and stone, and surrounded by fields with nearby graves, is well established in north Norwegian coastal settlements from approximately 300 AD (Johansen and Vorren 1986:745), but has roots which are now documented going back in the Pre-Roman Period (Henriksen and Sommerseth 2009:26-28; Sommerseth, Arntzen and Henriksen 2009:48). The north Norwegian Iron Age farm was thus well established, both as a way to *make* a living and as a *place* to live, when iron production took place at Flakstadvåg in the Late Roman Period. No Iron Age farmhouses have been found at Flakstadvåg, although the presence of graves and boathouses demonstrate that there was once a farm there that has yet to be discovered.

The size of the pit indicates that the furnace at Flakstadvåg was quite large, but size alone is in no way a reliable indicator of how many people were needed to maintain the production process. Imprints in the slag in addition to the size of the furnace indicate that it was fired by wood and not charcoal, which reduced the labor needed for the preparation of the smelting. Wood was probably chopped nearby and bog iron ore was found very close to the site, thereby demonstrating that the smelting did not require a large number of people and an extensive social organization to coordinate the work, as a few people occupying a minor, nearby settlement could have managed this.

When looking into the social setting in which the production took place, this also implies questions about who mastered and controlled the production iron? Was the iron production mastered by people living at Flakstadvåg, or did they come to Flakstadmyra from neighboring settlements to carry out their craft? Approximately two kilometers south of the iron production site next to the current settlement, there are several historical monuments dating to both the Stone and Iron Ages. Among these, there are approximately 50 houses located on an old beach terrace 15 m above sea level, and two of these houses were excavated in 1986 and 1989. The first excavation produced no artifacts, though one fragment of white quartzite was found during the excavation in 1989 (Johnsen 1989; Storli 1986). These houses are most likely from the Late Stone Age or Early Metal Period, and they were abandoned long ago when iron was produced at Flakstadvåg. Two Iron Age grave mounds and three boathouses were also found at Flakstadvåg. The graves have not been excavated and it is thus impossible to determine if any of them are from the Roman Period. In 1998, a minor excavation in the supposedly oldest boathouse was conducted, and a trench was dug through the wall in the most elevated boathouse located 4.4 m above sea level. Due to its altitude above sea level it was supposed to be from the Early Iron Age; however, the one ^{14}C dating from the excavation proved this assumption to be wrong, as it dated the boathouse to 1112±63 ^{14}C years BP (TUa – 2664), calibrated AD 771 – 1029 (Bronk Ramsey 2001, OxCal v. 3.10, 2005) (Appendix 13).

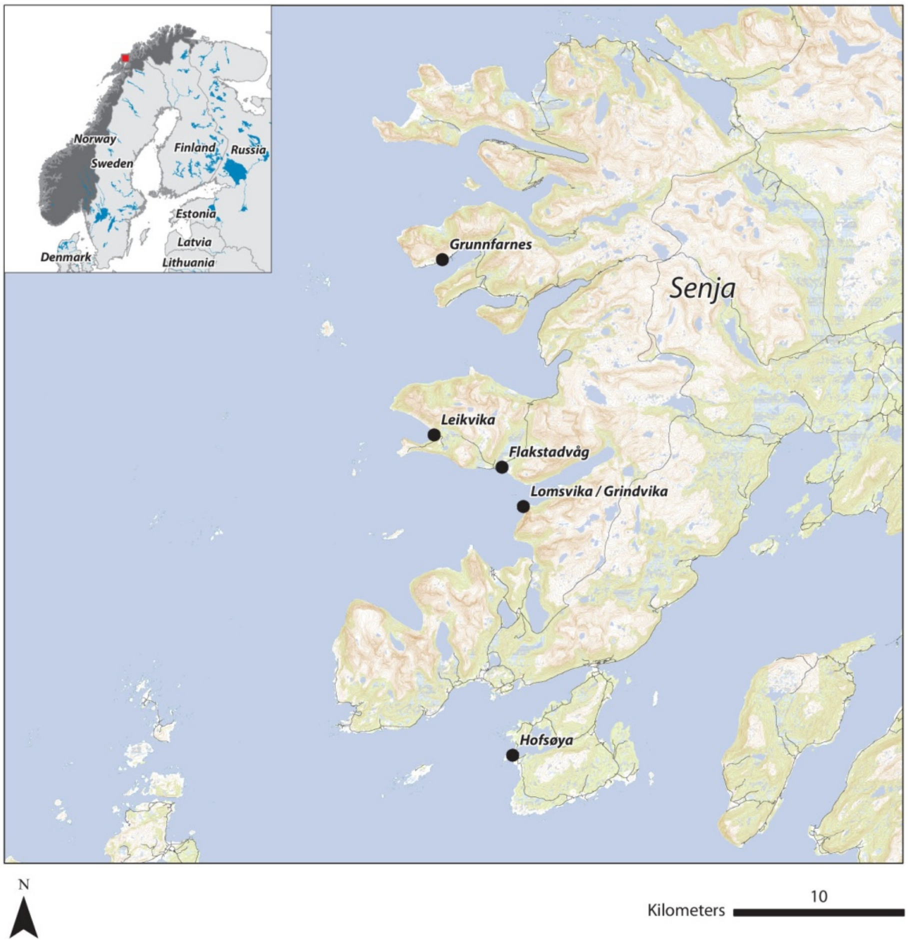

Figure 32 - Flakstadvåg and nearby prehistoric sites

No historic monuments dating to the Roman Period have so far been found at Flakstadvåg. Agriculture and other types of earthwork may have destroyed these monuments and it is still probable that there was a Roman Period settlement that has yet not been found. If, however, the iron producers did not live at Flakstadvåg, but instead just came there to carry out their craft, where did they come from? The closest site with a prehistoric settlement is Lomsvika and Grindvika, which is 3 km to the southeast and across the Selfjord (Figure 32) but none of the monuments found there, can be dated to the Iron Age. The second nearest prehistoric settlement, Leikvik, which is 5 km across mountainous terrain west of Flakstadvåg, has many graves and houses from the Iron Age. Unfortunately, no excavations have been conducted in this derelict place, and it is not possible to decide if there was a settlement contemporary with the Flakstadvåg site. Grunnfarnes is a settlement 20 km to the north and there are three prehistoric farms, one in the fjord bottom and two at the northern side. Two farms are dated to the Migration Period and the third to the Late Roman and Migration Periods (Munch 1973:270). As such, it is possible that one of the farms was settled during the production phase at Flakstadvåg. Thirty-five km south of Flakstadvåg across sea and land is an Iron Age farm at Hofsøy that also seems to have been settled during the production phase at Flakstadvåg (Johansen 1979:104). Excavations at Hofsøy uncovered older activity, thereby indicating that the site had been used over multiple periods. ^{14}C dates indicate that the settlement period, which is dated to the Roman and Migration Periods, partially overlapped the production phase at Flakstadvåg (Johansen 1979:104). During the excavation, many pieces of slag were found which is an indication of the presence of a smithy and a blacksmith (Johansen 1978 a:5). Could the iron that the blacksmith worked at Hofsøy have been produced at Flakstadvåg?

5.3.2 An Immigrant from Trøndelag?

The excavation at Flakstadvåg filled a gap in our knowledge about the Early Iron Age and gave some long sought answers to the question about iron production in North Norway during this period. It proved beyond a doubt that iron indeed was produced in North Norway during the Iron Age. However, while providing some answers, the discovery and excavation of this first discovery of an Iron Age production site in North Norway also raised a number of new questions such as who carried out the production, where did the technology and inspiration come from and why was the production terminated?

In capter 5.3 is documented that the Iron Age settlement at Flakstadvåg would had southern cultural connections but did the iron production technology also come from the south? When searching for the source of inspiration, there are obvious reasons to look to nearby geographical regions. Some of the nearest contemporary production sites to the east are found close to Rovaniemi in northern Finland and in northern Sweden as well. The stone box or slabstone furnace is the most common Finnish type but a “cupola” furnace has also been found. Both types are very different from the one found at Flakstadvåg and having no parallel in the west, they obviously have a different origin (Lavento 1999:76). The furnaces at Flakstadvåg and those found in northern Finland seem to be based on different technological traditions. Nevertheless, on the sites at Kotijänkä and Riitakanranta circular structures were discovered which resembled shaft furnaces (Kotivuori, personal communication, September 2003). Little is known about these structures and their function to assist in deciding if they are part of the technology related to the eastern stone box furnace tradition, or if this is a technological feature related to the European shaft furnace tradition.

During the Early Iron Age AD, iron production in Norway seems to have been based on the same technological tradition, but with regional variations. A very large furnace with a diameter at the top of the slag pit varying between 0.8 m (Trøndelag) and 1.6 m (Southeast Norway) (Larsen 2004:141) was a dominant feature at some of the production sites, with such furnaces found in Trøndelag as well as in west and Southeast Norway (Bjørnstad 2003:77; Larsen 1991:275-279, 2004; Stenvik 2003). The furnaces found in west Norway are similar to contemporary furnaces in Southeast Norway (Bjørnstad 2003:77). A typical location would have been on top of a hill or a knoll, and the slag pit would have been used several times, although the shaft would probably have been rebuilt between each production. This is the most significant difference to the contemporary Trøndelag furnaces in which both the pit and shaft were reused many times. The furnace was typically placed on top of a slope, and after each production, the pit was opened on the slope side and emptied before being closed and both the pit and shaft could be reused. In Southeast Norway, only the pit was reused during the Early Iron Age and the shaft had to be demolished in order to empty the slag pit before the next production. This technological difference between Trøndelag and Southeast Norway is not without its exceptions as the Roman Period type of furnace that dominates in Trøndelag is also found further south.

The site at Flakstadvåg is quite similar to production sites found in North Trøndelag in terms of not only the furnace, but particularly the location. The site is located at a dry spot in a swampy area, and the furnace is placed on top of a slope facing a stream below. The furnace, or rather the slag pit at Flakstadvåg, seems to have been about the same size as those in North Trøndelag. At Flakstadvåg, some pieces of slag had cooled against a flat surface thought to be flagstones, thus indicating that the slag pit had once been lined with raised flagstones such as many furnaces were in North Trøndelag. Those are factors which might lead one to draw the conclusion that the production was part of the same technological tradition as in North Trøndelag, and though there are many similarities, there are several dissimilarities as well. At Flakstadvåg, there is only one furnace while the North Trøndelag sites normally have several, which had presumably been in simultaneous operation, though in various stages of production. In addition, there are often three to seven depressions dug into the ground around the North Trøndelag furnaces that surround the slag pit like a "rosette" (Stenvik 1990:211). At Flakstadvåg, no such structures were uncovered and it is uncertain what purpose these "rosette" depressions served, but being such an integral part of the production sites in North Trøndelag, they must have been vital to the work being done.

As such, the Flakstadvåg site is no copy of the Trøndelag sites. Some of the similarities, e.g. the location, might be related to the topography at the production site. Iron ore is often found in bogs, so building a furnace on a dry spot in or next to a bog therefore seems sensible. The placing of the furnace on top of a slope seems a factor primarily related to the technology, the construction of the furnace, the emptying of the slag pit and the possible reuse of both the pit and shaft.

Even though the site at Flakstadvåg in some ways resembles sites in North Trøndelag, there are differences that might be seen as local adaptations to a shared technological knowhow. When compared to sites further south in Norway, it is important to bear in mind that this technology was not an isolated phenomenon. Furnaces similar to this type are found in southern Norway since this kind of furnace and the production technology associated with it were part of a European shaft furnace tradition.

One major obstacle in understanding the Flakstadvåg site is the lack of knowledge about the social setting in which the production took place, in addition to the unanswered question of why production was discontinued. The supply of high quality bog iron ore seems to have been abundant, and an analysis of the slag indicates that the smelting was successful. It therefore remains a mystery as to why the production of such a valuable and presumably much sought after product was terminated.

5.4 The Medieval Period

During the 500-year long Medieval Period, comprehensive social changes took place. A central power is in place and Christianity is becoming increasingly popular. Great changes are taking place on society's macro level but most people still lived on small farms and earned a livelihood as farmers and fishermen. The stockfish trade became increasingly important in connecting North Norway to southern Scandinavian and European markets. The importance of Vågan in Lofoten as a center for trading stockfish increased during this period (Bertelsen 1985; Urbanczyk 1992), and this trade expanded to become of importance for a great part of the coastal settlements in all of North Norway. This shift towards a market economy also had an effect on the settlement pattern as it led to the establishment of fishing villages along the coast (Urbanczyk 1992:259, Figure 77). Despite this increase in trade, most farms were based on subsistence agriculture, and people had to chiefly manage with the farm's products and subsistence fishing.

The iron production site at Rognlivatnet is part of this social context but because the site has not been excavated, our knowledge about of the site is quite limited. The following discussion will thus be affected by this.

5.4.1 Social Setting

The medieval iron production site at Rognlivatnet is located approximately 400 m above sea level, several kilometers from the contemporary settlements in Misværdalen. The site has not been excavated and the furnace(s) cannot be seen on the surface, so we have no information about the number of furnaces or their construction and size. Judging by the visible amounts of slag, however, it was not an extensive production. An analysis based on roasted iron ore from the site indicates a very high yield of 1.7 kg of iron per kg slag (Espelund 2004:29). The small amount of slag at the site indicates a very small production, and like the production at Flakstadvåg and Hemmestad, a small number of people could have carried this out as well.

Located in the hills in an outland area well away from the closest settlement, we cannot be sure where the iron producers lived. No contemporary settlements have been found in the nearby hills, and it is probable that the iron producers lived on one or several farms in Misværdalen or down by the sea. In order to minimize the cost of labor, such an enterprise would be placed as close as possible to the recourses rather than being close to the settlement of the craftsmen. In other words, there is no need to assume that the iron producers lived in the immediate surroundings of the production site. Seven kilometers southwest of Rognlivatnet, a farmhouse at Vestvatn in Misværdalen was excavated in 1966 (Figure 19). The house seems to have burned down and been abandoned sometime in the 1100s, although a few finds such as bone combs indicate that the farm may also have been settled into the 1200s (Munch 1967:104, 116). An extensive amount of smithing activity was documented during the excavation (Munch 1967:110), so it is theoretically possible that the iron being forged at Vestvatnet came from the production site at Rognlivatnet. A couple of other archaeological finds indicate settlements contemporary with the iron production site. A silver hoard was found in 1968 on the farm Skar, a couple of kilometers north of Vestvatnet, which seems to have been deposited sometime during the 1200s (Munch 1970:104; Spangen 2005:70-72) and in between Vestvatnet and Skar, at Stolpe, is a a soapstone quarry. According to the traces from vessels extracted from the rock it might have been in use in the Early Medieval Period. An analysis based on both archaeological and written sources indicates that there were surely three medieval farms in this area (Aarsæther 1975:31, 34) with another 10 farms identified and labeled as “possible” Medieval Age farms in the same area (ibid. 117). According to an analysis of the slag the smelting was very successful, but all the same, it did not result in a comprehensive production. Why such a seemingly successful enterprise was terminated stands as an unanswered question since there is no sign of a demographic crisis in the first half of the 1200s (ibid. 182). The devastating Black Death, which wiped out a great part of the population, occurred about a century after the iron production was terminated.

When the site at Vestvatn is brought into the discussion about who carried out the iron production at Rognlivatnet, a few comments on ethnicity seem appropriate. Several finds from the excavation are by Munch (1967:117) considered to be eastern imports. However, her conclusion was that this was a Norwegian settlement which had interacted with the Sami, and thereby acquired finds of eastern origin. Odner (1983:68) opposes this view when arguing that this was actually a Sami settlement. Apart from ornaments on some bone objects, a wide variety of artifacts made of bronze, bone and stone are believed to be of eastern or Sami origin (op. cit.). It therefore seems likely that there was a Sami population in the Misvær valley, and it is thus possible that the iron producers at Rognlivatnet were Sami.

5.4.2 Summing Up Rognlivatnet

When surveying sites with small amounts of slag and no apparent furnace, it may be hard to distinguish a smithy in an outland area from an iron production site. With the seemingly small amounts of slag at the Rognlivatnet site, could it have been a place for smithing and not for iron production? This would likely be the conclusion after a cursory survey, except the discovery of roasted iron ore at the site clearly defines it as an iron production site.

The modest amount of visible slag may not only be an indication of the scope of the production, but could also be a consequence of the type of furnace used. A furnace with a slag pit that was not emptied after the melting would have left little surface slag, and such furnaces are known at sites in southern Norway. The shaft could have been removed after the smelting to be re-used while the slag stayed in the pit (Haavaldsen 1997:73; Larsen 2003 a:178, 181), and these furnaces have numerous European parallels, for example, in Poland (Pleiner 2000:71, Figure 18).

The use of charcoal to heat the iron ore is consistent with the technological development in Trøndelag and southern Norway. During the Early Iron Age, the furnaces in North Trøndelag were fired with wood, but during the Late Iron Age and Medieval Period, furnaces were heated with charcoal. Since no excavation has been conducted at the site, we have very little data on the technology, the extent of the production or the layout of the production site.

5.5 Common Knowledge?

It is an open question as to whether the north Norwegian iron production was mastered and organized by local craftsmen or by specialists who were called upon to perform this task. Was the smelting technique common knowledge or was this a skill mastered by only a few? Before the first north Norwegian iron production site dating to the Iron Age was found at Flakstadvåg, the lack of such sites in the north was seen as a consequence of the great surplus of production that occurred in North Trøndelag during the Roman Period. Owing to the fact that no Iron Age iron production site was found in North Norway before the late 1990s, it has been suggested that this part of Norway was supplied from North Trøndelag (Stenvik 1987:99, 1994 a:15, 1994 b:192). In exchange for iron, the Trøndelag chieftains could obtain valuable merchandise such as fur, walrus teeth, hides, etc. (Stenvik 1994:192).

The Roman Period iron production in North Trøndelag was comprehensive and required both manpower and a well organized workforce, so it is likely that such an enterprise required technological expertise possessed by only a few. In comparison, the three iron production sites in North Norway are small and insignificant as suppliers of iron on a regional level, and the smelting at these sites did not require any sophisticated organization or large workforce; a few knowledgeable and skillful men could probably conduct the entire enterprise.

During the discussion about which production areas and technological traditions that might have inspired the north Norwegian ironworks, the question about how such knowledge was spread, has not been dealt with. In an illiterate society, crafts like blacksmithing can only be transferred by the movement of people (see Chapter 4). Skills could not be learned by word of mouth but by practicing and only someone who had participated in a previous smelting would be able to plan and carry out a successful one. Consequently, either the master blacksmiths in charge of the north Norwegian smeltings were southerners coming to the north to carry out their craft or they were locals who had acquired the skills at southern smelting sites. However, there is no clear-cut answer to this and further elaboration would be pure speculation.

The three ironworks and their seemingly small production can not explain how the demand for iron was satisfied during the Iron Age. However, they suggest that it is highly unlikely that this was done by local production. To acquire a better understanding of how North Norway was supplied with iron, it is necessary to look into some other find categories to shed some light on the supply situation. If most of the iron was procured by trade, some iron would be expected to manifest itself in the archaeological record as iron currency bars. No comprehensive study has yet been carried out on this group of finds in North Norway. The following chapter will present an overview and discuss north Norwegian iron currency bars as a potentially important commodity in supplying the northern settlements with iron.

6 IRON CURRENCY BARS

The amount of iron recovered in north Norwegian prehistoric contexts was very modest prior to the Roman Period. However, there seems to be no direct link between the actual amount of iron that at any time circulated in prehistoric societies and the amount of iron being deposited in archaeologically retrievable context. The number of iron objects found in archaeological contexts increases significantly after AD 300, but this change seems to be related primarily to changes in burial customs. Most iron objects dating to the Iron Age have been found in graves: in mounds, in cairns or in graves without any superstructure. Except for two graves dating to the 2nd century AD (Resi 2005; Sjøvold 1962:99-100; Winther 1976), all datable Germanic/Norse Iron Age graves originate from later periods. If archaeological finds from graves are disregarded and only finds from settlements are taken into consideration, the number of iron objects is drastically reduced and most finds of iron are small, unidentified fragments. The amount of iron found in Iron Age farmhouses from the Migration Period and the Late Iron Age is not significantly greater than that found at older Iron Age settlements. The large amount of iron objects found in graves younger than AD 300 is thus only to a limited degree reflected in settlement finds.

There is little doubt that the use of iron increased from the initial phase of introduction and throughout the Iron Age. As far as we know, local production could not have satisfied local demand, but how then was the supply secured? Did iron come in the form of finished or semi-finished products or as blooms and iron currency bars to be transformed into tools and the like by local blacksmiths? Some of the iron objects found in Iron Age graves were no doubt imported as finished products, but the frequent occurrence of slag at Iron Age settlements demonstrates that smithing was an ordinary and quite common activity. This proves that iron was worked, new tools were made, and old ones were repaired. Late Iron Age finds in Southeast Norway demonstrate that iron currency bars were in fact commercial goods (Resi 1995) and that they could have been important merchandise traded between the south and north.

Chapters 3 and 4 have dealt with available and relevant information about the north Norwegian ironworks, but the data is quite limited. To get a better idea about the iron supply it is necessary to broaden the perspective and include the iron currency bars, which have been closely related to iron production, trade with iron and the making of iron tools. Before concentrating on the north Norwegian material, I will take a broader approach to questions related to the distribution and function of iron currency bars.

6.1 Their Purpose

Iron currency bars are not completed objects, but part of a transformation process in between pig iron and the end product. They are a highly diverse group of finds, and it was not before 1918 that their proper function was recognized. In two different papers, J. Petersen (1918, 1932) discussed a group of finds previously identified as iron loom weights. These are often found in caches, and while most archaeologists thought these to be loom weights, Petersen understood that their main purpose was to serve as iron blanks. Generally speaking, the iron currency bars may be defined as standardized, semi-manufactured iron objects with a fixed value (Andersen 1994:60, 71; Magnusson 1986:274). Petersen (1918:178) divided the Norwegian iron currency bars into two main groups: one made up by quite large, multi-faceted, axe-like objects and the other by the much smaller and less axe-like "loom-weights". Even though later literature on iron currency bars has contributed to a more diverse and better understanding of the nature and function of the iron currency bars, this find category has probably not yet been fully understood.

Most Norwegian research on iron currency bars has been based on finds from Southeast Norway as the vast majority of bars have been found in this region. According to Dannevig Hauge (1946:169), 7,038 iron currency bars had been found in Southeast Norway up until 1946, while Resi (1995:135) estimates the number to be 8,500 in 1995 for all of southern Norway. An overwhelming majority of these are “the loom-weigh type”, R 438 (Rygh 1885). The number of wedge-shaped axes totaled approximately 80 in 1951 (Petersen 1951:214).

Iron currency bars occur as single stray finds as well as in caches, some having several hundred iron blanks weighing up to 80 kilos, while some caches may have as few as four bars weighing no more than 0.5 kilo (Dannevig Hauge 1946:163; Martens 1978 c:60). The composition of the depots varies, and Martens (1978:59) has divided them accordingly into six separate groups: blooms and finger iron (equivalent to “blåsterjern” and “fellujern” in Norwegian terminology), wedge-shaped axes, celts and spade-shaped bars, iron bars, iron tools and a combination of the bars mentioned above. A bloom is the pig iron as extracted from the furnace. It is described by Martens (1979:192) as circular, but it was sometimes split by the blow of an axe. The blooms show no signs of having been hammered for purification when they were hot. Finger iron has also partly been split, but is smaller and thinner after being worked by a hammer (op. cit.). The wedge-shaped axes are believed to have functioned as both an axe and a currency bar. Some of them show signs of having been hammered when used as a wedge-shaped axe, while others have been divided or cut into pieces to provide metal for some other tool.

In Southeast Norway, most of the iron production activity during the Iron Age and the Middle Ages seems to have taken place in the lower mountain districts, but most consumers would have been living in the coastal districts. Nevertheless, most of the iron currency bars have been found in the area midway between the producers and the consumers where the middlemen, those who traded with iron are supposed to have lived (Martens 1981:101; Resi 1995:134). Unfortunately, there is no distribution map of all iron currency bars in Norway, but the number of depots might be an indication. According to Martens (1981:99), 150 depots have been found in Southeast Norway, 25 depots in western Norway, 15 depots in Trøndelag and possibly one depot in North Norway. The figures for Trøndelag are corrected in a later study to eight depots in Trøndelag (Johansen 2003:41, Figure 4.3). In addition to the depots, single iron currency bars, blooms and finger iron have been found in south Norway as well as in the north. These are often stray finds discovered by chance and never found at prehistoric settlements (Resi 1995:137). Consequently, there is little or no information about any archaeological context. This applies to 25% of the finds of iron currency bars in Southeast Norway (Martens 1978 c:60). The only information is often that they were found next to a large rock, in a cairn, in a mound or in a field without any noticeable structures nearby. This lack of context, which is a problem related to both the depots and the single finds, complicates research on the meaning and significance of the iron currency bars.

One of the most common interpretations of the iron bar deposits is that they were caches, hidden stores to be retrieved when required. Such hidden stores are referred to in the literature as caches, depots and hoards. Here, I will use the term “cache” as a description of such hidden stores of metal objects. The objects in these caches could have served as raw material for the smith, as semi-manufactured products, standardized barter objects, some type of iron money or votive offerings never meant to be retrieved (Dannevig Hauge 1946:172; Herschend 1991:38-40; Petersen 1918:182-183; Resi 1995:137). Bogs seems to have been a preferred place for offerings to higher powers, and a few iron currency bars have indeed been found in such places (Dannevig Hauge 1946:170; Lindeberg 2009:28, 154) (see Chapter 6.5.2, Ts. 4674). However, the many caches found next to a rock or a stone that might have functioned as a topographical mark support the assumption that they were meant to be retrieved at some point. The interpretation of the iron bar caches as temporarily hidden stores of raw materials, semi-manufactured products and standardized barter objects seems plausible in most cases (Resi 1995:137).

6.2 Shape, Quality and Date

Iron currency bars come in many shapes and sizes. Some weigh close to two kilos, while others as little as 10 grams (Dannevig Hauge 1946:163, 174). In his thesis from 1946, Dannevig Hauge (p. 164, Figure 84) points out a possible development from wedge-shaped axes to standardized iron bars. Wedge-shaped axes are the heaviest of the iron bars with an average weight of approximately 1000 grams (Dannevig Hauge 1946:170). Figure 33 represents the main forms Dannevig Hauge (1946) found when studying iron currency bars, although they do exist in a variety of sizes and shapes (Dannevig Hauge 1946: Figures 77-81, 83-85, 87-88; Haglund 1978; Hallinder 1978 a, 1978 b). Most numerous in Southeast Norway is the “loom weight type”, R 438 (Rygh 1885) (Figure 33, Types c and d). This statement is based on figures from 1946, but the number of later finds is not high enough to change this overall picture.

There seems to be a chronological development from tools to the conventional iron bar (R438), from non-standardized forms and tools in the Early Iron Age to the standardized iron blanks of the Late Iron Age (Dannevig Hauge 1946:169; Petersen 1951:135). The latter are considered trade forms, indicating long distance trade with no contact between the producer and consumer. As such, the shape of the iron bar could be seen as a product declaration, a signal from the iron maker to the consumer. To the best of my knowledge, there is no study that verifies an unmistakable connection between shape and quality. Thålin (1973:31) has carried out a chemical analysis of some of the Swedish spade-shaped currency bars and concluded that they have not undergone any higher degree of refining as their composition is uneven and the slag inclusion is often large. Analyses of a few wedge-shaped axes indicate that they were forged from several pieces of inhomogeneous iron (Svane 1991:31). Chemically they are regarded as steel, but some have softer metal around the neck (Buchwald 2005:238). Analysis of a few iron bars of the Type R 438 (Rygh 1885) indicates that the best metal quality is found in the largest specimens that have a quite homogeneous structure (Langeng 2003:11). Analyses of several bars of the Type R 438 found in Southeast Norway show that these have a chemical composition similar to steel, suitable as raw material for knives, tools and steeling (Buchwald 2005:154). However, the chemical profile of iron currency bars varies greatly, and based on chemical analyses it has not been possible to group the bars according to shape and quality (Lindeberg 2009:93-95). If shape were related to quality, one would expect currency bars of different shapes to occur in the same find context. With a few exceptions this is not the case, and the shape therefore seems to be related to the place of production rather than to the quality (op. cit.).

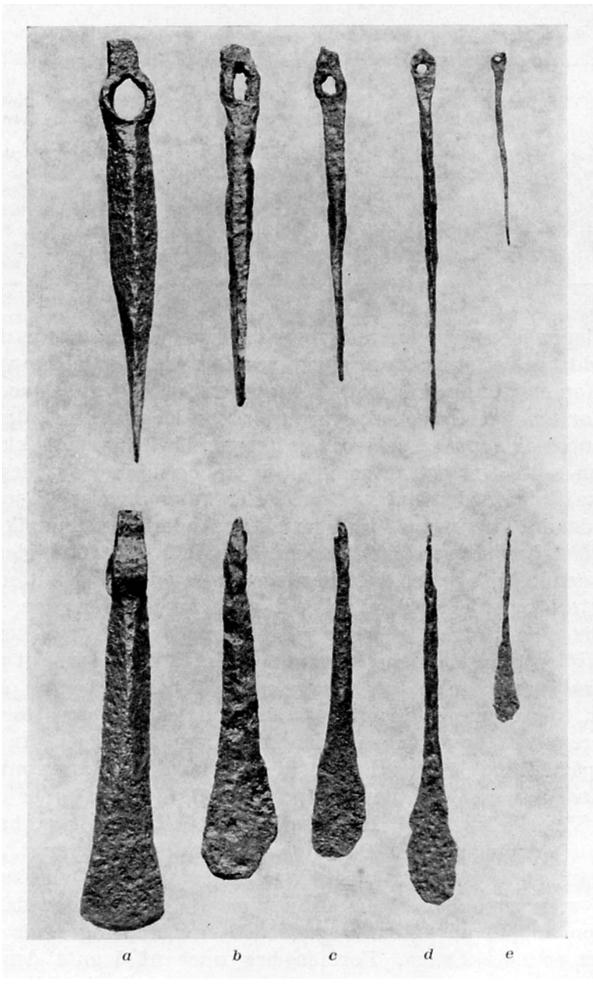

Figure 33 - Iron currency bars (Dannevig Hauge 1946:164, Figure 84)

Iron bars of the loom weight type as well as wedge-shaped axes are also found in Sweden and Denmark (Buchwald 2005:154, 239-241). The chemical profile of slag inclusions in Danish bars is identical to that found in iron produced in Southeast Norway (op. cit.) strongly suggesting that iron currency bars were traded over long distances.

The wedge-shaped axes are dated to both the Early and Late Iron Ages, and due to its long period of use the type is not a good chronological marker. Even so, the oldest wedge-shaped axes, which are dated to the Late Roman and the Migration Periods, are generally small and quite roughly shaped (Figure 34), while some of the younger ones dated to the Merovingian Period and the Early Viking Period are larger (Dannevig Hauge 1946:174; Martens 1981:99). A wedge-shaped axe (C 28600) found at Skjelle in Sel Municipality, Oppland, with a one-meter long handle intact, is dated to AD 590±90 (Buchwald 2005:237)[3]. Many of the wedge-shaped axes are single finds without any find context.

Martens (1981:99) divides the caches chronologically into two groups: those with wedge-shaped axes and tools, presumed to be the oldest, and caches with iron bars and blooms that are supposedly younger. This transition from one group to the next is not well defined since the wedge-shaped axes and blooms are dated to both the Early and Late Iron Ages. Rygh's (1885) iron bar R 438 (Figure 33, Types c and d) seems to be fully developed from AD 600, although it mainly belongs to the Viking Period (Martens 1979). Even though the iron blanks (R 438) and wedge-shaped axes chronologically overlap, they seldom occur in combination (Resi 1995:135).

[3] This information is based on personal communication between V. F. Buchwald and H. Svane, and I have therefore no knowledge about the date BP.

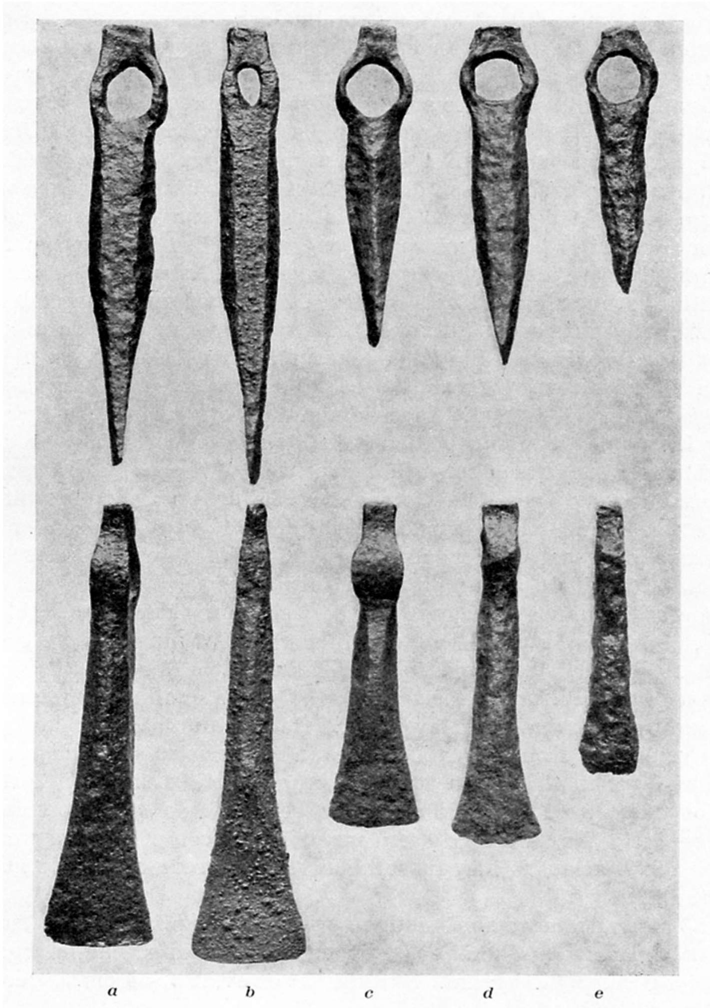

Figure 34 - Typology of wedge-shaped axes (Dannevig Hauge 1946:153, Figure 83)

6.3 Iron Currency Bars in Northern Finland and Northern Sweden

As we have seen, iron production seems to have been less extensive in northern Fennoscandia than in the south during the Iron Age and the Middle Ages. Therefore, the demand for iron must have been satisfied through some kind of trade, possibly including iron currency bars, although these are rather rare in northern Fennoscandia. Only one has been found in Lapland in northern Finland (Mäkivuoti 1988) and none in the far north of the county. The Norrland type of spade-shaped currency bar is distributed mainly in southern Norrland, but none has been found in Upper Norrland. Actually, most iron currency bars found in northern Fennoscandia have been found in North Norway. It may be argued that currency bars were so rare due to the great demand for and insufficient supply of iron. Consequently, most currency bars would have been transformed into tools and the like. However, in regions with many currency bars they are not often found at settlements.

A spade-shaped bar of the Norrland type was found in Torneå in 1984 (Mäkivuoti 1988:41, Figure 5). This is one of two Norrland type currency bars found in Finland. The other was found at Kvarnbo in Saltvik, Åland (Edgren 1993:235; Mäkivuoti 1988:37). The Torneå currency bar, which probably originated in central Sweden or in the southern part of Norrland, is chiefly dated to the Migration and Merovingian Periods (Englund 2002:304; Hallinder 1978 a:33, Figure 3, 34; Lindeberg 2009:40). The idea that this type of iron currency bar was of Swedish origin is supported by the great influx of Scandinavian finds at Åland from the Migration Period, which was probably caused by migrations from Sweden (Edgren 1993:200). A third iron currency bar of nondescript form has been found in Ylivieska in the southern part of Oulu County (Edgren 1993:235).

A variety of iron currency bars has been found in Sweden (Englund 2002:303; Haglund 1978; Hallinder 1978 b:45-46, Figure 15). There are two principal types of iron currency bars: In southeastern and central parts of Sweden, caches of scythe-like bars dominate while spade-shaped bars are most numerous in Norrland (Thålin 1973:24). In all, close to 1,500 spade-shaped iron currency bars have been found (Lindeberg 2009:25, Figure 2; Magnusson 1986:274, Table 34; Ramqvist 1991:315, Figure 6). The spade-shaped bars are found farthest to the north and as such are of greatest interest. They are grouped into two main geographical areas: the coastal region of southern Norrland (i.e. the Counties of Hälsingland and Medelpad) and around Lake Storsjön in Jämtland County (Magnusson 1986:274, Table 34; Thålin 1973:25, 27, Figure 1) (Figure 35). Approximately 400 bars have been found at 23 different locations in Jämtland County (Magnusson 1986:274, Table 34), while approximately 480 bars have been found in Hälsingland (Magnusson 1995:68). The spade-shaped bars occur in three principal forms distinguished mainly by size and weight. Type a, Figure 37, is the most numerous of the three types.

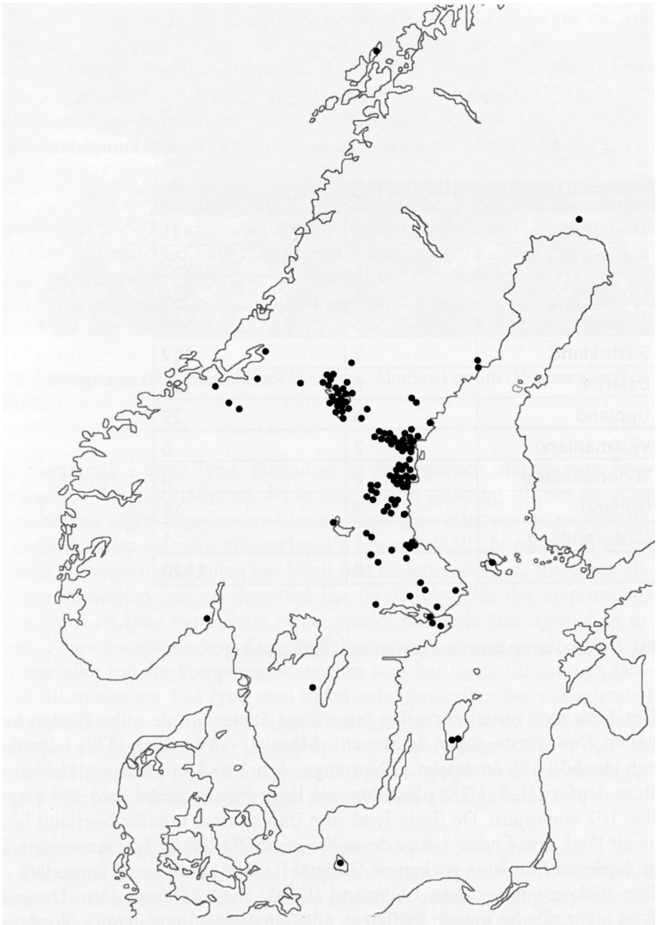

Figure 35 - Geographical distribution of spade-shaped iron currency bars in Sweden (Lindeberg 2009:25, Figure 2)

Traditionally, the spade-shaped bars have been dated to the Migration and Viking Periods (Hallinder 1978 a:33). An improved chronology indicates that most spade-shaped bars seem to have been produced during the Migration and Merovingian Periods, but some as early as in the Early Roman Period and the latest in the Viking Period, i.e. a period of 800-900 years (Englund 2002:304; Hallinder 1978:33; Lindeberg 2009:40).

The spade-shaped currency bars are the most numerous type of currency bar by far, and are presumed to have been the main form in which iron was distributed during the second half of the first millennium AD (Thålin1973:39).

6.4 Southern Norway

The overwhelming majority of iron currency bars are found in Southeast Norway, fewer are found in western Norway, and only a few are found in the southernmost part of southern Norway (Dannevig Hauge 1946:173, Figure 86; Resi 1995: 136, Figure 3). This applies to both single finds and caches.

In addition to iron bars and tools, 24 blooms and finger iron have been found in Southeast Norway, none of which has been found in datable contexts (Martens 1979:192).

Most currency bars in southern Norway seem to have been produced within this region. However, a few spade-shaped bars are found in Trøndelag, which are supposedly of Swedish origin (Hallinder 1978 a:33, Figure 3; Ramqvist 1991:315, Figure 6). According to Petersen (1951:118), three caches of iron currency bars have been found in North Trøndelag but none in South Trøndelag. Martens (1981:99) refers to 15 caches of iron currency bars in the Counties of Trøndelag, but in a later paper Stenvik (1990:115) claims that there are no caches in this region. In a more recent study, Johansen (2003:41, Figure 4.3) documents three caches with spade-shaped bars in South Trøndelag and five in North Trøndelag. According to this study, there are three types of socketed axes found in Trøndelag that may be regarded as iron currency bars. Some of these bars are severely damaged by the ravages of time, but Petersen (1951:118) believed them to be of the Swedish type, i.e. spade-shaped bars. Johansen's Type Ia (2003:37 - 38, Figure 4.2) (Figure 36) is no doubt very similar to the Swedish spade-shaped bars. These bear some resemblance to the socketed axes, but they have probably never been equipped with a wooden handle as they do not have fragments of wood in the socket and are never found in graves. This leads Johansen (2003:38) to believe that this type of "socketed axe" functioned exclusively as an iron currency bar. His Types Ib and IIa[4] (Johansen 2003:38-39) are found in graves as well as in caches, and they are believed to have served several purposes, both as axes and as currency bars. In total, 27 socketed axes have been found in 8 caches in Trøndelag; 6 bars of Type Ia, 5 bars of Type Ib, 14 bars of Type IIa and 2 bars which can only can be identified as Type I and Type II (Johansen 2003:37-39, 2008). The majority of the Norwegian spade-shaped bars are Type b (Figure 37) (Thålin 1973:27, Figure 2) which is identical to Johansen's (2003:38) Type Ia (Figure 36).

[4] The main difference between Johansen's Types I and II is that the latter has a split socket with the opening on the flat side of the blade (Johansen 2003:38).

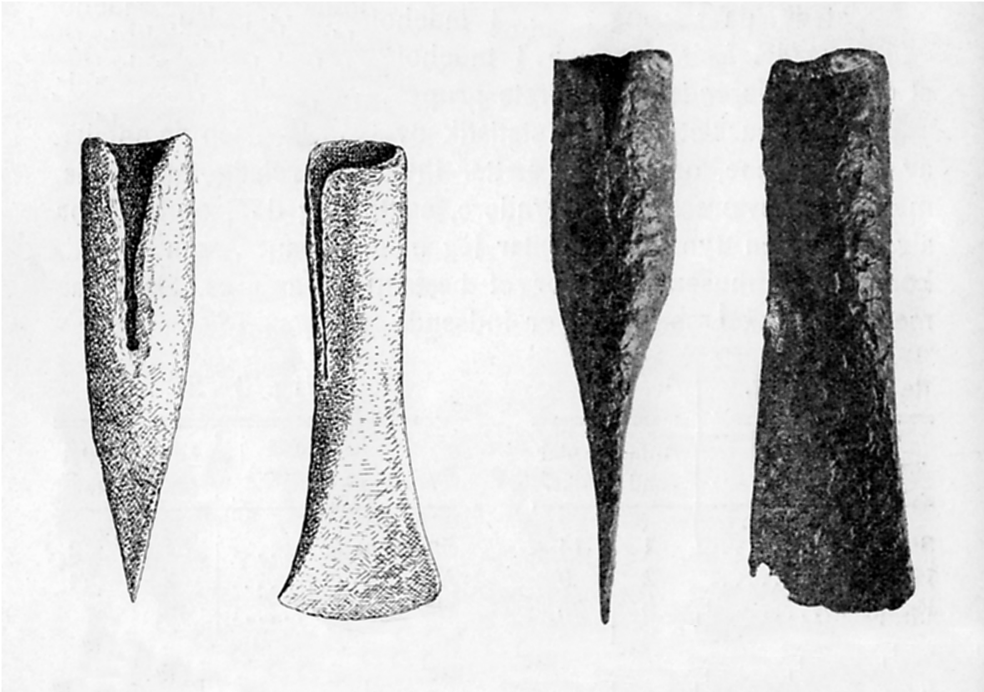

Figure 36 - Socketed axes of Johansen's (2003:37-39) Type Ia (right) and Type Ib (left) (Petersen 1918:180, Figures 8-9)

Figure 37 - Typology of Swedish spade-shaped iron currency bars (Thålin 1973:27, Figure 2)

The only referral to a spade-shaped bar from North Norway is one from Å in Andøy Municipality (Lindeberg 2009:24; Petersen 1951:118). This is a misunderstanding, however, as there are no spade-shaped bars among the finds from the grave at Å (Figure 40, Appendix 17). One of the four socketed axes has probably been misinterpreted to be a spade-shaped bar.

In addition to the bars, seven blooms have been found in Trøndelag: one bloom in South Trøndelag and six in North Trøndelag (Stenvik 2006).

Four of the seven blooms are dated to the Early Iron Age, two by the ^{14}C method and two by find context (Stenvik 2006:259). One of the ^{14}C dates (Tua-3591) date the bloom to 2455$\pm$50 BP, calibrated 761 – 408 BC (Bronk Ramsey 2001, OxCal 3.10, 2005). This is a very early date and Stenvik (2006:259) does not put much trust in it, especially because of the size of the bloom. The bloom T 21175 seems to be half of the original bloom, and its original weight would have been approximately 35 kilos. Stenvik (op. cit.) questions this date, partly because the kind of furnace in which this bloom had been produced has yet to be found. However, the furnaces at Hemmestad are dated to the same period, but these furnaces were far too small to have produced such a large bloom. The congruent dates of T 21175 and the furnaces at Hemmestad indicate that there was also iron production in Trøndelag at such an early date. If the date is correct, the bloom, T 21175, indicates that a different and much bigger furnace had to be in operation in Trøndelag at the very beginning of the Iron Age.

6.5 Iron Currency Bars in North Norway

Iron currency bars have attracted little attention in north Norwegian archaeology. This may be due to a general lack of attention paid to iron technology and iron production, but it may also be that the more numerous and well defined tools and weapons have overshadowed these few finds. The only find of iron currency bars in North Norway that has attracted the attention of archaeologists is a grave find at Å in Andøy Municipality (Petersen 1951:118; Sjøvold 1974:127).

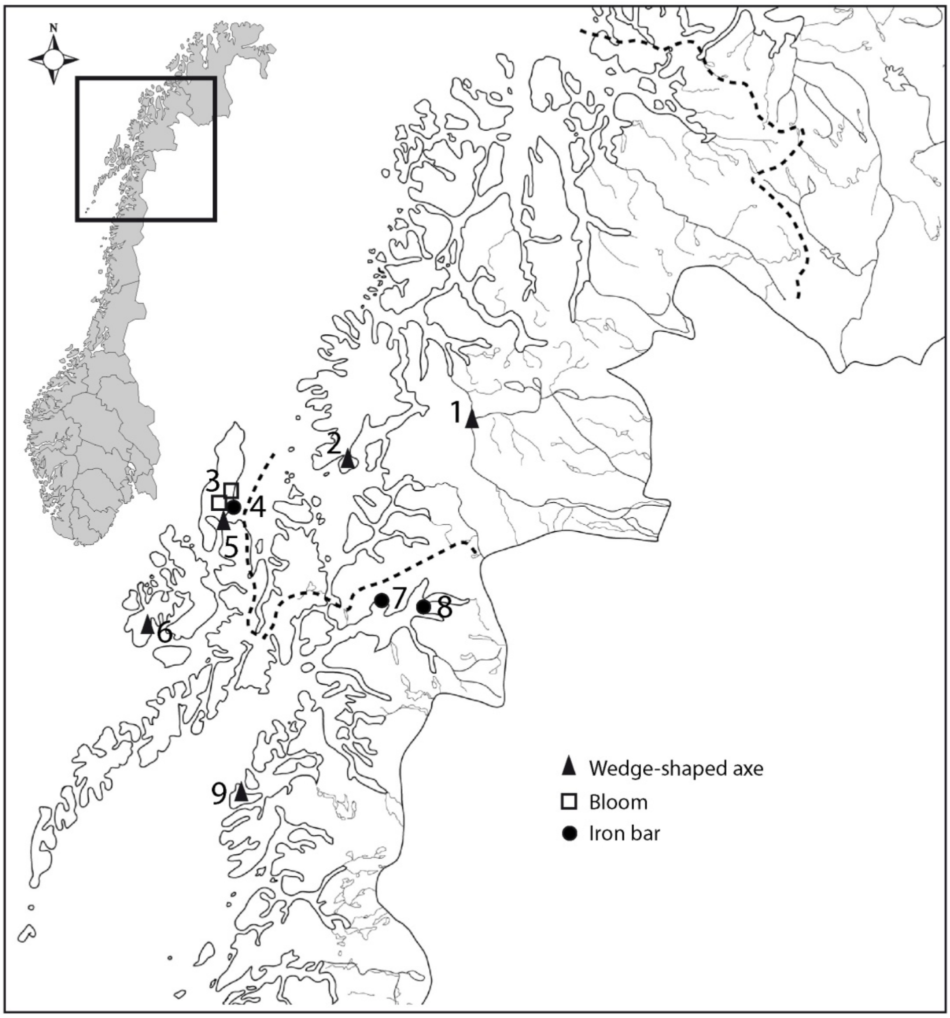

Figure 38 - Iron currency bars in North Norway (cf. Tables 11 and 12) (Graphics: Ernst Høgtun, Tromsø University Museum)

An examination of the finds at Tromsø University Museum reveals that a few iron currency bars have indeed been found in North Norway (Figure 38). However, due to poor preservation and misinterpretation, some iron bars may have been overlooked. It is possible, for example, that iron bars of Type R 438 (Rygh 1885), rod-shaped bars, scythe-shaped bars, plowshare-shaped bars and celt-shaped/spade-shaped bars may have been so badly preserved that their original form and function have never been recognized. The problem of representativity should always be taken into consideration, and small and thin objects are the first to disintegrate when conditions for preservation are unfavorable. It is therefore likely that the most solid objects are better preserved and that this is one reason for the lack of diversity. On the other hand, except for one find at Borkenes in Kvæfjord Municipality (Ts. 2898 - Ts. 2911) and the one at Å in Andøy mentioned above (Ts. 1796 – Ts. 1805, see Chapter 6.5.1, Appendix 17), no caches of iron currency bars have been found in North Norway. The find at Borkenes is especially interesting in this context. A total of 17 objects made of iron were found on the bedrock covered by 75 cm of earth below a knoll called Borkhaugen. The lack of a noticeable surface structure indicates that this could be a grave, and the question of whether this was a flat grave or a cache of iron remains unanswered. With no visible surface structure, no bones and no other indications of a burial, I am inclined to classify this as a cache of iron.

Museum no.	**Artifact**	**Type**	**Period**
Ts. 2898	Axe	Grieg 1923:11, Figure 17	Migration Period
Ts. 2899	Single-edged sword	R 498 (Rygh 1885)	Migration Period
Ts. 2900	Sword handle		Migration Period
Ts. 2901	Fragments of two-edged sword		Late Iron Age
Ts. 2902	Celt	R 401 (Rygh 1885)	Late Iron Age
Ts. 2903	Celt	R 401 (Rygh 1885)	Late Iron Age
Ts. 2904	Pickaxe		Late Iron Age
Ts. 2905	Axe		Migration Period
Ts. 2906	Hammer	R 394 (Rygh 1885)	Late Iron Age
Ts. 2907	Forging tongs	R 391 (Rygh 1885)	Late Iron Age
Ts. 2908	Anvil	R 392 (Rygh 1885)	Late Iron Age
Ts. 2909	Plowshare	R 383 (Rygh 1885)	Late Iron Age
Ts. 2910	Knife-blade		Late Iron Age
Ts. 2911	Four figurines of iron	Aspelin 1877-1884:137, Figures 588-590	Late Iron Age

Table 10 - Artifacts from Borkhaugen in Kvæfjord

The statement that these two finds are the only possible caches in North Norway has to be slightly modified. The find context of tools, weapons and unidentified iron objects is often uncertain, and in many cases it is not possible to determine whether they were deposited in a grave or a cache.

The north Norwegian iron currency bars are divided into two groups: the quite homogenous wedge-shaped axes and the very heterogeneous group “iron bar”. The “iron bar” category is an analytical construction based on the assumption that all objects represented in this group are iron currency bars. They do not have any typological features in common, only the ascribed characteristic of being an iron currency bar.

6.5.1 Wedge-shaped Axes

Seven wedge-shaped axes have been found in Nordland and Troms Counties. All the objects listed in Table 11 have the classic form of a wedge-shaped axe (Norwegian terminology = bleggøks) with a pronounced hammer and a faceted neck.

No.	Museum no.	Length (cm)/weight (g)	Find information	Date	Farm and Municipality
1	Ts. 3299	17.5/555	Stray find	Migration Period	Haugli, Målselv
2	Ts. 1037	13.8/360	Barrow	Late Roman Period	Stangnes, Tranøy
5	Ts. 1800	19/700	Barrow	Early Merovingian Period	Å, Andøy
6	Ts. 2066	14 / ?	Barrow	Early Migration Period	Buøya, Bø
9	Ts. 2687	18 / ?	Barrow	Early Migration Period	Skogøya, Steigen
	Ts. 4574	14.6/450	No information	Iron Age	No information
	Ts. 4575	11.1/300 (fragment)	No information	Iron Age	No information

Table 11 - Wedge-shaped axes (cf. Figure 36)

Ts 1037, Stangnes, Tranøy Municipality

This is a rather small axe with a missing edge (Figure 39). It is 13.8 cm long, the hammer part is quite narrow but distinct, and the handle hole is 4 cm in diameter, which is fairly large for such a small axe. It vaguely resembles a battle-axe (Fett 1940:pl. 1, Figure 3), but it has an even narrower and slightly faceted neck, which is almost round below the handle hole. However, the faceted neck and the protruding hammer indicate that this is a wedge-shaped axe.

Figure 39 - Wedge-shaped axe (Ts. 1037) from Stangnes in Tranøy Municipality (Photo: Jorun Marie Rødli, Tromsø University Museum)

The object was found in a barrow with a diameter of 20 m. An inhumation burial was found together with several objects in a low cist covered with stone slabs (Appendix 18). In total, there had been four graves at the site. Fett (1939:35) tends to date graves with axes to 500-600 AD, but Sjøvold (1962:115), on the basis of a pot found in the grave, date it to the early 5th century.

Ts. 1800, Å, Andøy Municipality

In 1908 a number of artifacts were found in a longish barrow with a circumference equivalent to 36 steps. A number of artifacts found within the barrow indicate that this could just as well have been a cache of tools and iron currency bars as a grave (Figure 40) (Appendix 17).

Figure 40 - Artifacts from a barrow at Å in Andøy Municipality (Photo: Tromsø University Museum)

Ts. 1796-1799 are celts or socketed axes, not to be mistaken for celt-like or spade-shaped iron currency bars which have a much longer blade (Thålin 1973:27, Figure 2). One wedge-shaped axe, Ts. 1800, was found in the barrow (Figure 41). There is a minor inaccuracy in the catalogue as it is said to resemble R. 556, but this is not correct since the object, except perhaps for the neck, looks more like R. 153. Ts. 1800 has a faceted neck like R. 153, while this is not the case with R. 556. The hammer part seems to have been hit several times with a heavy object, indicating that except for functioning as a currency bar it may also have been used as a wedge-shaped axe. Sjøvold (1974:127) describes this as a battle-axe typologically close to Fett, Figure 2 (1940:Plate 1). There can be no doubt, however, that Ts. 1800 is typologically very close to the southern Norwegian wedge-shaped axes (Figure 34).

Figure 41 - Wedge-shaped axe (Ts. 1800) from Å in Andøy Municipality (Photo: Jorun Marie Rødli, Tromsø University Museum)

Based on the shape of a spear (Ts. 1802) found in the grave and the similarity between the wedge-shaped axe and Fett's typology (1940:Figure 2), Sjøvold (1974:127) dates the barrow to the Early Merovingian Period.

Petersen (1951:118) believed this to be a cache based on the composition of finds deposited. Still, the fact that the objects had been deposited in such a mound is a strong indication that this was a grave and that all objects found in it had been deposited with the dead. The lack of skeletal remains may be due to unfavorable conditions for the preservation of bones.

Ts. 2066, Buøya, Bø Municipality

The object Ts. 2066 was found in an earthen barrow, 8.5 m in diameter and 1 m high. It has been missing for years but is said to have been *"... a wedge-shaped axe without a shaft hole. The front part is broken off but preserved*" (author's translation from the museum catalogue). The barrow had been opened prior to Nicolaissen's excavation (1911:82) as the central part had a pronounced depression (Appendix 19).

The barrow was located in an area with several graves, and it is likely that Ts. 2066 was deposited during a burial. The grave is dated to the Early Migration Period (Sjøvold 1962:83).

Ts. 2687, Skogøya, Steigen Municipality

This wedge-shaped axe was found in an earthen barrow, which was excavated in 1921 (Nicolaissen 1921) and has since gone missing. A number of artifacts date the barrow to the Early Migration Period (Appendix 20).

Bones from an inhumation burial found among the artifacts prove beyond a doubt that this was a grave. Again, we see that a wedge-shaped axe is part of the equipment buried along with the dead. The edge of Ts. 2687 is recorded to have ended in a lump of rust, and the width is therefore not given although the length is recorded as being 18 cm. In the same museum catalogue, Nicolaissen has dated the grave to the Migration period. Sjøvold (1962:59) is a bit more precise, and based on a shield-boss and a cruciform brooch fund in the same barrow, he dates the grave to the Early Migration Period.

Ts. 3299, Haugli, Målselv Municipality

While the other wedge-shaped axes have been found in coastal areas dominated by monuments from the Germanic Iron Age, this (Figure 42) was found inland, 35 km from the sea in an area totally devoid of such monuments. No topographical marks such as rocks or large stones are reported on the site where the artifact was found 40 cm deep in sand in 1928.

This is the only find in the artifact catalogue of Tromsø University Museum that is catalogued as a “bleggøks” (wedge-shaped axe). The object resembles R. 153, and the hammer part seems to have been dealt some heavy blows. Therefore, apart from being a currency bar, the item could also have been used as a tool for splitting logs, and the find is dated to the Migration Period (Sjøvold 1962:115).

Figure 42 - Wedge-shaped axe (Ts. 3299) from Haugli in Målselv Municipality (Photo: Jorun Marie Rødli, Tromsø University Museum)

Ts. 4574 and Ts. 4575, no find information

During World War II the occupying powers took possession of Tromsø Museum’s building, and all finds and archives had to be evacuated. When returned to the museum after the war, quite a few finds had lost their tags and as such could not be related to the find catalogue. Among all these finds that were re-catalogued in 1951 were two wedge-shaped axes, Ts. 4574 (Figure 43) and Ts. 4575 (Figure 44). The catalogue’s description would normally help decide whether the missing axes, Ts. 2066 and Ts. 2687, could possibly be the ones that had been re-catalogued. Nonetheless, the pre-war catalogue descriptions of the missing axes do not correspond well with those that were re-catalogued in 1951.

Figure 43 - Wedge-shaped axe (Ts. 4574), unknown place (Photo: Jorun Marie Rødli, Tromsø University Museum)

The missing Ts. 2066 is said to have been 14 cm long and the edge 5 cm wide. Ts. 4574 is the most similar to this, as it is 14.4 cm long with an edge 3.5 cm wide. While the length of the two is fairly similar, there are serious discrepancies when it comes to the width of the edge. Some of the edge is missing, and the damage could have taken place during the process of relocation during and after the war. However, these discrepancies do not support the idea that Ts. 2066 and Ts. 4574 are the same, but rather that they are two different wedge-shaped axes.

Figure 44 - Wedge-shaped axe (Ts. 4575), unknown place (Photo: Jorun Marie Rødli, Tromsø University Museum)

The wedge-shaped axe Ts. 4575 is only 11.1 cm long as it is broken off by the shaft hole and the entire hammer is missing. The missing object, Ts. 2687, was 6.9 cm longer, and Ts. 4575 is therefore not likely to be the missing wedge-shaped axe.

The available data do not indicate that the missing Ts. 2066 and Ts. 2687 are the same as Ts. 4574 and Ts. 4575. As a result, it is possible that the two became part of the collection in the intermediate pre- or post-war period and that any tags or linked information were somehow lost. Both are wedge-shaped axes in the classical form of R. 153. Ts. 4574 is nearly identical to Ts. 1800 and Ts. 3299, and the hammer is slightly flattened on top due to being hammered. Ts. 4575 is quite damaged as it is broken at the handle hole and the hammer part is missing. Despite the damage, there is no doubt that this is a wedge-shaped axe like Ts. 4574. As most dated northern Norwegian wedge-shaped axes seem to belong to the period between the Late Roman Period and the Early Merovingian Period, it is probably correct to place these two within the same chronological timeframe.

Summing up the wedge-shaped axes

Seven wedge-shaped axes have been found in North Norway. Two axes have been lost and another two lack information about find context. Four wedge-shaped axes have been found in earthen mounds, which most likely were barrows, and one was found without any noticeable structures nearby. The latter could have been part of an Iron Age grave without a superstructure, but because this was a single find, it is also possible that people travelling between the farming settlements on the coast to the inland and mountain areas of North Norway and northern Sweden had lost it.

A key point in this discussion is whether the northern Norwegian wedge-shaped axes were currency bars or tools. Chemical analyses based on a few wedge-shaped axes found in Southeast Norway indicate that they were carefully forged from various bits of inhomogeneous iron (Svane 1991:32). This is an indication that they were viewed and treated as finished or semi-finished objects and not as currency bars (op. cit.). None of the northern Norwegian bars was found in caches, but four were found in earthen barrows together with several other artifacts. Like some of those found in North Norway, some of the wedge-shaped axes found in Southeast Norway seem to have been hammered at the head. This is not likely to be related to the production but rather to the use of the artifact. The fact that some of these may have been used as tools does not preclude them from also having functioned as currency bars. On the contrary, this is similar to what is seen in Trøndelag, where Types Ib and IIa of the spade-shaped bars were used in some instances as socketed axes and in other instances functioned as currency bars (Johansen 2003:36-39). The northern Norwegian wedge-shaped axes are massive objects weighing up to 700 g, and because iron was supposedly quite costly in the Iron Age, they were probably precious and valuable to the owner. Some wedge-shaped axes could have been used as tools while others were made to be currency bars, and it is even possible that the function of some of the wedge-shaped axes could have changed throughout their life span, from serving as a wedge-shaped axe to being used as an iron currency bar. It is uncertain, however, whether this functional change was related to a change from the non-standardized forms and tools of the Early Iron Age to standardized iron currency bars in the Late Iron Age (Dannevig Hauge 1946:169; Petersen 1951:135).

6.5.2 Iron Bars

When facing a corroded and badly preserved iron object, it might be difficult to distinguish an iron currency bar from an object with a different function. In iron currency caches found in southeastern Norway, we see that tools were included, indicating that the currency bars could have had more than one purpose. A tool, which originally served one purpose, may have served a completely different purpose in a later operational phase. The decision as to whether a tool should be regarded as an iron bar or a tool is therefore partly based on find context, and a certain degree of assessment is sometimes involved in determining whether an object is to be regarded a tool or an iron bar.

No.	Museum no.	Type	Weight (gram)	Find information	Date	Farm and Municipality
3	Ts. 1805	Bloom	1600	Barrow	Early Merovingian P.	Å, Andøy
3	Ts. 1805	Bloom	1700	Barrow	Early Merovingian P.	Å, Andøy
4	Ts. 1803	Iron bar	269	Barrow	Early Merovingian P.	Å, Andøy
7	Ts. 7365	"Pig iron"	1200	Stray find in potato field	No date	Strand, Evenes
8	Ts. 4674	Spear-shaped	560	Deep in bog	No date	Stormyra, Narvik
	Ts. 4577	Iron plate	2778	No information	No date	No information

Table 12 - Blooms and iron currency bars found in North Norway (cf. Figure 36)

Ts. 1803, Å, Andøy Municipality

This artifact is shaped like a hammerhead without a handle hole (Figure 45). Petersen (1951:118) describes it as a 12 cm long hammer-shaped iron bar. Alternatively, this could have been a wedge-shaped axe broken at the handle hole and re-shaped into its present form. The central part of the object is possibly faceted, and this combined with the shape of the object and the width of the edge support such an interpretation. If so, it must have been a quite long wedge-shaped axe. It is possible, however, that the object never had a handle hole but was used as a chisel instead. The fact that it was found in the same mound as one wedge-shaped axe (Ts. 1800) and two blooms (Ts. 1805) supports the hypothesis that this was an iron currency bar.

The object itself is not datable, but a spear found in the same grave is dated to the Early Merovingian Period (Sjøvold 1974:127).

Figure 45 - Iron bar (Ts. 1803) from Å in Andøy Municipality (Photo: Jorun Marie Rødli, Tromsø University Museum)

Ts. 1805, Å, Andøy Municipality

There are no objects in the northern Norwegian archaeological record that fall within Martens definition (1979:192) of a bloom (see Chapter 6.1). The artifacts that come closest are the two pieces of iron, Ts. 1805, which could be defined as refined blooms or finger iron if they had been partially split. Bloom is probably the most correct term as some of the original surface is still intact. The two blooms have been subject to some hammering, which has slightly flattened both.

These two pieces of iron were found in a barrow at Å in Andøy Municipality along with the one wedge-shaped axe (Figure 41) and several more iron objects (Figure 40). In the catalogue, Ts. 1805 are merely categorized as two pieces of iron (Figure 46), and both objects are approximately rectangular with two “flat” sides. The texture reveals their origin, as the surfaces on the short sides are "spongy" and filled with small pits. They seem to be slightly worked blooms with the original surface on the short sides, while the flat sides have been hammered. The smallest object of the two measure 12 cm by 9.5 cm with a maximum thickness of 4 cm. This artifact weighs 1.6 kg and has a self-weight of 5.63 g/cm^3. The largest artifact measures 10 cm by 10 cm and has a maximum thickness of 5.5 cm. It weighs 1.7 kg and has a self-weight of 5.62 g/cm^3. The self-weight of wrought iron is 7.6 – 7.9 g/cm^3 (Specific Gravity Table For Ceramics, Metals & Minerals). These analyses confirm that the two Ts. 1805 have a self-weight much less than wrought iron, probably because they have inclusions of slag.

Figure 46 - "Blooms" (Ts. 1805) from Å in Andøy Municipality (Photo: Jorun Marie Rødli, Tromsø University Museum)

The partly preserved original "bloom" surface and the low self-weight indicate that the two objects have not been subject to repeated heating and extended hammering as in a purification process to remove the remaining slag.

According to Martens (1978:195), blooms have never been found in graves. It is therefore interesting that these two blooms were found in a structure interpreted to be a grave. Another example of this is the bloom T 22667 which was found in 1997 in a grave at Egge in Steinkjer Municipality (Stenvik 2006:257). The two blooms were found together with several other finds (Ts. 1796 – Ts. 1805).

Based on the shape of a spear (Ts. 1802) found in the grave and the similarity between the wedge-shaped axe and Fett's typology (1940:Figure 2), Sjøvold (1974:127) dates the barrow to the Early Merovingian Period.

Ts. 4577, no find information

There is no find information linked to this artifact, as it probably is one of the finds that lost its tag when being relocated during or after World War II. The iron plate (Figure 47) is damaged in one end, it is presently 29 cm long, 23 cm wide in the undamaged end, and the plate is 1.3 cm thick and weighs 2.8 kg. The find context is unknown and the type itself is not datable. Plate-shaped iron bars are known from Southeast Norway (Dannevig Hauge 1946:114), but it is uncertain whether this is of prehistoric origin and whether it was an iron bar or if it may have served other functions.

Figure 47 - Iron bar (Ts. 4577), unknown place (Photo: Jorun Marie Rødli, Tromsø University Museum)

Ts. 4674, Stormyra, Narvik Municipality

This spear-shaped iron bar (Figure 48) was found in 1951 one meter deep in the bog Stormyra in Narvik Municipality during the work involved in making peat briquettes for heating purposes. The bar is 30.6 cm long, has a maximum width of 3.5 cm and weighs 560 g. The tang is bent as a hook as if for hanging, and the "blade" is curved. In the museum catalogue the artifact is referred to as an "iron bar". However, there is no way of knowing if this really is an iron bar or a semi-finished object such as a spearhead or some other tool.

As the type itself is not datable and as the find context is of no help, the object cannot be dated.

Figure 48 - Iron bar (Ts. 4674) from Stormyra in Narvik Municipality (Photo: Jorun Marie Rødli, Tromsø University Museum)

Ts. 7365, Strand, Evenes Municipality

This artifact is categorized as "pig iron" in the museum catalogue. It was found in 1970 in a potato field at the farm Strand in Evenes Municipality (Figure 49). Ts. 7365 is approximately rectangular with two long parallel sides, one side rather flat while the opposite side is curved. One of the short sides has been cut off while the other is rounded. The flat side is quite uneven with small bumps and pits resembling the surface of a bloom. The object measures 12.4 cm by 7 cm, has a thickness of 3.2 cm, and weighs 1.2 kg. The self-weight is 6.98 g/cm^3, indicating that the iron is quite pure with very little slag. The object was waxed during laboratory treatment to prevent further corrosion, and this might have influenced the analysis of the calculated self-weight. The waxing would have increased the volume, and it is therefore probable that this piece of iron is even more pure and contains less slag than the estimated self-weight indicates. This is a chance find without any reported find context, and the object itself is not datable.

Figure 49 - "Pig iron" (Ts. 7365) from Strand in Evenes Municipality (Photo: Jorun Marie Rødli, Tromsø University Museum)

<u>Summing up the iron bars</u>

In the museum catalogue, a number of objects are referred to as "iron bars". It seems that quite a few have been labeled "iron bar" due to a lack of a proper identification. These are often fragments and otherwise unidentified objects of iron which have different shapes and sizes. Most of these artifacts have been excluded from this review after careful examination. The only ones from this category worth mentioning here are Ts. 6358 and Ts. 7269 from Lyngen Municipality and Ts. 10290, Ts. 10291 a, and Ts. 10291 b from Tana Municipality. These five objects are all catalogued as iron bars. One especially intriguing feature is that Ts. 7269 and Ts. 10291 b have been cut off as if a piece of iron had been needed for some other purpose. However, a careful examination and many inquiries have made it clear that these objects are most likely not prehistoric iron currency bars but probably parts of much younger steam engines.

The number of iron currency bars that differs from the wedge-shaped axes is very small. Three of the six iron bars described in Chapter 6.5.2 are found in the same barrow. Ts. 1803 is catalogued as an iron bar and Ts. 1805 are two blooms. Ts. 7365 is very likely a piece of pig iron that the black smith cut off a piece from for some purpose. The spear-shaped Ts. 4674 is also likely to have been an iron bar while Ts. 4577 is questionable. The small number of iron bars indicates that even though this review may have failed to recognize some, the overall picture demonstrates that there was never a large number of objects of this type.

6.6 Iron Supply

In general, the amount of archaeologically recovered iron seems to be related to the number of iron production sites as both increased in number during the last half of the Pre-Roman Iron Age (Myhre 2002:110). However, this is not always so. Prehistoric burial customs, preservation conditions at the deposition site, archaeological research interests, modern economic development and its influence on archaeological activity are some factors influencing the archaeological record that ends up in the museum magazines. In Trøndelag there is little iron in graves dating to approximately AD 200, the time when iron production peaked. On the other hand, graves dating to the Viking Period are rich in iron, but relatively few iron production sites are dated to this period (Stenvik 2002:51-53).

The caches of iron currency bars found in southern Norway indicate that iron, as a raw material, was part of well-developed system of trade. However, if the iron currency bars were vital to the iron supply during the Iron Age, one would expect to find numerous iron bars in North Norway as well. This clearly is not the case since only two finds could possibly be categorized as caches. The concentration of the Late Iron Age caches in Southeast Norway is found in the region midway between the lower mountain areas where most of the production seems to have taken place and the coastal region where most of the consumers lived (Martens 1981:101). Making this into a hypothetical model for Norway as a whole, one would not expect to find caches of iron currency bars in the north since this region was dominated by consumers. This presupposes that both the iron makers and the intermediaries, those who handled the trade, lived in the south. Iron currency bars could thus have been important in the supply of iron to North Norway without being well represented in the archaeological record. If iron had been scarce, most iron bars would probably have been transformed into objects. The fact that only 13 iron currency bars have been identified among the tens of thousands of Iron Age finds in the archaeological magazine of Tromsø University Museum may be seen as an indication on this.

How were the people of North Norway supplied with iron from the beginning of the iron-using period and throughout the Iron Age? Local iron production does not seem to have played a vital part as it did not represent a continuous effort with any significant capacity. Therefore, local iron production could at best have been a supplement of local importance. It may be argued that a continuous and focused search for iron production sites in the future will document that northern iron production was far more common and much more important for the local supply than today's research status indicates. It is true that more ironworks are likely to be found in the years to come, but there are no indications in the archaeological material that there ever was a comprehensive iron production in North Norway. Due to the seemingly small local production, it is likely that iron had been supplied from outside North Norway. Some of this undoubtedly came in the form of iron currency bars but there is no way of knowing if this was the main distribution form or not. Few iron currency bars have been found (13) and provided that our finds are representative, there are two explanations for this: (1) Iron was scarce and all bars imported were converted to tools, etc. and (2) iron was traded mainly into North Norway in the form of semi-manufactured or manufactured objects, such as tools and weapons.

The scarcity of iron currency bars is not exceptional as only a few have been found in the counties of Trøndelag as well. It is documented beyond doubt that iron production in Trøndelag during the Early Iron Age far exceeded local demand (Stenvik 2003 a:124). According to Petersen (1951:118), the only currency bars found in Trøndelag are the spade-shaped bars. In total, 27 spade-shaped iron currency bars have been found in Trøndelag (Johansen 2008), and it is quite possible that at least some of them (Type Ia) are of Swedish origin (Johansen 2003:37; Thålin 1973:27). There does not seem to be any correlation between the scope of iron production and the number of iron currency bars found in an area, but it seems that iron currency bars as a rule were not produced by the blacksmiths in Trøndelag. In Southeast Norway most iron currency bars are neither found in the production nor in the consumer region, but between those two (Martens 1981:101). Such a distribution pattern is not found in Trøndelag as only a few iron currency bars are found here. Also, given that only seven blooms have been found in Trøndelag, the only reasonable conclusion is that the blacksmiths in Trøndelag transformed blooms into tools and weapons before trading them, and it is most likely that some of these ended up in North Norway.

It is worth observing that all iron currency bars in North Norway have been found in a geographical area strongly influenced by the Germanic Iron Age culture. This is surely related to the fact that most prehistoric iron in North Norway is from graves. Very few Germanic Iron Age graves are found inland and north of this area, and this is naturally reflected in the distribution pattern. It is also worth observing that seven of the thirteen wedge-shaped axes and iron bars are found in graves (see Table 11 and Table 12). This could bee seen as an expression of the high value of iron and thus the high status of the buried. Few settlements from the first millennium AD have been documented in North Troms and Finnmark, and the small number of finds calls for caution when looking into find distribution in these areas.

6.7 Chains of Supply

When discussing the question of how and in what form iron was traded to North Norway, where the iron came from and who the suppliers were also has a bearing on this. During the Pre-Roman Iron Age no geographical area stands out as having had a major surplus in production. This is a period when iron was probably produced in many places but in small quantities. Some settlements along the coast from western Norway to North Troms, the geographical area of the Risvik ceramics, possibly made minor amounts of iron, but the metal could also have been procured through interactions with people to the south and the east. Iron is likely to have been brought into eastern Finnmark during this period from iron-using and iron-producing people in northern Finland and possibly from farther east. There are no indications of local production in Finnmark during this period.

The production of iron grew rapidly in North Trøndelag during the Early Roman Period, and before long the production exceeded by far the local need for iron. It is likely that during most of the Early Iron Age AD, the need for iron in Nordland and Troms was partially satisfied through trade with this area. At the end of the Early Iron Age the iron production’s center of gravity seems to shift eastwards as there seems to be a considerable growth in iron production in Jämtland during this period (Johansen 2003; Magnusson 1986). There is a noticeable Swedish influence in the northern Norwegian archaeological material from the Late Migration Period and into the Merovingian Period (Sjøvold 1974:358). A similar but stronger trend is seen in Trøndelag (op. cit.). Both single finds such as a sword found in Karlsøy Municipality (Ts. 299), typological groups like the Vendel spearheads, R. 519 (Rygh 1885) and ornamental features clearly reflect increased contact and trade with eastern

Scandinavia (Sjøvold 1974:358-359). However, no spade-shaped iron currency bar of the Swedish type has ever been found in North Norway that would indicate such a trade. We have no way of knowing if these increased eastern contacts included trade with iron, but it is possible that Jämtland was important in supplying the northern Norwegian settlements with iron during the Late Iron Age. This could have been organized through direct contact or channeled through the previously established contacts in Trøndelag.

In the Iron Age contacts with western and southwestern Norway seem to be strong. During the Late Iron Age there is a considerable surplus production of iron in the lower mountain areas of Southeast Norway. The archaeological material does not allow for categorical statements about which production area was most important in supplying North Norway with iron during the Late Iron Age. It seems likely that iron did not come from only one production area but rather through many of the channels characteristic of the external contacts during the period.

7 BLACKSMITHS

For blacksmiths, an intimate knowledge of iron is part of the craft. They deal with metal in its various forms and no one else in traditional societies had such a thorough insight in its characteristics and qualities. In north Norwegian rural societies, blacksmiths have for the last few hundred years dealt with smithing, i.e. repairing and modifying objects and the production of new objects. From such a perspective, one might ask why the craft of blacksmiths should be of interest when exploring the supply of iron. Ethnoarchaeological studies from traditional societies in Africa and Asia (Barndon 1992, 2001, 2004 b; Haaland 2004; Haaland, Haaland and Rijal 2002; Rijal 1998; Schmidt and Mapunda 1997; Østigård 2007) demonstrate that the blacksmith not only worked in the smithy with modifying and creating new iron objects, but were also in charge of the production of iron itself. Thus, also when exploring iron production and supply we have to bring the role of the blacksmith into consideration.

Blacksmiths were specialists not only in producing and forging iron, but the old Norse term *smið* also implied a person also working with wood and bone (Blindheim 1962:36; Jansson1981:162). The archaeological material also indicates this, as tools for working with wood and bone are often found in graves in combination with blacksmith's tools. In addition to wood, bone and iron, many smiths also worked with copper, bronze, silver and gold. Blacksmith's tools found in graves are often unsuitable for working with iron and could have only been used for working with softer metals. Examples of such tools are small and light hammers, small tongs, sheet metal shears, crucibles, molds and small anvils.

Due to the few iron production sites found in North Norway, it is not likely that there was an extensive iron production during the Iron Age. If so, the role of the north Norwegian blacksmith was probably different from one living in a society in which local iron production was of great importance, and the blacksmith's role would mainly have been as a smith and not so much as a smelter. By taking a closer look at the distribution and the number of graves with blacksmith's tools, I hope to better understand the role of the prehistoric blacksmith and if this was a craft known to most or only a few knowledgeable men. There is no necessary link between the number of blacksmiths in a society and the importance of iron. A few blacksmiths may imply that there was little use for iron and consequently little need for the skills of a blacksmith. Likewise, a high number of blacksmiths could indicate a comprehensive use of iron and that their services were in high demand. However, the existence of many blacksmiths can also imply a shortage of iron and therefore a need for the services of a blacksmith to repair and modify broken and worn-out objects. As such, there is no one-to-one relationship between the estimated number of blacksmiths and the amount of iron.

Even if the number of blacksmith graves is not directly related to the importance of iron, it may be an indication concerning the knowledge of iron work and the extent of iron production in society in general. As most blacksmiths probably had some knowledge of both producing and forging iron, a high number of them would imply that information about iron production was widespread. Likewise, few blacksmiths can be an indication that only a few had any knowledge of iron technology.

In Norwegian archaeological literature, the craft of the blacksmith seems to have been held in high esteem (Sjøvold 1974:306), which is supported by the fact that some of the graves with blacksmith's tools are quite rich in weapons and riding equipment. Ethnoarchaeological studies indicate that the blacksmith's role in society may have been much more diversified than has generally been taken into consideration.

> *Attempts to generalize about the role and the social status of the smith in Africa have foundered in the face of seemingly unmanageable diversity: here the smith is simply an artisan, there he is not only metalworker but also circumciser, burier of the dead, diviner, musician, maker of charms, peacemaker, and counselor of kings…*
>
> *Here, anyone can learn the trade through payment and apprenticeship; there, one must be born a smith and marry only within other smithing lineages. Here, the smith differs little from anyone else socially; there, he is a polluted outsider.* (Herbert 1993:12)

The status of the blacksmith in an ethnographic context seems to have ranged from that of fear, contempt and loathing to one of respect and awe (Rowlands 1971:216).

Apart from yielding insight and ideas about aspects of life, one main lesson from ethnoarchaeological studies is that the material left to the archaeologist, hardly can grasp the multitude of the roles and statuses that Iron Age man possibly may have had. For example, the seemingly rich graves with blacksmith's tools could represent blacksmiths or "aristocrats" buried with blacksmith tools. Despite this ambiguity in the meaning of blacksmith's tools in prehistoric contexts, I will, in chapter 7.2, present a short review of research into the prehistoric blacksmith.

7.1 Smithies

Nevertheless, the smith's work is closely linked to his workplace and the smithy, and even ambulating blacksmiths would need a smithy where he could conduct his craft. The number of smithies at any given time could therefore be seen as a rough reflection of the number of blacksmiths and vice versa. For example, many Late Iron Age smithies would imply a high number of blacksmiths during the same period. For that reason, before going into the intricacies of the role of the blacksmith I will give a short review of the smithies which have been excavated in North Norway.

7.1.1 Excavated Smithies

In 1960 and 1961, G. S. Munch and J. S. Munch excavated the prehistoric farm at Greipstad outside Tromsø (Munch 1965). Five presumably Migration Period houses were excavated and minor pieces of iron slag were found in several houses, and "large" amounts of charcoal and iron slag were found in two of the excavated houses. The fireplace in one of the houses was a shallow depression where four flagstones were placed horizontally next to each other. This constructional feature, combined with the finds of charcoal and iron slag, led to the conclusion that the fireplace had been a forge. Next to this, several minor post holes were found which may have served as a stand for the bellows. (Munch 1965:23)

In 1988-1989, the medieval farm Stauran in Skånland Municipality, Nordland County, was excavated (Urbanczyk 1991, 1992). Some charcoal pits and iron slag led Urbanczyk (1991:124, 134) to draw the conclusion that iron had been produced at the site. In Chapter 2.3.1, I have argued against this, though I agree with Urbanczyk (1991:136, 153, Figure 15) that there had been a smithy at the farm. There are, however, few preserved constructional features which can help in reconstructing the smithy. The farm was deserted sometime during the 14th century (Urbanczyk 1991:137).

During excavations in 2006 and 2007 at Skålbunes, next to Saltstraumen, some Iron Age houses were discovered (Grydeland 2008). A fireplace measuring 110 cm by 55 cm was found in one of the houses (Olsen 2008:44, Figure 5.12, 5.13), and burned bones found in the western part of the fireplace indicate that it had probably been used for cooking purposes. The eastern part, measuring 60 cm by 55 cm, seems to have been a forge (Floor 2009) which had been isolated from the cooking place by a raised flagstone, while two rocks in the northeastern part of the forge had probably served as anvils. A 1.3 kg piece of iron slag was found close to the hearth which supports the interpretation of this being a forge. (Olsen 2008:44, 50)

The house is dated by three radiocarbon dates, all of which go back to the late Viking Age or Medieval Periods, although the center of gravity for all three falls within the Early Medieval Period, most probably during the 12th century (Eilertsen Arntzen 2008:18; Hole 2009:17-18).

Two flat pieces of soapstone (Ts. 11933.14-15) (Olsen 2008:49, Figure 5.19), each with a hole drilled through, were found in the middle of the house approximately 3 meters from the forge. Three spindle whorls found nearby support the interpretation of these as being loom weights. However, soapstone is a very heat resistant material often used to shield the bellows from the heat of the forge, so an alternative interpretation of the two "loom weights" may be that they had been used as forge-stones. The two objects are roughly circular and quite thin and flat, and would have worked well as a heat shield for protecting the bellows. One of the objects (Ts. 11933.15) is sheared at the hole with one half missing. Prolonged thermal stress would be possible to recognize, but short-term use would probably not have left any noticeable traces.

7.1.2 Forge-stones

Many of the artifacts which would normally have been seen as part of a blacksmith's toolbox, may have been used for other purposes as well. Forge-stones are a find category, which may have had hardly any other use than in a smithy. According to Grieg (1922:65), there is no typology as the shape of the raw material determines the shape of the forge-stone. However, when studying the archaeological material, there seems to be two main types of forge-stones: a cylindrical and a shield-shaped type. The cylindrical type is sometimes slightly cone-shaped with the narrow part facing the forge with an underside that is often flat, while the sides and the top are either facetted or roundish. Its main function was to create a distance between the bellows and the forge, thus reducing its heat influence on the bellows. The shield-shaped type is most often an irregular, flat stone with a hole drilled through the center, which basically worked as a heat shield between the forge and the bellows. Both types have a funnel-shaped hole with the narrow opening facing the forge, while the bellows were attached to the wider opening at the opposite end. The main purpose of both of these types of forge-stones was to create distance and shield the bellows from the heat of the forge. They had been exposed to great heat and are therefore often fragmentary, brittle and badly burned on the side facing the forge.

According to a survey performed by H. G. Resi (1979:141-142), 29 forge-stones had been found in Norway in 1979, of which 10 were found in North Norway. A thorough examination of archives and find magazines at the Tromsø University Museum increased the number of forge-stones found in North Norway to 22: 12 from Nordland, 9 from Troms and 1 from Finnmark Counties (Figure 50).

The distribution pattern is congruent with the majority of finds belonging to the Germanic Iron Age. Except for one, all are found in the coastal areas south of Finnmark where the great majority of the Germanic Iron Age finds have been done. The only exception is the forge-stone from Nyrud in Sør-Varanger (Ts. 4396 a), which is far north and east of the core area of the Germanic Iron Age settlement.

Most forge-stones found in North Norway are made of soapstone, and there are two reasons for this: soapstone is a highly heat-resistant material and is soft and quite easy to shape and drill a hole through. The only exception is a forge-stone made of clay (Ts. 6099 y), found at Grunnfarnes in Torsken Municipality. Only a fragment is preserved, so even though it is possible that the artifact may have served another purpose, the interpretation of this being a forge-stone seems probable.

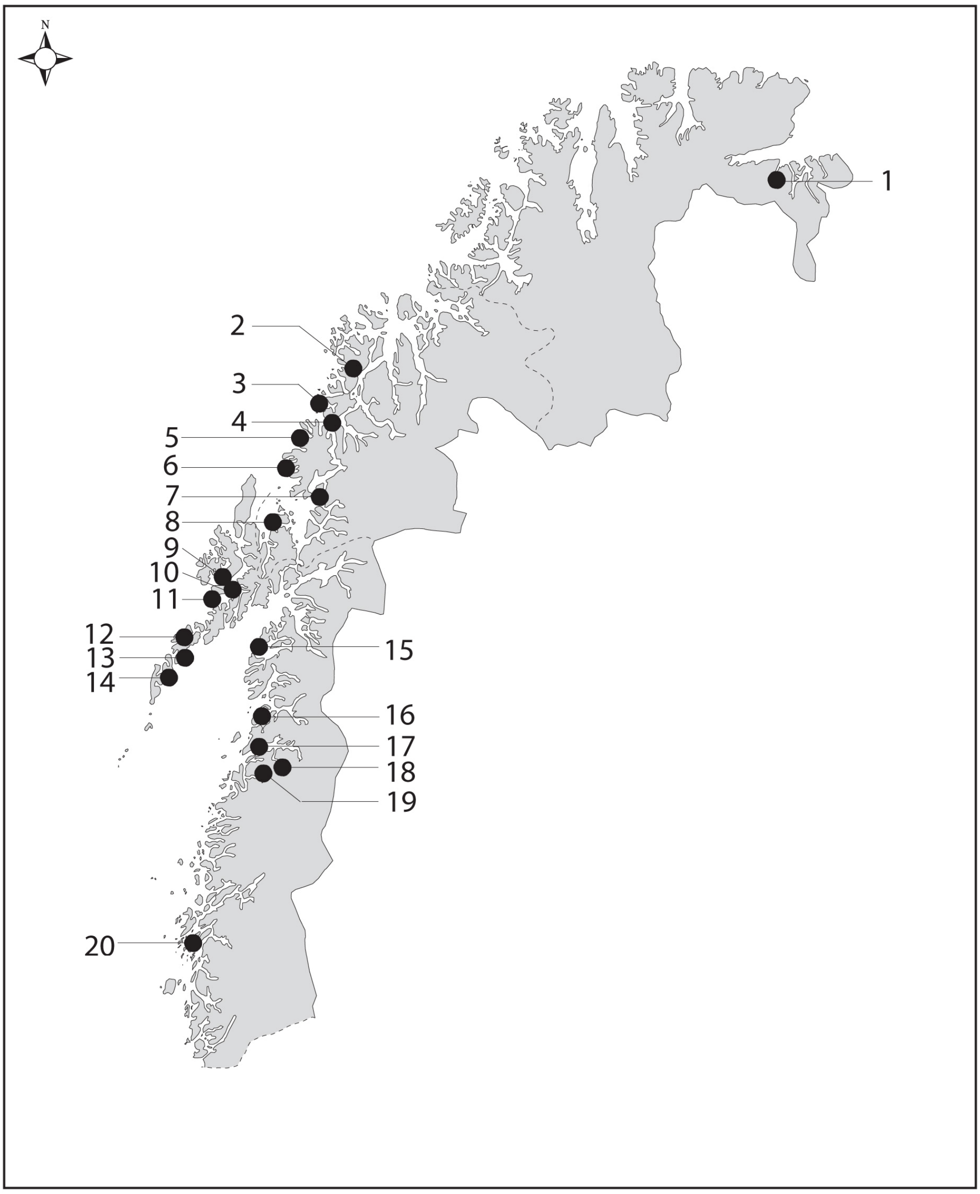

Figure 50 - Forge-stones found in North Norway (Graphics: Adnan Icagic, Tromsø University Museum)

No.	Mus. No.	Farm/Municipality	Grave/ Settlement	Date	Ornament/ Inscription	Cylindrical/ Shield-shaped
1	Ts. 4396 a	Nyrud, Sør-Varanger	Chance find	?	-	Shield
2	Ts. 6298 c	Greipstad, Tromsø	Settlement	Medieval P.	-	Shield
3	Ts. 6749 a	Tussøy, Tromsø	Grave	L. I. A.	-	Shield
4	Ts. 4651 n	Sandvik, Tromsø	Settlement	Medieval P.	-	Shield
5	Ts. 8094	Steinfjord, Berg	Grave	Viking P.	X	Cylindrical
6	Ts. 6099 y	Grunnfarnes, Torsken	Settlement	Med./Mod.	-	Cylindrical
7	Ts. 10385 b	Holm, Dyrøy	Settlement (?)	?	-	Cylindrical
8	Ts. 4762 p	Ytre Elgsnes, Harstad	Grave	Viking P.	-	Cylindrical
9	Ts. 5044 a	Hov, Hadsel	Settlement	Vik./Med.	X	Cylindrical
10	Ts. 5044 b	Hov, Hadsel	Settlement	Vik./Med.	X	Cylindrical
11	Ts. 5044 d	Hov, Hadsel	Settlement	Vik./Med.	-	Shield
12	Ts. 2964	Risøya, Hadsel	Grave	Viking P.	-	Shield
13	Ts. 2918	Husby, Hadsel	Grave	Viking P.	-	Shield
14	Ts. 8343 aj	Borg, Vestvågøy	Settlement	L. I. A.	-	Shield
15	Ts. 7016	Skotnes, Vestvågøy	Settlement	?	X	Cylindrical
16	Ts. 5400 e	Vestre Nesland, Flakstad	Settlement	Medieval P.	-	Shield
17	Ts. 1172	Lund, Steigen	Grave	L. I. A.	X	Cylindrical
18	Ts. 10337	Tverrbakkan, Bodø	Settlement	Medieval P.	-	Cylindrical
19	Ts. 11723.20	Knaplund, Bodø	Settlement	Vik./Med.	-	Cylindrical
20	Ts. 6251 de	Vestvatn, Bodø	Settlement	Medieval P.	-	Shield
21	Ts. 4409 b	Nordland, Beiarn	Chance find	Vik./M.P.	-	Shield
22	T. 17950	Dalen, Alstahaug	Chance find	?	-	Shield

Table 13 - Forge-stones found in North Norway

Forge-stones are generally without ornaments, although there are a few exceptions which either have ornaments or inscriptions and all of those are of the cylindrical type. The find from Steinfjord, Berg Municipality (Ts. 8094) has a mark engraved which either identified the owner or the manufacturer of the stone, and the tradition of marking objects goes back at least 2000 years in time (Olsen 1983; Solberg 1909:42-45, Figures 65, 66, 80, 1911:351). Today, the mark on the forge-stone cannot be deciphered and is of no help in dating the object. The forge-stone from Tverrbakkan, Bodø Municipality (Ts. 10337) has the inscription 1415 or 14/5 engraved on it, but 1415 is not likely to represent the year the forge-stone was in use. The inscription has been scrutinized by experts at the National Archives who expressed the opinion that using Arabic numbers was quite unusual in the early part of the 15th Century and that the style of writing numbers looks much younger (email from J.- R. Kristiansen Ugulen dated 23.04.2009).

There are four other forge-stones that have a different type of ornamentation, and the one from Skotnes, Vestvågøy Municipality (Ts. 7016) has several v-shaped grooves cut into the stone's longitudinal direction, though the grooves are of different lengths. Only the cylindrical part facing the forge is preserved, thus making it impossible to recognize if any ornamental pattern has covered a greater part of the stone. The forge-stone from Lund in Steigen Municipality (Ts. 1172) has six parallel lines engraved around the upper side of the end of the stone that faces the bellows, while the last two cylindrical forge-stones with ornaments are from Hov in Hadsel Municipality. Ts. 5044 a has a crosswise and sidelong pattern of two or three parallel lines (see Figure 51). The other forge-stone from Hov (Ts. 5044 b) has a ribbon towards the end that faces the bellows and looks like a twisted rope or weaved ribbons, and close to the end which faces the forge, two circles are connected with two parallel lines, as in a ribbon. Munch (1962:21-22) thinks that these ornaments may be part of a stylized human face; the two circles are the eyes, while the connecting band indicates the forehead or the eyebrows. The forge end of the stone is missing, meaning that Munch's hypothesis cannot be substantiated. However, a forge-stone from Snaptun in Jylland in Denmark definitely has a carved out face, which has been interpreted to be a depiction of the Nordic God Loke (Bæksted 2001:86). The face is very detailed with adjoining eyebrows, curly hair, a long mustache, a small chin and a mouth which seems to have been sewn together, as the stitches clearly are visible.

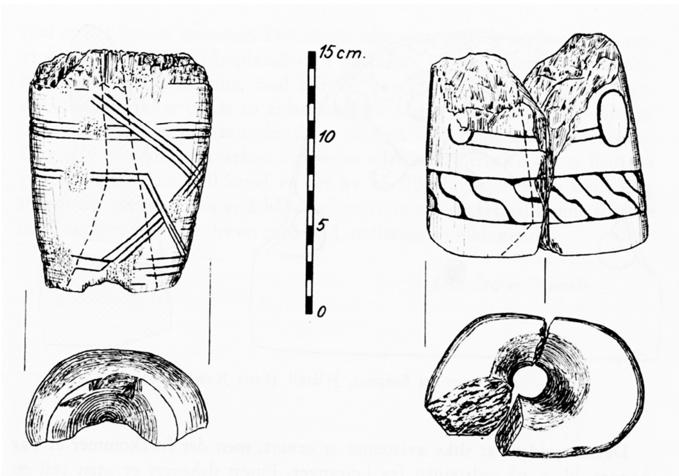

Figure 51 - Ornamented forge-stones (Ts. 5044 a and b) from Hov in Hadsel Municipality (Munch 1962:21)

Figure 52 - Forge-stone from Snaptun in Jylland, Denmark (Horsens Museum, homepage)

According to the sagas, the dwarf Brokk who had won Loke's head during a wager did this, but as revenge for not being able to separate the head from the body, he stitched Loke's lips together (op. cit.). This connection between the mythological sphere and ironworking is supported by information from elsewhere about the magical and mythical aspects of the craft and are especially well documented in Africa and Asia (Barndon 2001, 2004 a, 2004 b; Haaland 2004; Haaland, Haaland and Rijal 2002; Rijal 1998). It is thus possible that the ornaments on the forge-stone from Hov (Ts. 5044 b) may have had mytological significance. This, however, can be no more than mere speculation also because the stone is heavily fragmented. Nevertheless, there is another find, which may indicate such a connection between metal tradecraft and the supernatural world. A triangular, shield-shaped forge-stone (Ts. 8343 aj) was found during the excavation of the chieftain's house at Borg in Vestvågøy Municipality in a post hole inside the great house (Johansen, Kristiansen and Munch 2003:147, Figure 9B.7). Three gold foil plaques known as "gullgubbe", were found in the same room which is thought to have been the hall where the great feasts took place and where the chieftain conducted religious ceremonies (Munch 2003:251, 254, Figure 9H.13). Moreover, the three forge-stones from Hov in Hadsel are all found at Lundhaugen, a place where the local Hov was supposedly located (Munch 1962:22). The Hov was a place where the old Nordic Gods were worshipped, and placing a smithy in such a milieu might have been the result of Iron Age society's understanding and perception of the contemporary blacksmith's craft and its relationship to supernatural powers.

Another indication that the production and working of iron might not only had practical but also magical and symbolic values, is the Norwegian word "avlstein", which means "forge-stone" (Haaland 2004:16). The syllable "avl" may be derived from the old Nordic word “afl” which refers to strength and power. “Avl” may also refer to cultivation, harvest and reproduction (Bokmålsordboka). This linguistic indication of an historic connection between reproduction and the craft of the blacksmith is very much the same as has been documented in ethnoarchaeological works in Africa and Asia where reproductive symbolism is conspicuous. Seen in connection with the forge-stones found at a Hov where the Gods were worshiped, their possible face-like ornaments as well as the deposition of the forge-stone at Borg, it does not seem likely that the the craft of the Iron Age blacksmith only was guided by technical knowhow and practical measures. This information rather indicate that magic, symbols and contact with the supernatural sphere was an indispensable part of the blacksmith’s work, in addition to being a prerequisite for a successful outcome.

The oldest forge-stones may date back to the Merovingian Period, but the vast majority has been dated to the Viking and Medieval Periods. As no chronology-based typology has been worked out, the forge-stones can only be dated according to their find context. Four of the finds have no known find context and can therefore not be dated, while seven finds are dated to the Late Iron Age, five to the Viking/Medieval Periods, five to the Medieval Periods and one to either the Medieval or Modern.

Type of forge-stone	**Late Iron Age**	**Late Iron Age/ Medieval**	**Medieval**	**Medieval/ Modern**
Shield-shaped	4	2	4	
Cylindrical	3	3	1	1

Table 14 - Date of the north Norwegian forge-stones

According to Table 14, the shield-shaped type is evenly distributed between the Late Iron Age and Medieval Periods. The cylindrical type seems to be slightly more numerous in the Iron Age than in the Medieval Periods, although the numbers are small and the possibilities for statistical errors great. When looking into the two type’s find context Table 13 indicates a nearly even distribution; three disk-shaped have been found in graves, while six have been found at settlements, three cylindrical-shaped have been found in graves, and seven have been found at settlements. Not surprisingly, all grave finds are dated to the Late Iron Age. Only one settlement find is definitely dated to the Late Iron Age, four are dated to either the Late Iron Age or the

Medieval Periods, five are dated to the Medieval Periods, and one is supposed to be of modern origin. All of this supports Grieg's hypothesis (1922:65) that the shape of the forge-stones is entirely random and not related neither to any chronology.

When looking into the find context, six forge-stones have been found in graves, 13 have been found at settlement sites and three have no further information in regard to find context (Table 13). All settlement finds have been conducted by amateurs, resulting in the fact that information about the find context is therefore incomplete and not reliable. The grave finds are somewhat different since they are closed finds, and some have been found during archaeological excavations. In three of the graves (Husby, Tussøy and Steinfjord), no blacksmith tools were found except for the forge-stones, while the three other graves (Lund, Risøy and Ytre Elgsnes) are among those with the most blacksmith's tools found in North Norway (Table 16).

7.1.3 Smithies: A Résumé

This short review demonstrates that only three smithies have been excavated in North Norway and only one of those is dated to the Iron Age with any certainty. However, seven out of 22 forge-stones are definitely dated to the Late Iron Age, and another five are found in context with both Late Iron Age and Medieval finds. Even given that the latter date to the Late Iron Age, there are still only 12 forge-stones and one smithy dated to this period. If we accept that each forge-stone represents a smithy, there is evidence of only 8 (possibly as much as 13) smithies in all of North Norway from the 450-year-long period representing the Late Iron Age, which surely cannot reflect prehistoric reality. Archaeological excavations have documented slag to be present in most Iron Age farms, which indicates that smithing was a quite common activity. This low number of smithies may be explained by how excavations have been performed at Iron Age farms. Most excavations have been quite small trenches inside the house structures, and very little has been excavated on the outside of the house. If the smithies were located outside the farmhouses and even outside the farm courtyard, as seen at Rødsmoen in Southeast Norway (Narmo 1997), they would most likely not have been discovered and excavated. Another possibility is that smithies may have been excavated without being recognized as such by the archaeologists, so if the type of smithy found at Skålbunes was the norm, it is possible that the archaeologists may have failed to recognize that fireplaces inside houses could have served as more than just for heating and cooking purposes.

7.2 "Blacksmith's Graves" or "Graves with Blacksmith's Tools"?

For a long time, prehistoric blacksmiths have attracted the attention of archaeologists. The two major works by S. Grieg (1920) and J. Petersen (1951) take into account all finds of blacksmith tools that were known at the time of publication and several later works have dealt with this group of finds either on a regional basis or as individual finds (Blindheim 1963; Bøckman 2007; Christensen 1990; Martens 2002; Narmo 1997; Sauvage 2005; Simonsen 1953; Sjøvold 1962, 1974; Straume 1986; Wallander 1989).

Grieg (1922) and Petersen (1951) discuss many aspects of the blacksmith's trade and have surveyed in detail finds of blacksmith's tools. In these and other works, some questions tend to be repeatedly discussed: Were the blacksmiths ambulating or did those who needed their services seek them out? Were they free men or servants? Were they professional blacksmiths or was this a trade which they practiced in addition to/between other tasks? These are not questions that will be dealt with here, but instead I will look into some other aspects of the significance of the north Norwegian graves with respect to the blacksmith's tools. Can the number of graves with blacksmith's tools be seen as indicative of the supply of iron, the abundance or the lack of iron, or are these variables independent of each other?

One major problem is actually how to define a blacksmith's grave. Blacksmith tools are often found in combination with weapons, hunting and horse riding equipment, and most graves with a variety of blacksmith tools also have objects that indicated a high social status (Straume 1986:46). Based on a combination of finds from the Late Iron Age, Petersen (1951:111) concluded that many of the most prominent men were also practicing blacksmiths. This pattern, in which the amount and the types of weapons is an indicator of the deceased's status, seems valid as well in terms of the north Norwegian grave material (Storli 2006:87-88).

A complete set of weapons (e.g. sword, spearhead, axe and shield), in combination with blacksmith's tools, is only found in one grave which is located at Risøya in

Hadsel. A set of bridles was also found in this grave, thus strengthening the impression of this being a grave of an individual with a very high status. It is worth noting that of the 37 graves with blacksmith's tools found in North Norway, 32% had at least three types of weapons, 76% had two types of weapons or more, and 89% of had at least one type of weapon. Horse-related equipment was found in five graves, while hunting equipment was only found in three graves. Provided that the number of weapons-types found in graves indicates social status, the link between a blacksmith's tools and a high status seems strong. (Appendix 21)

It is therefore difficult to distinguish between a blacksmith and a high-ranking member of society who also practiced blacksmithing. Petersen (1951:113) sidesteps this dilemma by taking the stand that graves where the blacksmith's tools constitute a dominate part of the grave goods probably represent a blacksmith's grave. Straume's (1986:46) definition of a blacksmith's grave is somewhat similar: A grave where the blacksmith's tools are the only finds or constitute a dominate part of the grave goods. Based on this definition, and with the Iron Age as a chronological framework, Straume (1986:48, Figure 2) ends up with only 20 blacksmith graves in the whole of western Europe. Quite a large portion of the graves are found in Norway, including five in southern Norway and one in the north (op. cit.). Considering that the Iron Age covered a time span of 1500 years, these numbers hardly make any sense. Another problem with such a strict definition is that the richest find of blacksmith tools in Norway, the Bygland grave (Blindheim 1963), falls outside such a definition because of all the other artifacts found in the grave. Martens (2002:176) questions such a rigid definition, but maintains that the more blacksmith tools there are in a grave, the more likely it is that the person buried was a blacksmith.

Based on archaeological finds and ethnographical material, Grieg (1920:91) has estimated the number of tools necessary in a Viking Age smithy to have been approximately 12. He (op. cit.) figures that such a smithy would have two hammers, two or three tongs, one pair of sheet metal shears, one or two anvils, one file, one chisel, one nail-making iron, one forge-stone and a bellows. Except for the Bygland grave (Blindheim 1963), there are no examples that the entire inventory in a smithy has been put in a grave. As Petersen (1951:108) points out, the overwhelming majority of graves with blacksmith tools have only one tool.

The most comprehensive work on prehistoric blacksmith's tools is Petersen's monograph (1951) about tools in the Viking Age. The book is more than half a century old, but the inventory of archaeological finds on which it is based is even older. The review of the north Norwegian finds was up to date until 1939, and the conclusions are thus based on data nearly 70 years old. There have surely been new finds conducted since its publication, but new regional works such as Sjøvold's "The Iron Age Settlement of Arctic Norway" (1974) have not changed the overall tendency with regard to either geographical distribution or chronology.

7.3 Graves with Blacksmith's Tools in North Norway

In a survey conducted by Straume (1986:49), graves with blacksmith's tools were found in continental Europe dating back to the Pre-Roman Period and in Denmark to the Early Roman Period. In Norway, one of the oldest graves with blacksmith's tools seems to be the Vestly grave in Rogaland (Møllerop 1961:13), which dates to the Migration Period. The small-sized implements found indicate that they belonged to a goldsmith (Magnus, Møllerop and Sjøvold 1966). In North Norway, the oldest blacksmith tools are found in a grave at Øysund in Meløy Municipality (Sjøvold 1974:309). A couple of blacksmith tools, a riveting hammer (Ts. 1641) and a pair of forging tongs (Ts. 1642) were found mixed together with finds dating to the Early Iron Age and the Merovingian Period (Sjøvold 1962:40, 208). As the majority of blacksmith tools found in Norway are dated to the Late Iron Age, it is highly likely that these two objects belong to the latest burial and should be dated to the 8th century.

The overwhelming majority (375) of the total of the 395 blacksmith's tools registered in Petersen's survey (1951:72) are found in graves. Blacksmith's tools are mainly found in men's graves, although a few have also been found in graves with women's equipment. An example of the latter is a grave at Austnes in Bjarkøy Municipality (Ts. 907-915). However, since this was a double burial, the blacksmith's tools are believed to have been part of the male's equipment. Altogether, Grieg (1920:81) has a list of nine graves in all of Norway with blacksmith's tools and woman's equipment, but he believes all of these to be double burials and maintains that blacksmith's tools were only part of men's grave equipment. Petersen (1951:74) believes Grieg (1920) to be mistaken because two of the nine graves probably are more than likely single, female burials. Objects normally associated with men are sometimes found in women's graves and vice versa, so blacksmith's tools found in a woman's grave do not necessarily imply that she was a blacksmith. On the other hand, Linné's description (1907:64) of female participation in 18th century iron production in Sweden, indicate otherwise. It is thus possible that some women played a part in iron production or even acted as blacksmiths. However, I will refrain from going further into this issue.

Graves with blacksmith's tools constitute a fairly high share of the total number of male graves found in North Norway. According to Petersen (1951:77), 25 of the 196 male Iron Age graves in Nordland County have blacksmith's tools which equals 12-13%, while the figures for Troms are 10 graves with blacksmith's tools out of 50 male graves, which equals 20% (op. cit.).

In his survey of north Norwegian graves, Sjøvold (1974) arrives at slightly different figures than Petersen (1951) because both stray and other finds, which are difficult to date, are excluded from the analysis. The reason for this is that blacksmith tools have changed little over time, and without a datable find context, it is often impossible to tell a Late Iron Age blacksmith's tool from one dated to the Medieval Period or even a modern one (Sjøvold 1974:306). Sjøvold (op. cit.) has found 20 graves with blacksmith's tools in Nordland, which brings the percentage down to the national average of 10%, and he brings the number of graves with blacksmith's tools in Troms up to 14, which is 28% of the all male Iron Age graves in the county. These percentages are based both on Sjøvold's and Petersen's figures, which are not quite commensurable. No estimate of the total number of Iron Age male graves in North Norway has been done since Petersen's survey (1951). Sjøvold (1962, 1974) did a survey of the total number of graves in North Norway, but did not distinguish between male and female graves. This was done by Holand (1989), though the area of research includes only Troms and northern Nordland Counties. In many cases, there are wide-ranging methodological problems in distinguishing male from female graves and a detailed analysis of the north Norwegian Late Iron Age graves falls outside the scope of this work.

A careful examination of the empirical data has increased the number of graves in Troms with blacksmith tools to 15 and I have added two more graves in Nordland County (no. 18 - Sørmela in Andøy Municipality and no. 26 - Kilan in Flakstad Municipality) to Sjøvold's 20 (1974:306), thus bringing the total number of graves with blacksmith's tools up to 22. As such, there are 37 graves in Troms and Nordland Counties with blacksmith's tools (Table 16), and these figures are based on works by Bøckman (2007), Petersen (1951), Sjøvold (1974), Wallander (1989) and my studies at the Tromsø University Museum's archive, which should probably be considered a minimum amount. It is likely that in some instances the conditions for preserving iron have been so poor that tools could not be identified, which of course affects the number of graves with blacksmith's tools.

Of all the counties in Norway, Sogn og Fjordane ranks the highest with a total of 71 graves with blacksmith tools, which is 20% of all the male graves in the county (Petersen 1951:76), while the national average is 10%. Few of these fall within Petersen's (1951:108, 113) or Straume's (1986:46) definitions of a blacksmith's grave as only one blacksmith's tool was found in 78% (214) of the 275 male graves. In Nordland and Troms Counties, 19% (seven graves) of the graves with blacksmith's tools had only one tool, so the average is three blacksmith's tools per grave with 14% (five graves) containing a number of tools above the average. Thus, blacksmith's tools are more often found in graves in Nordland and Troms Counties than in South Norway, and the number of tools per grave is higher.

Besides blacksmith's tools, weapons are the most frequent find in graves with blacksmith's tools, with 33 out of 37 graves having an average number of 3 weapons per grave (Appendix 21). The second most common type of find is carpenter tools, and in 26 of the graves with blacksmith's tools, one or more wood- and/or bone-working tools was found, which yields an average of 2 tools in each grave containing blacksmith's tools (Table 16).

In general, the composition of the finds in graves with blacksmith's tools is quite similar, as wood- and bone-working tools and weapons are often found in these graves. In the two graves with the most blacksmith's tools, Ytre Elgsnes and Risøya, two types of objects of bone were found which were not found in any of the other graves with blacksmith tools: a chafing-piece (Ts. 2979, Ts. 4762 r) (Figure 53) and some type of vice (Ts. 2980, Ts. 4762 c). The chafing-pieces are a type which are quite common in an Iron Age context, but as far as I know, this type of vice is not known from any other context in Norway. The vice is constructed like a primitive clothespin with an iron nail holding two pieces of bone together. Among other areas, this type is known from Denmark and Greenland, and Roussell (1936:109-110, Figure 83) believes it was used as a clamp or a vice during the production of combs. This may be true, but it is also likely that this type was also used to hold on to all kinds of small objects of metal, bone or wood during the work process.

Figure 53 - Vice of bone (Ts. 4762 c) from Ytre Elgsnes in Harstad Municipality (Photo: Jorun Marie Rødli, Tromsø University Museum)

Another very interesting feature related to the deposition of finds in the grave at Ytre Elgsnes is that the blacksmith's tools had been laid in a wooden box with iron mountings placed by the head of the deceased (Simonsen 1953), which might be seen as an indication or link to certain aspects of the life of the person buried. Blacksmith's tools deposited in a wooden toolbox are not unique, but are quite rare. In one of the largest and best known finds of blacksmith's tools in Scandinavia, the Mästermyr find at Gotland (Arwidsson and Berg 1983), numerous tools were found deposited in a wooden chest. This find appeared during plowing and it is uncertain as to whether it was part of a burial or not. The two finds do not match chronologically, as the grave from Ytre Elgsnes is dated to the Early Viking Period (Simonsen 1953:116-117) and the Mästermyr find is from the Late Viking or possibly Early Medieval Period (Arwidsson 1983:37).

Even though the list of graves in Table 16 is possibly incomplete, I believe that the general picture in terms of the chronological and geographical distribution is, for the most part, correct. While graves with blacksmith's tools amount to 10% of all male graves on the national level (Petersen 1951:72), the figures for Nordland and Troms Counties are 15%. The number of graves in North Norway is too small for any sophisticated statistical calculations, but the impression that Nordland and Troms Counties are within the national average has been confirmed.

7.4 The Significance of the Finds

There are reasons to question the interpretation of the function of some of the tools which are thought to be blacksmith's tools. In seven (19 %) of the graves, only one tool categorized as a smith's tool has been found. In the two of the graves (no. 22 - Husby in Hadsel and no. 33 - Haugvik in Meløy), the diagnostic finds are a forge-stone and a blacksmith's thongs, which would have likely been used in a smithy. In the other five graves with one blacksmith's tool (no.7 - Lekangen in Tranøy, no. 18 - Sørmela in Andøy, no. 28 - Tro in Steigen, no. 29 - Erikstad in Fauske and no. 31 - Sørfinnset in Gildeskål), the diagnostic tools are a file, a hammer and a chisel. These types of tools are normally seen as being part of the blacksmith's equipment, but may have very well been used by others for working with bone and/or wood. Not only did the blacksmith fill a multi-functional role, but some of his equipment was probably some type of "all purpose tools" which could have also been used by others. An essential problem when looking for evidence related to prehistoric blacksmiths is deciding what the primary function of tools was found in graves, and finds with many blacksmith's tools often have tools associated with woodworking. The grave excavated by Simonsen (1953) at Ytre Elgsnes (no. 11) is one local example and the Mästermyr find at Gotland (Arwidsson and Berg 1983) is another. Consequently, there is every reason to question the seemingly strict division between a blacksmith's tools and woodworking tools. Hammers, files, augers, chisels and whetstones are tools which may have been used when working with wood and bone as well as iron, while heavy hammers would probably have been used for ironworking. Today's blacksmiths have hammers weighing between 0.5 kg and 2 kg (Bjørlykke 1966:71). However, doing precision work on small objects and soft metals such as silver and gold would require small and light hammers. Even though most hammers in Table 16 are on the small side, they could have been used for working with both metal and wood, which also applies to other objects that may have served a multiple purpose.

According to Straume's (1986:46, 48) and Petersen's (1951:113) definitions, there is only one Iron Age grave in North Norway where the number of blacksmith's tools are sufficiently dominant to define the profession of the deceased. Still, there are several graves which are equally or nearly as rich as the one at Ytre Elgsnes (Simonsen 1953), including Sletten (6), Nord-Rollnes (10), Risøya (20) and Lund (27), with the numbers in brackets referring to Table 16.

Artifact	**Ytre Elgsnes**	**Sletten**	**Nord-Rollnes**	**Risøya**	**Lund**
Blacksmith's tools	9	6	7	8	6
Carpenter's tools	4	2	1	4	3
Other		2	3	22	6(1)
Total	13	10	11	34	35

(1) Including 16 gaming pieces

Table 15 - Graves rich in blacksmith's tools

In the graves at Ytre Elgsnes, Sletten and Nord-Rollnes, blacksmith's tools constitute a dominant part of the grave inventory. The graves at Risøya and Lund are the ones where the most artifacts have been found, but even though the number of blacksmith's tools is quite high the group of artifact named "other" is the most abundant. As mentioned above, Straume's definition (1986:46) of a blacksmith's grave is one in which the blacksmith's tools are the only finds or constitute a dominant part of the artifacts, and the graves at Ytre Elgsnes, Sletten and Nord-Rollnes fall within this definition because of the low number of "other" objects. The graves at Risøya and Lund, which are equally rich in blacksmith's tools, fall outside this definition because the number of "other" tools is much higher, thus illustrating the inadequacy of such a definition and demonstrating the need for reviving the discussion about blacksmith's graves or graves with blacksmith's tools.

7.5 Geographical Distribution

The geographical distribution of graves with blacksmith's tools (Figure 54) falls well within the geographical area of the Germanic Iron Age settlements (Sjøvold 1974:3, 45, 93, 131, 165, 176). The northernmost find of blacksmith's tools is from Karlsøy Municipality in North Troms, which also seems to be in the northern periphery of the Germanic farming settlements. There are no finds of blacksmith's tools further to the north and there can be little doubt that these graves were an integral part of Germanic Iron Age culture. Even though the finds are evenly spread along the coast, the main area of distribution seems to be in Steigen, Hamarøy, Vesterålen and the islands around Vågsfjorden, where more than half of the graves (22) with blacksmith tools have been found. This is an area with many historical monuments dated to the Iron Age and a high number of Iron Age graves with blacksmith's tools in this region are to be expected.

North Troms was in the geographical periphery of the Germanic Iron Age settlements, as historical monuments and stray finds fade out in this area (Sjøvold 1962, 1974). There is no decline in the number of graves with blacksmith's tools in the middle and southern part of Troms compared with areas further south as the percentage of such graves in Troms is slightly above the national average. However, with only 15 graves with blacksmith's tools in Troms, caution should be exercised when drawing conclusions based on the significance of these numbers.

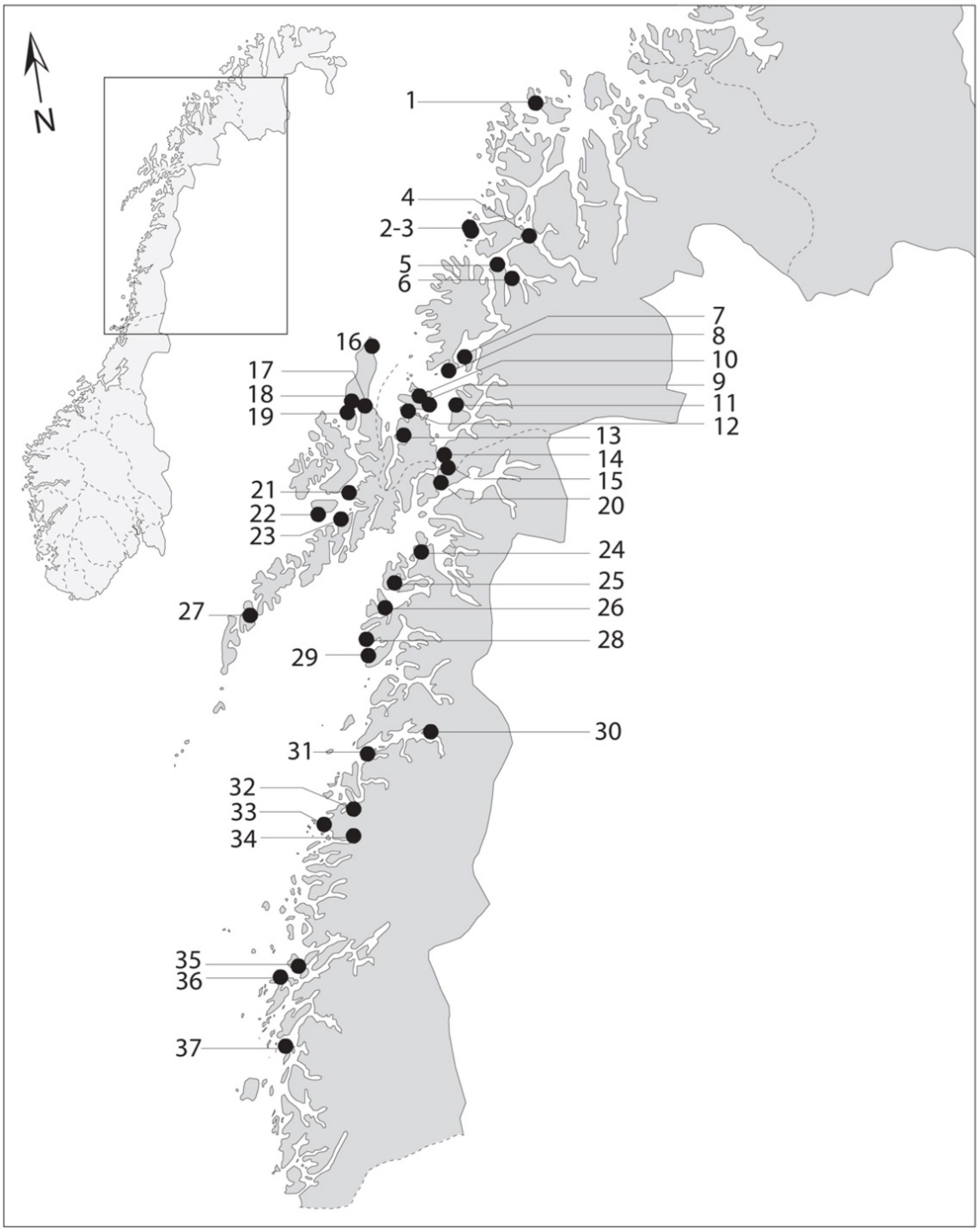

Figure 54 - Graves with blacksmith's tools (Graphics: Adnan Icagic, Tromsø University Museum)

No.	Farm	Municipality	County	Museum no.	Blacksmith's tools										Carpenter's tools								
					Anvil	Forging tongs	Hammer	File	Sheet-metal shears	Forge-stone	Iron rod/ auger	Chisel	Nail-making iron	Whetstone	Axe	Celt	Knife	Vice	Gouge	Awl	Black-smith	Carpenter	Total
1	Korsnes	Karlsøy	Troms	Ts. 2519-2525			2				7	1	1								11		11
2	Tussøy	Tromsø	Troms	Ts. 3639 a-g			1							1			1				2	1	3
3	Tussøy	Tromsø	Troms	Ts. 6749 a						1											1		1
4	Balsnes	Tromsø	Troms	Ts. 874-882							1			2							3		3
5	Engenes	Tromsø	Troms	Ts. 528-535			1				1				1						2	1	3
6	Årnes	Lenvik	Troms	Ts. 7364, Ts. 7367	1	1					1				1						3	1	4
7	Sletten	Tranøy	Troms	Ts. 975-983	1	1	1				3				1	1					6	2	8
8	Lekangen	Tranøy	Troms	Ts. 959-93								1									1		1
9	Sundsvoll	Bjarkøy	Troms	C. 5494-5505	1			1						1	8	1					3	9	12
10	Austnes	Bjarkøy	Troms	Ts. 907-915				1			1				1						2	1	3
11	Nord-Rollnes	Ibestad	Troms	Ts. 2278-2288		1	1	1	1				1	2	1						7	1	8
12	Ytre Elgsnes	Harstad	Troms	Ts. 4762 a-w		1	1	2		1	1	1		2		1	2	1			9	4	13
13	Borkenes	Kvæfjord	Troms	Ts. 2898-2911	1	1	1								2	2	1				3	5	8
14	Haukebø	Harstad	Troms	Ts. 4124 a-d		1								1	1						2	1	3
15	Haukebø	Harstad	Troms	Ts. 10817 a-n			1		1					2							4		4
16	Bleik	Andøy	Nordland	Ts. 2923-2924		1					1				1						2	1	3
17	Bø	Andøy	Nordland	Ts. 374-377		1	1							1							3		3
18	Lanesskogen	Andøy	Nordland	Ts. 1762		1	1														2		2
19	Sørmela	Andøy	Nordland	Ts. 4178 a-f			1							1	1		1				2	2	3
20	Steinsvik	Tjeldsund	Nordland	C. 20317			1	1	1						1	1					3	2	5
21	Risøya	Hadsel	Nordland	Ts. 2954-2984	1	1	2			1	2			1		1	1	1	1		8	4	12
22	Hadsel	Hadsel	Nordland	B. 3181 a-f		1		1							1						2	1	3
23	Husby	Hadsel	Nordland	Ts. 2918						1											1		1
24	Tannøy	Hamarøy	Nordland	Ts. 1225				1			1			1	1		1				3	2	5
25	Nes	Hamarøy	Nordland	B. 5161 a-q		1	1		1						1						3	1	4
26	Myklebostad	Steigen	Nordland	Ts. 1811				1						1	1						2	1	3
27	Kilan	Flakstad	Nordland	Ts. 4160 a-m			1							1	1		1				2	2	4
28	Lund	Steigen	Nordland	Ts. 1168-1181	1	1	1	2		1							1			2	6	3	9
29	Tro	Steigen	Nordland	Ts. 3027			1								1						1	1	2
30	Erikstad	Fauske	Nordland	Ts. 1722				1													1		1
31	Seines	Bodø	Nordland	Ts. 1466-1467			1	1													2		2
32	Sørfinnset	Gildeskål	Nordland	Ts. 3654 a-h				1							1	1					1	2	3
33	Øysund	Meløy	Nordland	Ts. 1641-1642		1	1														2		2
34	Haugvik	Meløy	Nordland	Ts. 3496 a-i		1									2	1					1	3	4
35	Alsøy	Nesna	Nordland	C. 5617-5619			1	1						1	1						3	1	4
36	Dønnes	Dønna	Nordland	T. 11906 a-k			1							1	1	1					2	2	4
37	Tjøtta	Alstadhaug	Nordland	T. 15139 a-i			1							1	1	1					2	2	4
Total					6	15	24	15	4	4	19	3	2	20	31	11	9	2	1	2	113	56	169

Table 16 - Graves with blacksmith's tools

7.6 Chronology

Chronologically, the 37 graves with blacksmith's tools are spread out with one grave dated to the 7th or 8th centuries, 15 dated to the 8th century, 10 dated to the 9th century and 4 dated to the 10th century (Sjøvold 1974:102, 123, 309). The remaining seven graves cannot be more closely dated than to the Late Iron Age. The practice of burying the dead with blacksmith's tools seems to have quickly spread and became increasingly popular in the Late Merovingian Period. This burial practice continued, although with less intensity, in the Early Viking Period and faded out towards the end of the Late Viking Period, and this development is mostly in accordance with the national trend in burial customs. Depositing blacksmith's tools in graves was a custom chronologically restricted to the Late Iron Age, and the oldest grave in Norway with blacksmith's tools dates back to the 8th century (Sjøvold 1962:40, 208). According to Petersen's national survey (1951:72), 57 graves with blacksmith's tools were dated to the Merovingian Period, 144 to the Early Viking Period, and 103 to the Late Viking Period.

	Merovingian Per.	Early Vik. Per.	Late Vik. Per.
Norway	19%	47%	34%
North Norway	53%	33%	13%

Table 17 - Chronological distribution of graves with blacksmith's tools

In North Norway, the number of graves with blacksmith's tools corresponds to 53% of all Germanic male graves in the Merovingian Period, 33% in the Early Viking Period and 13% in the Late Viking Period. The figures for Norway as a whole are 19% in the Merovingian Period, 47% in the Early Viking Period and 34% in the Late Viking Period.

The custom of including blacksmith's tools in grave inventories in the north seems to have spread and reached a maximum during the Merovingian Period, while it was less common in the Early Viking Period and faded away towards the end of the Late Viking Period, which seems to have been slightly ahead of the development taking place in the south.

7.7 An Ethnic Dimension?

Ethno-archaeological studies in Africa and Asia (Barndon 1992, 2001, 2004 b; Haaland 2004; Haaland, Haaland and Rijal 2002; Rijal 1998; Schmidt and Mapunda 1997; Østigård 2007) have shown that the blacksmith socially often was considered to be an outsider with extraordinary skills and knowledge. This gave him a certain prestige as he was able to transform nature to culture, and earth and sand into iron objects. As such, he was placed in between man and nature, and his professional and social life were guided and ruled by taboos which set him apart from other men. According to Hedeager (2001:485-486), the role of the blacksmith is exactly a consequence of this:

> *Mastering metallurgy meant controlling a transformation; from iron ingots to the tools for agricultural production and the weapons on which production, fertility, and protection or aggression depended; from ingots, bars, and items of gold and silver into ritual objects central to the symbolic universe of a given society. Blacksmiths and jewelers in traditional societies are usually associated with power because they forge the implements by which the natural and social world may be dominated; furthermore, they create objects that mediate between mankind and the supernatural.*

There is no way of knowing if a blacksmith's life in Iron Age Norway was considered anything like this. However, these studies of "traditional" societies provide insight into certain immaterial aspects of social life which are difficult to fathom through archaeological methods. Ethnoarchaeological studies of modern societies sometimes enable us to obtain ideas of what life might have been like during prehistoric periods. In Norwegian archaeology, the master blacksmith has often been considered a man of high status (Hagen 1967:215; Sjøvold 1974:306) because blacksmith's tools are often found in graves together with weapons, horse harnesses and other tools (Straume 1986:46). The picture painted of the socially powerful blacksmith of high status has been modified in the 1990s and later due to contributions by the aforementioned referred ethnoarchaeological studies.

To acquire an idea of the concepts and what might have constituted the conception of the prehistoric blacksmith, it is necessary to go back in time using non-archaeological data. There are few written sources from the Nordic countries older than AD 1200, but there are ancient traditions, legends and myths which are reproduced in the

Finnish national epos Kalevala and the Norse sagas. Such sources should be handled with care as it is easy to get lost in the intricacies of these stories. These myths are not exclusively Nordic in origin, but instead constitute part of a common European mythological tradition, and there are numerous references to blacksmiths in both the Kalevala and the Eddas. In the Kalevala (Ervast 1999; Kuusi 1987), Ilmarinen is a master blacksmith with exceptional powers. Even though the meaning of iron and fire, which are often referred to, is symbolic and not to be taken literally, this is an indication that the blacksmith was regarded as having a status apart from that of ordinary men and was seen as a person with extraordinary meditative and transformative powers.

In Norse mythology, there are several referrals to dwarf blacksmiths who, among other things, forged magical objects with exceptional power such as Tor's hammer known as Mjølner, Odin's spear known as Gungne, Sigurd Fåvnesbane's sword known as Gram and Frøy's ship the Skibladne (Hoftun 2001; Lind 2007; Stefánsson 2005). The Poetic or Elder Edda and the Prose or Younger Edda were put down in writing in the 13th century and deal in part with Norse mythology and in part with events that took place in previous centuries. Even though the Edda poems are not literally considered to be copies of older poems as each new poet made their own version, they may provide important insight into some myths, ideas and concepts that were also internalized in Iron Age culture. Still, there is no way of knowing whether the concept of the master blacksmith with magical powers was related to the role of the blacksmith in the Iron Age society.

In the traditional societies of today, the nature of the blacksmith's work often set them apart from other people as they are often regarded as "others", and are sometimes ethnically different (Eliade 1978:99; Hedeager 2001:486). The Volundarkviða in the Elder Edda is about the master blacksmith Volund, who was the son of a king of the Finns, neither dwarf nor human (The Poetic Edda 1986:159-160). This reference to the master smith being the "son of a king of the Finns", and thus a Finn himself, is interesting. In Norse medieval sources, the Sami were consistently referred to as Finns, and it is therefore very likely that the Volund saga refers to the Sami (Hansen and Olsen 2004:47-49). The Sami have been considered to have supernatural powers, not only the Noaide, the Sami shaman, but the Sami people in general. This has influenced the relationship between the Sami and the Nordic peoples, and the Sami have been much used as healers, fortune tellers, magical experts, etc. (Hansen and Olsen 2004:60-65, 108-109). Thus, there are signs of similarity between some of the character traits connected to the prehistoric smith and Sami ethnicity.

The Sami have always been considered to be master shipbuilders, and there is a story in Snorre Sturluson's "Haraldsønnenes saga" (1979:614) about Sigurd Slembe who one winter had a hiding place in Gljuvrafjord (possibly Fiskefjorden) on Hinnøya in Vesterålen. During the winter, he let some Finns build him two ships which were so fast that no other ship could overtake them (op. cit.). This saga is a part of Heimskringla, the best known of the old Norse Kings' sagas, which Snorre wrote in the 1220s. P. C. Friis (Storm 1881:403) describes how the coastal Sami in the 1600s decimated the pine forest to get materials for shipbuilding. K. Kolsrud's research (1947:141) on the Sami population in Ofoten document that the coastal Sami of the 1700s excelled as boat builders. This is said to have been characteristic for Sami economic life in the 1600s and 1700s (Storm 1881:403-404), but the sagas indicate that this has much older roots.

Where did the rivets and iron necessary for constructing such ships come from? A traditional small boat such as the 15-foot-long "færing" would need approximately 3 kg of iron for nails, rivets, and roves and to build the approximately 36-foot-long "fembøring", 20-25 kg of iron was needed (e-mail from Gunnar Eldjarn 5. May and 2. June 2009). Boatbuilding and smithcraft would have been expected to have gone hand in hand, and smithcraft has been seen as a premise for boatbuilding because of the large amounts of iron that would have gone into such a ship (Kolsrud 1947:140), which is confirmed by inventories of estates from Ofoten in the 1600s and 1700s. Smithing tools are frequently found in inventories of Sami estates, but rarely in the Norwegian ones (Kolsrud 1947:131-132). This trend is so consistent that Kolsrud maintains that there must have been *"… a pure specialization, not only individually but on an ethnic level"* (author's translation, op. cit.). Borgos and Torgvær's research (1998) on Sami life in the 1700s and 1800s in Vesterålen seems to confirm this.

Most blacksmith's tools in North Norway are found in Vesterålen and Lofoten. The ethnic aspects of the Iron Age settlement in these areas have not attracted much interest, so as a consequence, knowledge about historical monuments of Sami origin in these areas is rather incomplete (see however Holdø 2004). There are, however, written sources from the early 1800s which indicate that most smiths in Vesterålen were of Sami ethnicity (Borgos and Torgvær 1998:105). In Norwegian men's decedent estates, blacksmith's tools were quite rare in the early 1800s, while they are quite common in the decedent estates of Sami men (op. cit.). This is also reflected in the listings of men liable for military service from the same period in which only men of Sami ethnicity are said to be smiths (op.cit). In the late 1700s, there seems to have been a network of Sami blacksmiths on the biggest islands in Vesterålen (Borgos and Torgvær 1998:106). They were living among a predominantly Norwegian population and it is likely that the latter were the most important customers who sought their services and the products the Sami smiths had to offer. The same tendency is seen in many probate cases from the 18th century in Karlsøy Municipality in Troms County where a blacksmith's equipment is quite rare in Norwegian probate cases compared with Sami ones (Bratrein 1990:198). Blacksmithing seems to predominantly have been a traditional craft among the Sami population in the 18th and 19th centuries in Vesterålen and North Troms. An important question is whether this is a recent development, or if this ethnic division of labor has old roots dating back to prehistoric times?

In 1918, a wooden sculpture interpreted as a Sami God (Ts. 2517) was found in a cave together with a few fragments of bone and some pieces of burnt clay (Ts. 2555) in Melfjordbotn in Rødøy Municipality, Nordland County (Nicolaissen 1919:19-21, 1920:8-11). The find site has been interpreted as a Sami sacrificial site. The wooden figure is a 38 cm long double-branched piece of wood, and the head and face are quite distinct, while some of the "body" is broken off (Figure 55). The clay, glazed on one side and reddish on the other, has undoubtedly been exposed to great heat, and none of the pieces of clay have any signs of having been in contact with soil, as would have occurred in a forge, and I find it most likely that these are fragments of the superstructure of a shaft furnace.

In both Africa and Nepal, a successful smelting did presuppose the approval of the forefathers or of supernatural powers which was gained by making sacrifices. The Melfjordbotn find may indicate that the craft of the blacksmith worked within a framework of everyday realities as well as the supernatural sphere, as the ritual deposition of bones is well known in Sami tradition. The combination of finds such as bones, a wooden sculpture interpreted as a Sami God and shaft fragments of a furnace for producing iron indicate activities intended to bridge the natural world with a supernatural one in order to ensure a successful smelting. This find is highly interesting as it indicates a link between the Sami, the blacksmith and the supernatural sphere. This find further supports the written sources indicating that blacksmithing was a craft which possibly was even more widespread among the Sami than the Nordic population. However, the find is not dated and we can not know if this tradition goes back to prehistoric times.

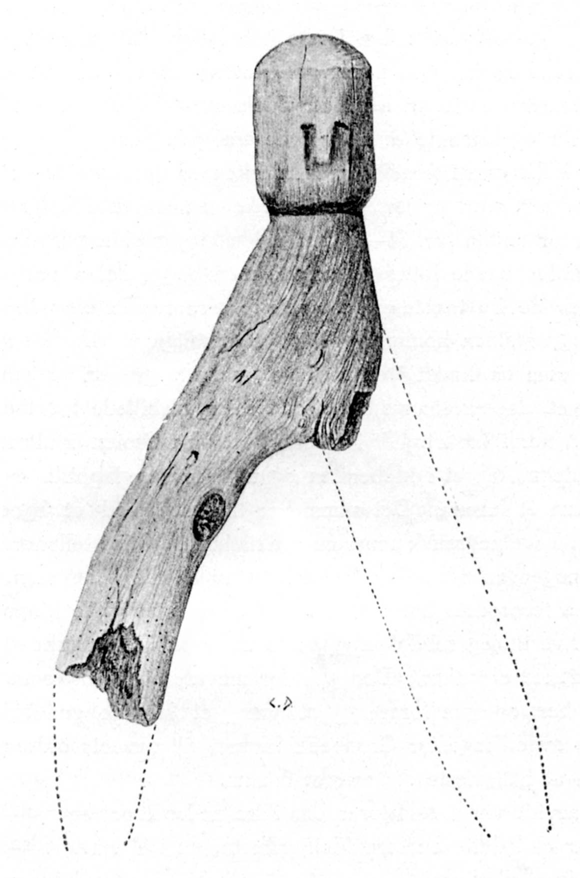

Figure 55 - Wooden Sami sculpture (Ts. 2517) from Melfjordbotn in Meløy Municipality (Nicolaissen 1920:20, Figure 2)

7.8 Summing Up

As previously pointed out, there is an obvious connection between the craft of the blacksmith and iron production. The main question is whether information about and the distribution of blacksmith's tools and smithies have any relevance for our understanding of the supply and production of iron.

Without going further into the debate about professional vs. part-time blacksmiths, the Late Iron Age grave material indicates a population with an extensive knowledge of smithing, and blacksmith's tools are often found together with weapons which could indicate a high status (Sjøvold 1974:306; Storli 2006:87-88; Straume 1986:46). Even so, the knowledge about ironworking does not seem to have been exclusive and reserved for only a few. The relatively high number of graves with blacksmith's tools indicates that the knowledge of at least a simpler form of blacksmithing was widespread.

Unfortunately, there is no simple open and shut conclusion to be drawn from my assumption that the knowledge of ironworking and blacksmithing seems to have been widespread and an easily available craft, as many blacksmiths may be seen as a consequence of a society with an ample supply of iron. Easy access to iron might have led to the high demand and extensive use of iron. Consequently, the services of the blacksmith would have been much sought after for making new tools, as well as repairing and modifying old ones. On the other hand, if iron was scarce, costly and hard to obtain, the services of a blacksmith would probably be in high demand for modifying and repairing old, broken and worn-out objects.

The services of the blacksmiths were probably in high demand either with transforming iron currency bars to tools, weapons and other objects or with repairing broken and worn out objects. Slag found at most Iron Age farms document that blacksmithing undoubtedly was a normal activity mastered by quite a few people. Based on the archaeological material, no definitive conclusion might be drawn as to whether iron was supplied as iron currency bars or as manufactured and semi-manufactured goods. The few iron currency bars found in North Norway might be a result of most iron bars having been transformed into objects.

The thirty-seven graves with blacksmith's tools which have been found scattered along the coast from Trøndelag to North Troms cover a time span of 450 years. This number might not seem like a lot but it corresponds to 15% of all the Late Iron Age male graves that Petersen (1951:72) had documented in Nordland and Troms. These numbers combined with the fact that slag is frequently found in small amounts on many Iron Age farms, support a conclusion about smithing having been a widespread and quite common activity in Late Iron Age farming settlements.

Surprisingly few smithies have been documented and excavated in North Norway, and the three smithies in question have been found at Greipstad, Skålbunes and Stauran. Of these, only Greipstad can be with any certainty to the Iron Age. The smithies at Skålbunes and Stauran are dated to the Medieval Period, but might still shed some light on Iron Age smithies as well. Even though the remains of only one Iron Age smithy has been found, the finds of both blacksmith's tools and forge-stones demonstrate that this number is far too low. Assuming that each forge-stone represents a smithy, 22 smithies are represented in the archaeological material, yet only seven of those can be dated for sure to the Iron Age, while five could either belong to the Late Iron Age or Medieval Periods. Archaeologically speaking, there is evidence of a maximum of 13 smithies, of which only eight can definitely be dated to the Late Iron Age. As a result, one would have expected more smithing pits to be found during the many excavations of Iron Age farms that have been conducted in North Norway. A probable explanation for this is that often only minor parts of Iron Age farms have been excavated, and that smithing pits located outside the central farm yard may have been overlooked. Thus, our present knowledge of the Iron Age smithy is too incomplete and fragmented to provide a more complimentary understanding of its place and function in regard to iron production and iron supply in Iron Age North Norway.

North Troms is in the northernmost periphery of the Germanic Iron Age settlements, and the land in the north and east was dominated by the Sami. However, it is likely that a considerable amount of Sami people also lived throughout Nordland and Troms, as evident from historical sources, though they seem to have left few traces in areas such as Lofoten and Vesterålen which were densely populated by Germanic Iron Age farmers. The tradition of shipbuilding being a Sami specialty possibly goes back to the Late Iron Age. Any shipbuilder would need quite large amounts of iron to carry out their craft and Post-Medieval documents indicate that blacksmithing, like shipbuilding, was a Sami specialty. The sagas reference to blacksmiths and ethnic identity is vague and cannot be emphasized without the support of other data. However, Post-Medieval written sources indicate that the Sami of the 1700s extensively exercised blacksmithing to a degree of ethnic specialization. We do not know if this "ethnic division of labor" goes all the way back to the Iron Age, but it is possible that this is related to ancient traditions of Sami shipbuilding. Grave finds, of which most of the blacksmith's tools are a part, do not support any ethnic division of labor when it comes to blacksmithing, and blacksmith's tools have only been found in one grave (Table 16, no. 3) with ethnically mixed grave goods (Bruun 2007:53-54). The supposed Sami element in this grave is three arrowheads with clefted points. This type is found in both a Nordic and Sami context (Serning 1956:88), but the majority are found in areas with a predominantly Sami population (Zachrisson 1997:213-214) and are thus considered relatively reliable as an ethnic marker.

Whatever the reason was for seeking the services of a blacksmith, a substantial part of the male population seems to have had at least some knowledge of smithing. Ethnoarchaeological research in modern, traditional societies in Africa (Barndon 1992, 2001, 2004 b; Haaland 2004; Haaland, Haaland and Rijal 2002; Rijal 1998; Schmidt and Mapunda 1997; Østigård 2007) has shown that the blacksmith was often responsible for doing both adjustments to and repairs of iron objects, as well as for the process of producing iron. We cannot know if that also was the case in the Late Iron Age, but if so, the reason for the seemingly small local iron production cannot be explained by a lack of knowledge as suggested by Stenvik (2003 b:80-81). Judging by the numerous iron objects found in Late Iron Age burials, iron seems to have been in high demand during this entire period. All the things necessary for producing iron seems to have been in place, the natural resources were easily available and the technological knowhow was present. Therefore, other reasons must have been decisive when choosing not to produce iron.

8 SYMBOLISM, TECHNOLOGY AND SUPPLY OR WHY THERE ARE SO FEW PRODUCTION SITES IN NORTH NORWAY

The excavated bloomery sites at Hemmestad and Flakstadvåg document the fact that iron was produced in North Norway during the Early Iron Age, though a problem to be considered is that only two sites have been found in the vast area which constitutes North Norway. When the raw materials were available and the production technology and seemingly superior quality of the metal were known, why don't we find numerous production sites? Today, our attitude to new technology is largely based on its economic and utilitarian value, but we should be careful to not transfer modern concepts to prehistoric realities. In this chapter, I will explore the possible mechanisms concerning the spread of iron and what social factors may have influenced local iron production and the supply of iron to North Norway.

Since the industrial revolution, a divide has opened up between science and religion. For a long time, research related to metallurgy, the spread of iron and iron production was dominated by natural science's way of thinking, which has been seen as a determined, evolutionary process; a biological model from which the terminology also originated. Gordon V. Childe was an exponent of this way of thinking and in a paper published in 1944 he expresses such views. Chronological periods are seen as "*stages in human progress*" linked to "*the level of control over the environment*" and further "*the Neolithic farmer in cultivating plants and breeding stock harnessed powerful forces of Nature and made biochemical mechanisms work for him"* (Childe 1944:8). This biological attitude towards the development of social relations and material culture is reflected in his explicit use of biological terminology such as "*the new genera and species of tools*" (Childe 1944:9). This biologically based terminology was followed-up by archaeometallurgists such as Wertime (1964:1257-58) who referred to "*the birth of metallurgy"* and "*giving birth to entirely new arts of economics and communications".*

A consequence of this biological approach towards human and material evolution was that metallurgy was seen as a superior technology that was much more demanding than the "crafts", and required full-time specialists who could be accommodated only by a large scale social reorganization. A picture is painted of the early metallurgists as proto-scientific experimenters working on an industrial scale almost like the developed metal production of the latter part of the Industrial Revolution (Budd and Taylor 1995:137).

The general unwillingness of the archaeometallurgists to see prehistoric metal artifacts as anything other than the remnants of scientific experiments in some cumulative, progressive and rational developmental sequence is linked to an inter-disciplinary divide between archaeological scientists and sociocultural archaeologists and anthropologists (Budd and Taylor 1995:134). However, ethnographic studies in Africa and Nepal (Barndon 1992, 2001; Haaland 2004; Haaland, Haaland and Rijal 2002; Rijal 1998; Schmidt and Mapunda 1997) have led to alternative approaches to this biological model.

8.1 The Spread and Acceptance of Iron and Iron Technology

There is little doubt that iron was introduced to Europe from Asia Minor and the Middle East (Pleiner 2000:33, Figure 9), but there was no uniform pattern of acceptance. Over a period of 10 to 12 centuries iron was assimilated into the material culture (Pleiner 2000:34), and the introduction of iron into Europe may be identified and divided into the following four stages (Pleiner 2000:20-22).

In Phase I, iron made only a sporadic appearance on the human cultural scene and had symbolic and ritual, rather than technological significance. The metal came from meteorites or was accidentally produced during the melting of copper and was only available to the ruling strata of society. This phase lasted in Mesopotamia from approximately 5000 until 1.300 BC.

In Phase II, iron was produced on a limited, but regular basis and considered to be a high prestige metal produced by a very limited number of specialist metal workers, though it is debatable as to whether it was made from the smelting of ore. This period is described as the “Initial Proto-Iron Age” and was considerably shorter than the previous period and was in Anatolia from 1300 until 1100/1000 BC and in India from 700 until 400/200 BC.

Phase III is the Early Iron Age proper in the technological and socio-economic sense, and the four basic types of implements: knives, axes, chisels and sickles appear. The distribution was still regulated and controlled by the "Temple and Palace" and it was primarily the ruling classes who profited from iron as they armed their soldiers and used it as a means of applying political pressure. This period in Anatolia is dated from 1000/900 to 700/600 BC and in India from 400/200 to 100 BC.

Phase IV is represented by the fully-fledged iron-using civilizations in which mass production was the rule in the smelting centers, tools were manufactured using sophisticated techniques and the range of available artifacts increased greatly as the blacksmiths began specializing as toolmakers, armorers, swordsmiths, etc.

The spread of iron from the Near and Middle East did not happen as a swift and uniform movement but rather in a slow and stepwise manner and the spread of iron technology throughout Europe lagged behind where it all began by more than a millennium (Pleiner 2000:23).

The aforementioned outlined phases related to the introduction of iron do not explain how iron and iron technology spread from the Near or Middle East, but Alexander (1983:30) has outlined two models for explaining the use and introduction of metal and technology into Europe.

Model I describes a peaceful introduction in which knowledge of the technology was acquired in four stages: (a) the importation of a few iron objects of high prestige value, (b) a wider importation of iron objects already common to neighbors, although iron is not made within the community, (c) restricted manufacturing within the community. Iron objects are in common, but its use is restricted and (d) iron technology is well understood and iron is in common and unrestricted use.

Model II describes a warlike introduction in which knowledge is acquired fairly quickly, either by raids or folk movements which could have happened in stages characterized by: (a) a few objects, probably weapons obtained without any transfer of technology, (b) a speedy acceptance of technology equal to the level of the raiders and (c) iron technology is well understood and independent of the raiders.

The spread and degree of acceptance of iron caused by migration depends on to what degree iron was integrated into the culture of the immigrants. The spread of iron happened in several phases and took several thousand years from the time the first iron object emerged until the metal and technology was fully accepted and integrated throughout Europe.

Models for cultural change which have been based on economically determined evolutionary processes would have us believe that the spread of iron was dependent on availability, and that once people acquired the knowledge of and access to iron, they would instantly embrace the new product and adopt it as their preferred material for tools and weapons, and the same goes for the production of iron.

Ethnoarchaeological research conducted during the 1900s has made us understand that prehistoric reality worked differently. According to Alexander (1983:29), some of the factors influencing the spread of iron could have been religious taboos regarding the use of iron or the smelting of iron ore, social traditions restricting the acceptance of the use of iron and iron making and political control of iron ore sources.

The universal models (Alexander 1983; Pleiner 2000) outlined above might prove to be a useful background in understanding the spread and acceptance of iron to some of the peripheries of Europe, including North Norway. Ethnoarchaeological research done in Africa during the 1900s has shown that religious beliefs and taboos embedded in the recipient's culture were decisive in the spread and acceptance of this new metal and new technology.

8.2 Models for the Introduction of Iron

Looking back into the history of research, there has been a tendency to think that theories about social change and major technological developments were first explained by immigration and later by a gradual, local development or combination of the two, which was the case in the comprehensive discussion about the coming of the Germanic Iron Age in North Norway. At first, the development of an Iron Age culture was explained by immigration from southwest Norway (Gjessing 1929:37-38, 1930:99-100; Petersen 1930:45-46; Sjøvold 1962:237), but gradually this point of view was replaced by the belief that local development was a key factor behind the great changes that took place during the transition to the Iron Age (Brøgger 1931:25; Johansen 1982 c:47; Magnus Myhre and Myhre 1972:60). Alexander's (1983:30) two models about the use and introduction of iron to the northern societies resemble this old discussion. His Model I (Chapter 7.1) is comparable to local development while Model II, the warlike introduction, is closer to an explanation based on immigration.

Such studies often focus on one or just a few cultural traits without so much as a brief glance into the context they constitute a part of. This is not to say that all studies have to be of a holistic nature, but it is important to take into account that "everything is connected." When looking into the introduction of iron technology to North Norway it is necessary to raise one's eyes to study society and the social relations this practice was part of. According to Ingold (2000:314) *"... there is no such thing as technology in pre-modern societies."* The separation of technology and society is a modern construction, a product of a historical process. Today, technology is thought of as society's means of controlling nature which creates distance between the two. In pre-modern societies, tools and technique were used to minimize this distance, to draw nature closer to society or vice versa, thus creating a sort of mutualism between the two. In Iron Age society, technology and economy would have been embedded in social relations and can only be understood in this context and not studied as being separate from society (op. cit.).

The technique of extracting iron from bog ore was not a local invention, which implies that a study about the introduction of iron production technology into North Norway must focus on interregional interaction. In the archaeological record, we see many examples of artifacts showing up in new contexts, as both imported objects and styles may be quite randomly applied in their new social context if the contacts are superficial. However, if such interactions are continual over longer periods of time, they may lead to a mutual and selective borrowing of more complex value systems and institutions, and in the process, a transformation of social organizations as well (Kristiansen and Larsson 2005:13). It is necessary to distinguish between the transferral of artifacts, as described above, and technological practice. In illiterate societies like the Iron Age, the latter probably had to involve movement of people. In interregional interaction Kristiansen and Larsson (2005:28) distinguish between two types of processes: An initial process involving the flow of people and the introduction of new ideas, goods, knowledge and value systems, followed by a process of acculturation in which ideas and practices gain acceptance and can be re-conceptualized on a local and regional basis, followed by a fast process of transformation and institutionalization (op. cit.) that resembles those used to explain the coming of the Iron Age in the North.

The transferral of iron production technology into new areas might be compared to the transferral of the practice of farming into new areas. Some of the key concepts used in explaining the transition from foraging to farming may therefore be of help in searching for a methodical framework for the introduction of iron technology to North Norway. Zvelebil and Rowley-Conwy (1984) distinguish three stages in the transition from foraging to farming in both Denmark and Finland. The introduction of farming into non-farming areas is characterized by: (1) a phase of availability, (2) a phase of substitution, and (3) a phase of consolidation (ibid. 104-106). The availability phase resembles Kristiansen and Larsson's (2005:28) initial process in interregional interaction and the consolidation phase may correspond to their secondary process, while the phase of substitution may be compared to the long period in which iron replaced the use of stone. Even so, stone and metal were used side by side for an extended period and lithic material was not totally replaced even during the so-called phase of consolidation.

Combining several models is not without its problems. In Table 18 I have tentatively merged the models of Pleiner (2000), Alexander (1983), Kristiansen and Larsson (2005) and Zvelebil and Rowley-Conwy (1984). These phases or models are generalizations thought to be universal and are not designed to fit every local cultural adaption and development, and I have compared the four models for change and seen which phase in each model might correspond with the others. The cultural development in North Norway is in some ways set apart from what took place further south since the production phase never really seemed to have gained a foothold. The iron production site at Hemmestad seems to be a contemporary of or nearly as old as the introduction of iron into southern Scandinavia. From the time iron was first introduced in North Norway in the first half of the last millennium BC until the Roman Period, it seems to have become widespread and quite common, but mostly available in small quantities. The fact that only one iron production site dating to this period has been found indicates a quite limited production. However, this does not necessary imply that knowhow regarding the production technology was unavailable or unknown, but might well be a consequence of social structures which prevented the northern peoples from making iron.

Pleiner (2000)	**Alexander (1983)**	**Kristiansen/ Larsson (2005)**	**Zvelebil/Rowley-Conwy (1984)**
I Sporadic appearances, little production			
II High prestige, limited production	**Model II**, warlike introduction	**Initial** process, flow of people	**I** Phase of availability
III Comprehensive production	**Model I**, peaceful introduction	**Secondary** process, acculturation	**III** Phase of consolidation
IV Mass production			

Table 18 - A combination of models by Pleiner (2000), Alexander (1983), Kristiansen and Larsson (2005) and Zvelebil and Rowley-Conwy (1984)

8.3 The First Metals

Copper is the oldest metal found in North Norway. The next metals to appear on the scene are some bronze objects of southern or eastern origin and a few soapstone molds, but the number of objects and the range of types are very limited (Bakka 1976; Bergum 2007; Jørgensen 1986). In total, 12 bronzes belonging to the Nordic Bronze Age have been found in Nordland and Troms (Bergum 2007:29), which date between the Bronze Age Period 2/3 and Period 5/6 (1550 – 500 BC) (Bakka 1976:28; Bergum 2007:27, Table 1). Bakka's (1976) hypothesis about a uniform Nordic Bronze Age settlement north to Troms, is not supported by these empirical data. Still, the votive practices guiding the burial of these finds are very much like those in southern Scandinavia (Bergum 2007:74). The Nordic bronzes found north of Harstad in Troms may not reflect a Nordic Bronze Age culture as seen in southern Scandinavia, but rather an interaction among loosely connected coastal settlements north of Trøndelag. They do not express an unbroken chain of settlements in which Nordic bronzes were part of the material culture, but instead reflect a settlement pattern in which regions with Bronze Age finds overlap with regions where no bronzes are found (Bergum 2007:86). A few soapstone molds found in eastern Finnmark, Troms and Nordland do not change this overall picture. The number of bronze artifacts is low and most are votive finds. Those that did not intentionally become deposited were probably highly prized treasures that were well taken care of and repaired if broken. This very sporadic presence of metal seems not to have contributed in bringing about a full-fledged metal using culture. Instead, copper and bronze objects probably functioned as highly prized prestige objects used or displayed only in certain settings, although it is possible that the few metals that were in circulation prepared the way for the acceptance and first use of iron. The spread of bronzes to the north should probably be seen in context with the distribution of the Risvik ceramics and the appearance of the first iron (see chapter 5.2.2). The north – south cultural connections which go back to the Neolithic strengthen throughout the Early Metal Period and were vital to the spread of the first metal to the north.

Pleiner (2000:20-22) and Alexander (1983:29) have created models for the introduction of iron which are closely related to the development of social organization, taboos and both secular and religious power. In these models, controlling access to metal and the production itself are crucial factors, and even if such information on a micro level is inadequate for large parts of North Norway, these models may still be useful tools in understanding the introduction of iron. North Norway is a vast area and it is a question as to whether the introduction of iron to hunters and gatherers in eastern Finnmark was guided by the same principles as in the southernmost part of Nordland. The first iron-using societies in Finnmark probably obtained their iron through contact with iron-using and iron producing peoples in the southeast in what today is Finland and Russia, while the first use of iron in Nordland and Troms mainly seems to have been a result of contact with people from South Scandinavia. It is therefore likely that the introduction and acceptance of iron took place at different times and at different rates of speed in various parts of North Norway.

Some of the first evidence of iron use is found at Kjelmøy in eastern Finnmark, dated to approximately 600 BC (Olsen 1994:132). There is no indication that iron was produced at this site, but it was clearly worked as it was adapted to fit local bone tools (Solberg 1909:39-45, Figures 35, 79, 1911:351). There is no sign that iron was worked in a smithy since no slag was found, although the fragment of a mold indicates the smelting of metal, probably bronze or copper. Iron seems to have been adopted for everyday use such as knives, iron-tipped harpoons and fishhooks made of bone. Even though iron seems to have been widely used at Kjelmøy, it may have been restricted to certain subsistence activities and this early documentation of iron use has no parallel in any other contemporary settlement in northern Norway. The main problem with tracing the use of iron is that there are quite few sites dated to the Late Bronze Age, Pre-Roman Iron Age and the first centuries AD. Because of this, it is possible that iron was in continual use from approximately 600 BC and onwards, though the data situation limits our possibilities for elaborating on this matter. It is assumed that the iron used at Kjelmøy was procured through contact with iron producing and iron-using people to the south and east and that these practices originated in the Ananjino culture at the Kama River, east of the Urals.

The metallurgical traditions prior to the iron-using settlement at Kjelmøy are close to nonexistent. Three copper objects have been found in Finnmark: an arrowhead from Lebesby (C 24484 a), a copper sheet from Storbukt at Magerøya (C 24845 b) and a copper dagger (Ts. 8458 bg) from Karlebotnbakken in Nesseby (Figure 56, Table 19). The copper dagger is the oldest and is dated to approximately 2000 BC (Schanche 1989:62-63, 66, 1994:44, 101). The arrowhead is probably older than 1500 BC and the copper sheet is dated to the period between 1800 and 900 BC (Olsen 1994:125-126). Moreover, a nearly complete set of a soapstone mold and a half (Ts. 816 a, b, Ts. 817) are found in Jarfjord, one mold (C 21105.335) at Kjelmøy and three in Sør-Varanger. The molds in Jarfjord are dated to the period of the textile ceramics (Carpelan 1975:29; Olsen 1994:125-126), which is much older than the settlements at Kjelmøy, and the mold found at Kjelmøy is contemporary to the use of iron. One of the oldest iron artifacts from Finnmark is the blade of a moon-shaped iron knife (Ts. 2004) found in a grave at Kvalnes in Nesseby Municipality, together with several pieces of slate and a fragment of Kjelmøy ceramics (Nicolaissen 1912-13). The knife blade resembles knives found in Denmark and northern Germany dated to the Early Pre-Roman Iron Age (Unset 1881:351, Figure 102, Table XXV, Figure 5, Table XXVI, Figure 4) and the find context indicates that this also is the date of the knife.

In the north Norwegian archaeological material, there is no evidence of Pleiner's (2000:20) Phase I or Phase II where the use of iron was limited to the ruling strata of society and only used for high prestige objects. However, if the metal using periods BC are seen as one and the few finds of copper and bronze are seen as high prestige materials, they may represent high status artifacts which do fit into Pleiner's Phases I and II. The use of iron at Kjelmøy does not indicate any restrictions with regard to the use of iron as it seems to have been quite common and worked to fit a wide variety of locally made products. Despite the lack of ironworks, this comprehensive use of iron in basic types of implements makes the level of integration closest to Pleiner's Phase III (2000:20-22). Alexander (1983) operates with two major models concerning the introduction of iron: (I) a peaceful introduction of iron and (II) a warlike introduction. The archaeological material does not indicate any warlike actions in the north. His Model I describes an introduction in four stages (Chapter 7.1). The first stage (a) is characterized by the importation of a few iron objects of high prestige value, while the second stage (b) is characterized by a wider importation of iron, but not by any iron production. The iron use from the BC era at Kjelmøy is probably best characterized by Alexander's (1983:29) Model I b and Pleiner's (2000:22) Phase III.

Figure 56 - Molds and artifacts of bronze and copper dating to the Early Metal Period (Bakka 1976: Plate 16; Bergum 2007:27, Table 1; Jørgensen 1986:69, Figure 1) (Graphics: Ernst Høgtun, Tromsø University Museum)

When the production of iron took place at Hemmestad, people at Kjelmøy may have been working, modifying and using iron tools for 100 years or more (Olsen 1994:132). No iron object contemporary to the ironworks at Hemmestad has been found in the regions of Lofoten and Vesterålen, and except for the Pre-Roman Period long house at Hunstadneset (Henriksen and Sommerseth 2009:26-28; Sommerseth, Arntzen and Henriksen 2009:48), every other Iron Age find in the region is dated to either the Late Roman Period or later periods. Neither have any finds of bronze or molds dating to the Early Metal Period in the immediate surroundings of Hemmestad been made. However, within a radius of 125 km, a few bronze and moulds have been found (Figure 56).

No.	Museum no.	Object	Site and Municipality	Date BC[5]
1	Ts. 816 a, b	Soapstone mold	Jarfjord, Sør-Varanger	1800-900
	Ts. 817	Soapstone mold		
2	C 21105.335	Soapstone mold	Kjelmøy, Sør-Varanger	800-BC/AD
3	Ts. 8458 bg	Copper dagger	Karlebotnbakken, Nesseby	2nd Millennium
4	C 24484 a	Copper arrowhead	Lebesby, Lebesby	Older than 1500
5	C 24845 b	Copper sheet	Storbukt, Nordkapp	1800-900
6	Ts. 6361	Soapstone mold	Grøtavær, Harstad	950-500
7	Ts. 11434.5	Socketed axe	Altervågen, Harstad	950-500
	Ts. 11737	Necklace		
8	Ts. 160	Two necklaces	Tennevik, Skånland	950-750
9	Ts. 4318	Bronze sword	Vinje, Bø	1300-1100
10	Ts. 7071 a	Soapstone mold	Kolvika, Vestvågøy	?
	Ts. 7060 q	Soapstone mold		
11	Ts. 2194	Copper dagger/arrowhead	Skotnes, Vestvågøy	1550-1300
12	T. 7581	Tweezers	Bø, Steigen	950-500
	T. 7582	Button		
13	Ts. 4225 / T. 4656	Socketed axe	Åsjorda, Steigen	1100-500
14[6]		Socketed axe	Værøy	1300-1100

Table 19 - Molds and artifacts of bronze and copper found in the nearby regions of Flakstadvåg and Hemmestad (After Bakka 1975:Plate 16; Bergum 2007:27, Table 1); Jørgensen 1986:69, Figure 1).

A soapstone mold for casting socketed axes (Ts. 6361) of the Nordic type dating to Period 5-6 (Bakka 1976:27; Munch 1966:62-64) has been found in Grøtavær at Grytøy. Two bronzes, a socketed axe presumably of the Nordic type (Ts. 11434.5)

[5] Absolute dates of the Bronze Age periods are based on Montelius (1917).
[6] Privately owned socketed axe of bronze. According to Bergum (2007:27), this is of Nordic origin, dated to the Bronze Age, Period III.

and a necklace (Ts. 11373) has been found at Altevågen near Harstad. The necklace is quite similar to the two bronze necklaces (Ts. 160) from Tennevik in Skånland. Bakka (1976:27) and Munch (1966:69) date the two Skånland necklaces to Period 5, which probably also would be the correct dating for both the socketed axe and the necklace from Altevågen. These finds indicate that knowledge of metal was present in the region prior to iron production and that the blacksmiths most likely had been in contact with copper, bronze and possibly iron before constructing the iron production site at Hemmestad. There are no finds indicating prehistoric copper mining in all of Norway (Melheim 2009) but this early contact with metal could have involved modifying and smelting copper or bronze, cf. the soapstone mold (Ts. 6361) found at Grøtavær. The reason why so few metal objects from this period have been found is most likely due to the fact that bronze and iron were scarce and thus a valuable commodity. Worn and broken objects were likely not to be discarded, and instead were repaired, re-forged or re-casted which kept the metal in circulation for a very long time. Bronze is a very resilient material, much more able to withstand corrosion than iron when being deposited in an unfavorable chemical milieu, which could be part of the explanation as to why no iron object dating to this period has been found. The number of metal objects dating to the end of the Bronze Age is low, but the few existing finds document that knowledge of metal was present. The few bronzes which were in circulation could both have been in possession of and used by a few high-ranking members of the settlements or they might have had a communal function during, for example rituals and religious practice (Bergum 2007:84-86).

Slag does not disintegrate as easily as iron, which may explain why only slag but no Pre-Roman iron has been found at either Hemmestad or neighboring farms in Kvæfjorden. Iron and slag have been found in association with Risvik ceramics at several sites (Figure 30), as can be seen at Hemmestad. It is therefore likely that at least small quantities of iron were common at sites along the coast north of North Troms during the period from 800 to 400 BC.

None of the models in Table 18 can be easily applied to the situation at Hemmestad since there are no finds documenting the use of iron. Hemmestad stands out as the only iron producing site from this period, although finds from several other sites with Risvik ceramics document the fact that iron was available and quite common. This could probably be compared with Pleiner's Phase III (2000:20-22), characterized by the most basic tools being made of iron. Alexander's (1983:30) Model Ic, which is characterized by a limited production and iron objects being in common use, might also be a valid description of the phase.

The iron production at Flakstadvåg was established during the transition from the Early to the Late Roman Period, i.e. AD 200 at the beginning of the Iron Age proper, as iron was becoming increasingly more common. The iron production at Flakstadvåg took place several hundred years later than the one at Hemmestad and, at present, it is not possible to point out any older, local metallurgical traditions which may have inspired the iron production at Flakstadvåg. There are quite a few Early Iron Age finds uncovered in the Vågsfjord area (Sjøvold 1962:100), but not many are as old as the Roman Period. Excavations at Hunstadneset at Kveøya in Kvæfjorden document settlement during the Bronze Age and the presence of a Pre-Roman Period long house (Sommerseth and Arntzen 2009). Thus, it is possible that the Iron Age farm as an economic and social institution was established in the region at the time that iron production took place at Hemmestad and surely long before the production phase at Flakstadvåg. The establishment of the iron production site at Flakstadvåg coincides with the great expansion of the Germanic Iron Age settlements in Nordland and Troms and the production could have been the answer to the widespread use of and thus demand for iron. Be that as it may, this production seems to have been small and without any regional significance and the termination of the production at Flakstadvåg seem to have only been of local importance. Except for the iron production site, there are no Roman Period finds from Flakstadvåg. Taking a wider geographical area such as Lofoten and Vesterålen into account, we see that iron was well integrated into the material culture and there is reason to believe that this was also the case for those extracting iron at Flakstadvåg. Even though no mass production took place, the integration of iron into the material culture can best be compared with Pleiner's Phase IV (2000:22) and Alexander's Model Ib or Ic.

8.4 Towards an Iron-using Age

The introduction of iron to North Norway seems to have occurred sometime during the first half of the last millennium BC, and it is likely that the amount of available iron was modest in the early iron-using phase. During the Pre-Roman Iron Age iron seems to be widespread, indicating supply systems that included all or most of North Norway.

At Kjelmøy, iron seems to have been applied to a wide variety of both pointed and cutting tools, thereby indicating a regular supply of iron. Around BC/AD there seems to have been a break in the external relations to the south and east which, in the period BC, secured the supply of iron. Quite a few sites in eastern Finnmark dated to the 1st millennium AD have been excavated and despite the interrupted relation to the east, there seem to have been no shortage in the supply of iron (Hansen and Olsen 2004; Hesjedal et al. 1996). There is actually much that indicate that iron now was channeled through contacts with the Norse societies living further south along the coast of North Norway (B. Olsen, personal communication, February 2010; Hansen and Olsen 2004) before contact with new external suppliers was established.

Without having located the houses where the iron producers lived at Hemmestad, we have no information about the extent and duration of the use of iron. The limited amount of data from the Pre-Roman Iron Age in Nordland and Troms is somewhat parallel to the 1st millennium AD in Finnmark, and except for the sites with Risvik ceramics, we have little information about the use of iron prior to the Roman Period. Consequently, it seems that once it was introduced, iron continued in varying degrees to be part of the material culture all over North Norway.

The use and supply of iron to North Norway could by no means have been dependent strictly on local production, though it would be naive to think that all prehistoric iron production sites have been uncovered. Several ironworks have probably been destroyed by modern activity, and there are most likely sites still to be discovered. However, there are, at present, no indications of the existence of such sites and I believe that even though more iron production sites will be uncovered, the number will remain quite low and it is improbable that large production sites such as the ones found in north Trøndelag and Southeast Norway will be discovered. Why was this so? What is the reason that so few iron production sites have been established in North Norway? Resources such as wood and suitable bog iron ore seem to have been in abundance, and presumably, there was an ample supply of wood resources. Bog ore is found in many places in North Norway without any sign of being used for iron production, and the chemical composition of several bog ore deposits has been analyzed and is supposedly well suited as a raw material for iron production (Appendix 22).

It is thus not possible to give an absolute answer to the question of why so few iron production sites were established in North Norway, but I will elaborate on a few issues that may have influenced the iron supply and possibilities of establishing ironworks in North Norway.

8.4.1 Ethnic Restrictions?

Late Stone Age finds from the north Norwegian coast north to the Tromsø area indicate a long lasting contact with agrarian settlements in the south (Johansen 1979; Valen 2007). During the Early Metal Period, intensified contacts developed between the hunter/gatherers in northern Fennoscandia and peoples in the south and east. Together with social and economic changes in the coastal settlements, this led to social and cultural differentiation in a social landscape formerly dominated by hunter/gatherers. The importance of farming increased in coastal settlements south of Mid-Troms at the end of this period, while hunting and gathering prevailed as the dominant subsistence activity in the north and the east. These economic, social and cultural developments probably led to the cultural differentiation which formed the basis for the ethnic duality that has existed in northern Fennoscandia ever since (Hansen and Olsen 2004:40).

Ethnoarchaeological studies have documented that ethnicity may have played a key role in the social acceptance of blacksmithing (Eliade 1978:99; Hedeager 2001:486), but it is unclear as to whether this had any relevance in north Norwegian settlements. Sundquist (1999:55-56) suggests that the reason for not finding any iron production sites in Finnmark should be understood in terms of an ethnic division of labor, and he says (1999:55) that *"…the production of iron should be seen as part of the agricultural and sedentary ethnic 'label'."* For hunter/gatherers to take part in such an activity would consequently be equal to crossing ethnic boundaries and a break in ethnic traditions could mean endangering ethnic identity. Archaeobotanical finds indicate that farming in Finnmark during the Early Metal Period and Iron Age was non-existent or scarce (Johansen and Vorren 1986) and it is highly likely that the main subsistence activity was some form of hunting and gathering. Based on the archaeological finds, it seems as if Finnmark during the Iron Age was mainly inhabited by Sami hunters and gatherers who had access to iron, but who did not carry out any local production. Sundquist's hypothesis (1999:55) might be valid when confining the geographical research area to Finnmark, but taking northern Fennoscandia into account as a whole, his explanation has some serious flaws. In the surrounding areas of Rovaniemi in northern Finland, several ironworks have been excavated which date to the centuries both before and after BC/AD, and judging they all seem to have been operated by hunter/gatherers. Excavations at Sangis in Kalix Municipality, the northernmost iron production site in Sweden, have so far uncovered one furnace (e-mail from C. Bennerhag, 9. and 13. November 2009). Due to the ongoing excavations, I have no information about any nearby settlements and whether the site was related to hunter/gatherers or farmers/stock keepers. The northernmost, major iron production area in Sweden is located in the surrounding area of Storsjön next to the city of Östersund in Jämtland (Magnusson 1989). In the Roman Period, this area seems to have been settled by hunter/gatherers who possibly traded iron with their farming neighbors (Magnusson 1986:297). Thus, there is no reason to pay much attention to arguments about hunter/gatherers who lacked the social organization or manpower needed to perform such a task. Iron production in northern Fennoscandia seems to have been practiced within Nordic farming settlements as well as in milieus dominated by Sami hunter/gatherers, thereby indicating that the ethnic dimension was probably not a decisive factor in creating a social structure that refrained from producing iron.

8.4.2 Religious Beliefs and Taboos or the Power of Magic

Research related to prehistoric iron production has traditionally focused on technology and economy, while social conditions, beliefs and morals have not nearly attracted as much attention. When social conditions have been considered, it has generally been related directly to economic factors. Based on years of ethnoarchaeological research, an alternative picture is emerging which indicates that prehistoric metal making was very different and far from the rational, proto-scientific practice exercised from the Industrial Revolution onward. It was based on activities which are documented archaeologically, but likely related to social activities of which we have no archaeological "evidence." These social activities of metal making were both symbolic and ritual aspects related to the metallurgists' daily life and religious beliefs (Barndon 1992, 2001, 2004; Haaland 2004; Haaland, Haaland, and Rijal 2002; Huysecom 1995; Rijal 1998; Saltman, Goucher and Herbert 1986). Despite the time gap, geographical distance and cultural differences between the north Norwegian Iron Age and 20th century Nepal and Africa, the ethnographic examples provide insight into beliefs and practices which might have been crucial for bringing about smelting. Rituals or symbols related to prehistoric practices can usually not be documented, traced and understood archaeologically, so ethnographic analogies may be our only way to explain some of these prehistoric realities.

The acceptance of this new metal was influenced by a multitude of factors. Religious beliefs, social control and taboos were probably important, but are the most difficult to recognize from an archaeological standpoint. The spatial and chronological gap between the aforementioned ethnographic examples and north Norwegian prehistory is vast, though it is likely that there was more to prehistoric metallurgy than mere technological aspects. Because of this, our understanding in relation to the introduction of iron to North Norway will be seriously flawed if we refrain from taking into account the cultural aspects and context in which the metallurgical practice took place. The production and use of iron may have been controlled by religious taboos, but the degree of religious/magical observance which is thought necessary during ironworking may vary greatly (Alexander 1983:29). I will give a few, brief examples from such studies which have documented the close and inseparable ties between the technological practice of metal making and religious beliefs and practices, as the process of metal making is closely linked to that of reproduction. The furnace is portrayed as a woman and is in some instances equipped with female attributes like breasts (Barndon 2004 a: 28). The smelting process is metaphorically associated with sexual intercourse and in Ethiopia the tuyeres, which are partly inserted into the furnace, are named after the male sexual organ (Haaland 2004:5, 6). The furnace and ore is washed and treated much like a woman who is giving birth. The smelters have to practice sexual abstinence both the night before and during the smelting and women, especially menstruating women, have restricted access to the smelting site. The blacksmiths are believed to possess magical powers, but also to breach taboos which make them "unclean" and set them apart from other people as being someone to be avoided (Haaland 2004:5). In some ways they are regarded as outcasts, although they are also believed to possess power in transforming nature to culture, i.e. ore to metal and metal to objects. As such, the blacksmiths may be involved in transformations in daily life such as "rites of passage" or other rites concerning the transformation of status (Haaland 2004:15).

Slag is quite frequently found in rock shelters and caves in western Norway (Bjørnstad 2003; Tveiten 2005), and these finds may be interpreted within a symbolic framework. *It is therefore reasonable to speculate if rock shelters are one important locality where rituals, connected to the powers, perceptions and processes of growth and transition, were performed.* (Prescott 2000:221). However, slag is found in only a few northern Norwegian caves and rock shelters paintings have been found in eight rock shelters and caves in Nordland County, but none in Troms and Finnmark Counties (Helberg, pers. comm., January 2009). The figures are found inside the caves, in the transitional zone where light gives way to darkness, which has been seen as an indication that the creation of or the figures themselves were part of a ritual, e.g. connected to rites of passage (Bjerck 1995:145-146; Hesjedal 1990:210-211). According to popular belief, caves and mines are both alluring and dangerous as they may be seen as gateways to the underworld or the inner part of the earth. This is not solely a Norwegian tradition, but it is linked to a much wider tradition (Eliade 1978:41-42) that is excellently depicted in the books by Tolkien (1975, 2003). Caves may also have been the scene for initiation rites and concealed activities which were not meant to be conducted in the open.

Many of the ritual beliefs and practices related to metal making do not seem to be isolated to Ethiopia and Africa and are found among people working with metals in other parts of the world. The taboo referred to above, which regulates the smelters relationship with women, is not exclusively African. Ethnoarchaeological studies have also revealed that such taboos also are found on the Indian sub-continent (Rijal 1998:123); the perception of the furnace as a fertile woman, female power and fertility are recognized in both the furnace itself and in the process, but only men participate directly in the smelting, sexual abstinence has to be practiced some time before and during the smelting, and sacrifices have to be made both before and after the construction of the furnace. In addition, blacksmiths are often stigmatized and placed on a lower social footing than the rest of society and live in separate quarters of the village with other low-status members (op. cit.).

Such beliefs are not only related to the production of iron as magical powers have also been ascribed to the metal itself. In India and Nepal, iron anklets are put on the infants as protection against evil, iron sickles and knives are swung over a patient's body as part of the treatment during cholera epidemics and people have carried axes and sickles to keep diseases away, as the magical property of iron worked to ward off evil spirits (Rijal 1998:119, 175). Such beliefs are known also from our culture where iron and steel knives used to be placed in cradles as protection against evil, an iron horseshoe was hanged above the door for bringing or keeping good luck and scissors and knives placed crosswise under the bed made you dream of your future spouse (Solheim 1952:38-42).

Iron and slag have been found in Iron Age graves throughout most of Fennoscandia (Burström 1990; Pukkila 1995; Stenvik 2006). The reason for this is unclear, though it may have to do with magical powers related to the process of making iron or to the metal itself. In the Nordic Edda saga, the smith is displayed as an individual with exceptional status and powers (Burström 1990:265; Hedeager 2001:490-492; The Poetic Edda 1986). A master smith is referred to as the son of a Finn king, which might indicate the belief that the Finns (or the Sami) also had magical powers when it came to working with iron (Hedeager 2001:491). Additionally, a number of graves with blacksmith's tools dating to the Iron Age have been found in North Norway, indicating that the status of the blacksmith indeed was different from that of most people.

A major problem for the archaeologist when dealing with the influence of religious beliefs, taboos and social control is to establish the existence and consequences that such forces may have had on social practice and material culture. It is much like the astronomer's search for black holes which cannot be seen although their existence can be established by observing how they affect their surroundings. Archaeologically, we can observe that iron became part of the material culture in many places from Træna in the south to Kjelmøy in the northeast in the last millennium BC, and that iron production also became part of the cultural practice. When iron was introduced to different parts of Europe we see that during the initial phase the new metal had a very restricted use, was available to only the most high-ranking members of society and used for prestigious objects (Alexander 1981:57-58, 1983:29-30; Pleiner 2000:18-22). In North Norway, there are only a handful of sites from the last millennium BC where fragments of iron and slag has been found, thus indicating that there does not seem to have been severe restrictions on the use of iron as would be expected if it had primarily been used for objects with ceremonial connotations.

Even though taboos and religious beliefs are hard to document in prehistoric societies, ethnoarchaeological research has substantiated the idea that such powers were at work in relation to early iron use and production. Though it may be hard to document the extent of these powers and how they affected social relations and material culture, it is important to bear in mind that developments and cultural traits that would otherwise be difficult to explain, might have been caused and influenced by such powers.

8.5 Social Organization

The secular division of religious leadership and economic power is a relatively late development and throughout most of human history these powers have been intertwined and indivisible. During most of our prehistory, there has been no distinction between secular and religious power as political and religious leadership were supposedly in the hands of the same person(s). It is therefore likely that the economic power increasingly rested with the leading members of the settlements as social stratification and political centralization increased during the Early Metal Period and Iron Age. During these periods, most trade is likely to have been organized and controlled by a few people within the societies in question.

We like to think today that most of our actions are governed by common sense and some form of social and economic rationalism. However, there is a great irrational element in our decision making and daily lives in that we have to relate to reality with various types of rationalities. There is reason to believe that the calculative and rational attitude we wish to relate to were different in the Early Metal Period and Iron Age and the production of iron may have been discontinued and restricted due to religious beliefs and taboos. However, there is no reason to believe that those communities or individuals were completely victims of their own religious conceptions. Therefore, it is possible that the discontinuation of iron production at Hemmestad and Flakstadvåg was either wholly or partially due to economic estimates and pragmatic decisions based on some type of cost-benefit calculations.

Research on social conditions in Norway during the Iron Age seems to concur that the Germanic chiefdoms were political institutions characterized by a fundamental unstableness, full of conflict and in a constant struggle to create alliances (Odner 1973, 1983; Skre 1998; Storli 2006). The disintegration of old alliances and a fight to establish new ones seem to have been a hallmark, so with this social development in mind, it is important to realize that the Iron Age was a very long period and both social organization and alliances would have varied greatly during this period. Throughout the Iron Age in general, there was a tendency towards the consolidation of power (Storli 2006:185). The number of farming settlements increase greatly from the Roman Period and social stratification also increases, culminating in the establishment of chiefdoms as the dominant social system (Storli 2006:182-188). Among other things, the courtyard sites have been interpreted as being central to the settlements of the elite or as a assembly or *thing* site (Storli 2006:184). They are dated as early as AD 200 and may be seen as expressing centralized and consolidated power. Eight sites are dated to the Early Iron Age, but from AD 600 power was further consolidated and only three courtyard sites (Tjøtta, Steigen and Bjarkøy) can be dated to the Late Iron Age (ibid. 74). The expansion and the consolidation of the Germanic settlements that are seen in Nordland and Troms from the Roman Period, are likely to have been associated with socio-political networks based on some form of alliances which would have been vital for the structuring and regulation of trade within the web of Germanic settlements at the coast from North Troms and further south.

The main distribution area of the Kjelmøy ceramics is coastal and interior Finnmark, northern Finland and northern Sweden (Jørgensen and Olsen 1987, 1988). In the same way as the Risvik ceramics may have worked as a signal in terms of identity and a desire for contact with coastal settlements north to North Troms, the Kjelmøy ceramics could have worked as both an internal and intra-group signal among hunter/gatherers in northern Fennoscandia. The Kjelmøy ceramics seem to have been in use until AD 300, but their function is likely to have changed during the last few hundred years. The latest dated ceramics are found in graves (and one possible sacrifice), while the older finds are from settlements (Hansen and Olsen 2004:57). This change of context from settlement to grave indicates that the use of the Kjelmøy ceramics in the last phase was related to rituals within the group and not in intra-group relationships (Hansen and Olsen 2004:58), which may be a sign of a change in both external interactions and trade partners.

Olsen (1994:136) sees the spread of iron objects as part of an egalitarian distribution system within the band(s) living at Kjelmøy. At the end of the settled period at Kjelmøy (BC/AD) external relations to iron-using and iron-producing people in the southeast and east seems to weaken (Hansen and Olsen 2004:72-73) to be replaced by contacts with coastal settlements in west and southwest (ibid. 75).

8.6 Chains of Supply

When discussing the question of how and in what form iron was traded to North Norway, where the iron came from and who the suppliers were also has a bearing on this. During the Pre-Roman Iron Age, no geographical area stands out as having had a major surplus in production. This is a period when iron was probably produced in many places, especially in South Scandinavia, but in small quantities. Some coastal settlements in Nordland and Troms possibly made minor amounts of iron from the beginning of the Iron Age and throughout the period, but due to the little production, most metal is likely to have been procured through interactions with people in the south. In North Troms and Finnmark there is no sign of iron production and therefore, the need for iron had to be satisfied through trade with societies in the southwest, south and/or east.

The present data indicates that the local iron production in the north never reached a scale that would have allowed North Norway to be self-sufficient. It may be argued that our knowledge of historical monuments in the outland areas is particularly fragmentary and insufficient, and that there can possibly be many iron production sites that have not yet been discovered. An extensive survey and dating program which began in Trøndelag in the early 1980s greatly increased the number of Iron Age production sites in the forests and lower mountain regions (Stenvik 2003 a:123-124). During the 1000 years since the Iron Age, forests and fields have been quite intensively exploited without more slag being found. Even so, there is no reason to believe that all the ironworks have been discovered and I think that more production sites will be found in the years to come. However, no current information indicate that a large number of production sites will be discovered which will change the impression of North Norway as a region dependent on an external supply of iron during the entire Iron Age.

8.6.1 North Troms and Finnmark

During the Iron Age until AD/BC, northern Fennoscandia was dominated by settlements of hunter/gatherers. The geographical area of these settlements is indicated by the spread of the Kjelmøy ceramics (Jørgensen and Olsen 1988:4, Figure 1) and the external connections seem mainly to have been with societies within this cultural sphere and towards eastern cultures like the Ananjino.

The earliest use of iron is documented at Makkholla in eastern Finnmark where the many finds indicate an ample and long lasting supply of iron (Olsen 1994:132; Solberg 1909;39-45, Figures 35, 79, 1911:351). The supply of iron was secured through contacts with western offshoots of the Ananjino culture in the south and southeast that both used and produced iron (Olsen 1994:132-133). The Ananjino culture includes small, hollow and very light iron points that are highly transportable (Bjørnar Olsen, personal communication, December 2009). A small sack with such artifacts could easily be transported long distances to support a quite large group of people. No slag has been found at Kjelmøy indicating that iron was produced or forged at the site. However, iron points have undoubtedly been adapted to fit locally made bone tools and such lightweight objects of soft iron could easily be altered by cold-hammering to fit locally made tools.

There seems to have been a break in these social relations from BC/AD, and a reorientation towards the west and southwest indicate that iron was mostly later provided from Germanic settlement (Hansen and Olsen 2004:73-75). The Germanic farming settlements south of North Troms expanded greatly during the Iron Age AD, and trade with the Sami settlements further north increased, which are indicated by the import finds (Hansen and Olsen 2004:73,75). In Finnmark, there are only three Sami graves with Germanic imports and one gold and silver hoard dated to the first millennium AD (ibid. 74; Brøgger 1931). This may seem little to postulate an orientation towards the Germanic societies in the west and south, however, the Kjelmøy ceramics disappear from the archaeological record at the time of the emergence of the slab lined pits in North Troms and Finnmark. This seems to coincide with an increased mobility among the Sami settlements (Henriksen 1996). The production of oil from seal- and whale-blubber and possibly cod-liver in numerous slab-lined pits in North Troms and Finnmark (Hansen and Olsen 2004:76, Figure 9; Henriksen 1996) is likely to have been made for trade with the Germanic settlements in the west and south. This western orientation seems to have lasted until the Viking Period when a reorientation towards east takes place (Henriksen 1996:91, 93; Schanche 2000:232-233).

8.6.2 Coastal Settlements in Nordland and Troms

The distribution of artifacts of South Scandinavian origin, indicate contacts between coastal settlements from Rogaland to Troms from the Late Stone Age (Bakka 1976; Johansen 1979; Jørgensen 1986; Valen 2007). Although contacts between north and south seem to have dominated the external relations, a few eastern type artifacts such as knives with animal or bird heads and the Rovaniemi pickaxe, dating to the Late Stone Age, and jewelry, dating to the Iron Age (Storli 1991), document eastern contacts as well.

Iron and slag at sites with Risvik ceramics document that iron was available and fairly widespread in Nordland and Troms during the last millennium BC. These early finds of iron and slag should be viewed in a wider geographical context as small amounts of iron and iron slag have been found at several Bronze Age sites in southern Scandinavia (Hjärthner-Holdar 1993:38, Figure 7).

There are no indications that local iron production could have satisfied the local demand for iron in Nordland and Troms. No major iron production centers dating to the Pre-Roman Iron Age have been found in Scandinavia, and it is therefore uncertain as to which areas supplied the settlements in Nordland and Troms with iron. No potential supply centers are known in the north and the east, and it is likely that the BC supply of iron was secured through exchange with many production sites in the south or even in the east. Given such a situation, the closing of production at

Hemmestad is quite incomprehensible, though there could have been a number of accidental or immediate causes for this such as: resources running out, a loss of technological knowhow, ideological changes among those who controlled the production, iron not being sought after, easier procurement through external contacts, etc. The southern contacts, which supplied these sites with iron during the Risvik ceramics phase, did not break apart because of the disappearance of the ceramics, but rather seem to have been strengthened throughout the Iron Age.

The iron production in Trøndelag began 300 – 400 BC but reached its peak during the Roman Period (Stenvik 2003 a: 124), yet to date, no site contemporary to Hemmestad has been found. In Southeast Norway, a few sites are ^{14}C dated to the same period, but these dates are questionable and should be handled with care (Larsen 2004:149). The production at Hemmestad seems to have been quite limited and rather short-lived. What happened after the production was terminated? Was the use of iron discontinued or, if not, where did the metal come from and how was the supply organized? No Pre-Roman production sites in Trøndelag or further south stand out in the archaeological record as having a noticeable surplus in production. Iron have been found at several sites with Risvik ceramics and the metal seems thus to have been an integral part of the material culture at these coastal sites. Except for Hemmestad, there are no signs of iron production at the Risvik sites.

The production of iron grew rapidly in North Trøndelag during the Early Roman Period, and before long, the production exceeded by far the local need for iron. It is likely that during most of the Early Iron Age AD the need for iron in Nordland and Troms was, at least partially, satisfied through trade with this area. At the end of the Early Iron Age, the iron production’s center of gravity seems to shift eastwards as there is a considerable growth in iron production in Jämtland during this period (Johansen 2003; Magnusson 1986). There is a noticeable Swedish influence in the North Norwegian archaeological material from the Late Migration Period and into the Merovingian Period and a similar but stronger trend is seen in Trøndelag (Sjøvold 1974:358). Single finds such as a sword found in Karlsøy Municipality (Ts. 299), typological groups like the Vendel spearheads, R. 519 (Rygh 1885) and ornamental features, clearly reflect increased contact and trade with eastern Scandinavia (Sjøvold 1974:358-359). However, no spade-shaped iron currency bar of the Swedish type has ever been found in North Norway that would indicate trade with iron. We have no way of knowing if these increased eastern contacts included such a trade, but it is possible that Jämtland was important in supplying the northern Norwegian settlements with iron during the Late Iron Age. This could have been organized through direct contact or channeled through the previously established contacts in Trøndelag.

During the entire Iron Age, contacts with western and southwestern Norway seem to be strong but no iron production site with a major surplus in production has been found. In the Late Iron Age, there is a considerable surplus production of iron in the lower mountain areas of Southeast Norway. Still, the archaeological material does not allow for categorical statements about which production area was most important in supplying North Norway with iron during the Late Iron Age. It seems likely that iron did not come from only one production area but rather through many of the channels characteristic of the external contacts during the period.

8.7 A Model for the Supply of Iron

South Scandinavian imports constitute part of the north Norwegian archaeological record from the Stone Age and hereafter (Johansen 1979; Myklevoll 1997:180-184, Appendix 5; Valen 2007) thus documenting a "flow" of objects between north and south. The north Norwegian iron production seems to have been very small and thus insufficient to satisfy local demand. The presence of iron tools and weapons and other kind of import finds demonstrate that the north Norwegian settlements throughout the Iron Age were part of external exchange systems. There is a saying that "artifacts do not travel, but people do". Still, single objects could have "travelled" long distances from hand to hand and this may have been the method of exchange bringing the first iron objects to North Norway. During the Pre-Roman Iron Age, the use of iron seems to have been widespread but possibly limited to small and light artifacts, like the points used at Kjelmøy (Solberg 1909:42-45, Figures 65, 66, 80, 1911:351). Such small iron objects did not presuppose access to large amounts of iron. During the Roman Period the use of iron increased and soon the demand for iron would have been too great to be satisfied by such a "hand to hand " supply system and the exchange of trade goods like iron, had to be secured in a more predictable and efficient manner.

The distance from South Troms to the production centers in North Trøndelag are approximately 500 km with an important question being if trade with iron could have been organized during the entire Iron Age with Trøndelag or regions even further away. The means of transport and social organization would have been crucial for maintaining a long lasting and successful long distance trade. Our knowledge about Pre-Roman boats is inadequate, but based on finds of boats and rock carvings it is evident that quite large and seaworthy boats have been used. Whether the social organization made direct trade possible between the areas of production and the consumers is quite another matter indeed. The Pre-Roman Hjortspring boat found in Denmark was 18 - 19 m long and could carry 24 men (Crumlin-Pedersen 2003:36), and similar boats dated to the period between 900 and 100 BC are part of the rock carvings in Alta in North Norway (Helskog 1988:88, 94, 2000:6). The Hjortspring boat was most likely used for military purposes (Kaul 2003), although similarities with rock carvings indicate the existence of boats in North Norway that performed well in quite rough weather and could travel long distances. It is uncertain whether the social organization during the Early Iron Age allowed for the planning, carrying out and maintenance of long distance travel between North Norway and Trøndelag and southern Norway. However, exchange of goods was not necessarily based on direct contact between the producer and consumer, as the use of intermediaries between the northern settlements and southern iron producers could have made this possible.

The use of iron among both farmers and foragers seems to have been widespread, maybe except for the initial iron-using period. There seems to be a quantitative shift in the use of iron from the Roman Period and even though the supply of iron to all of North Norway seems to have continued unabated from the Pre-Roman Period, iron was most likely a valuable commodity during most of the Iron Age and therefore much sought after. In this context, the termination of the production at the sites Hemmestad and Flakstadvåg after only a short period of use is incomprehensible. From a modern, strictly economic point of view, one would believe that the investment of labor would have easily paid off since smeltings seem to have been successful at both places and resources were in abundance. The time difference between the two sites is 700-800 years and the reasons for the termination of production were surely not the same. An entire range of scenarios could be drawn, though we will never know for sure. To explain the lack of iron production in North

Norway, Stenvik (2003 b:80-81) draws a line from the desire in modern times to safeguard and keep company secrets back to the Roman Period, thus making it possible that craftsmen did not share their technical skills. He thinks (op. cit.) that this may have been one reason why the practice of iron production never gained a foothold in North Norway. If this was the case, iron production could not have been "common knowledge" but must have been fairly specialized and primarily carried out by "professionals." If such a "blockade" was exercised, it would not have been without loopholes. The two Iron Age iron production sites discovered up until now document that, at least to a certain extent, the technical knowledge was present, but for some reason was hardly used. Knowing that not only the knowledge but also that the natural resources were available, gives us a reason to search for alternative explanations for the small amount of iron production in the social, religious and political organization of the northern societies.

When looking into reasons for why iron production never rose to a level where the northern settlements were self-supported with iron, the Iron Age will have to be divided into two periods, one before AD 200-300, and the other after. The successful smelting(s) at Hemmestad in the Pre-Roman Period, demonstrate the presence of the technical knowhow, at least at that site. The closing down of this single production site indicates that: (a) the technical knowhow was not available any more, (b) there was too little of a demand for iron or (c) iron was provided from other sources. In the case of (a), Stenvik's hypothesis (Stenvik 2003 b:80-81) about restricted access to the technological knowhow may have had an effect which influenced the possibilities and will to establish new iron production sites in the north but hardly in keeping already established sites going. The second alternative (b) may have several explanations. A low demand for iron may have been rooted in a lack of acceptance for use of this new metal. Such restrictions could be one reason for the seemingly modest use of iron at sites with Risvik ceramics. In addition, the lack of technical knowledge in terms of modifying, repairing and using the new metal could have influenced its use and therefore its demand. In case of (c), iron could more easily be obtained from outside sources than from local production.

In the Iron Age following AD 200-300, the premise for both the production and supply of iron changed. Iron was produced in great quantities in many regions in southern Norway and in Sweden. The production site at Flakstadvåg was established in the beginning of this period at a time when iron production peaked in North Trøndelag, and there was a pronounced rise in the use of iron in North Norway. This increased usage was not due to local production, but rather was related to an increased trade with iron. In other words, the peoples of the north seem to have preferred to secure their need for iron through trade rather than relying on local production. Could this be because the terms of trade were so favorable that iron could be easier and "cheaper" to obtain by trade rather than by production? It is not likely that such an assessment was made at every settlement, and that with a few exceptions, all settlements unanimously agreed to refrain from iron production, particularly since trade was not likely to have been an activity in which everybody participated. Therefore, small-scale, local iron production on farms with access to natural resources would have been an easy and less costly method of acquiring iron. Even so, this was not the case and I therefore find it more likely that a causal connection must be searched for in the social structure of the northern societies.

In Trøndelag, an increase in the number of imports in Roman Period graves (Stenvik 1987:111) demonstrates the presence of an exchange system reaching outside the boundaries of Scandinavia. Such a system may have also included all of North Norway and this northern trade may have been vital to the wealth of North Trøndelag. Apart from prestige goods such as walrus teeth, valuable fur and gerfalcons, which were possibly much sought after among the elite in South Scandinavia and continental Europe, whale, seal and fish oil were produced in great quantities in the north. In North Troms and Finnmark, numerous slab-lined pits dating from the Early Roman to the Viking Period have been documented (Hansen and Olsen 2004:76, Figure 9; Henriksen 1996). These pits are believed to have been used for producing oil from seal and whale blubber, and possibly also from cod liver. Such oil had a wide range of uses and could be used to grease and impregnate leather, rope and wood, in addition for domestic purposes such as light and heating (Hansen 1990:173; Hansen and Olsen 2004:73). There was a demand for both prestige goods and oil, not only among leading members of the iron producing societies in southern Norway, but on the European continent as well (Baudou 1995:107-108; Gustavsson 1987:372). All these trade goods would have made the northern peoples valuable trade partners and it is likely that iron and iron objects constituted part of this exchange.

Throughout the Iron Age, there was a development towards increased stratification and political centralization within the Germanic settlements along the north Norwegian coast. Without one central power to grant rights and safe passage, alliance systems based on kinship, marriage, etc. were crucial. Moreover, manpower for transport and protection would also have been of great importance, making it likely that most trade was carried out and controlled by leading members of the north Norwegian Germanic settlements, as exemplified by the tale of Ohthere (Ottar in Norwegian), a north Norwegian farmer and tradesman who probably lived in the southern part of Mid-Troms (Storli 2007:81-85). According to his account, which was recorded approximately AD 890, he traded with the Sami and travelled to South Scandinavian marketplaces (Bately and Englert 2007), which very well may be an exchange system with roots going well back into the Early Iron Age.

A network of Germanic north Norwegian tradesmen may have controlled the trade both with the Sami in the north and the east, and with iron producers and iron producing settlements in the south. Successful trade presupposes that the trade partners have access to products of interest to the other part. Iron would have been in high demand in the north because of a small local iron production and northern products such as fur, walrus teeth, oil, and possibly gerfalcons was much sought after among the Germanic elite both in south Scandinavia and on the continent. The southern iron producers and the north Norwegian elite, who controlled the trade, would both have benefited from an alliance, based on mutual agreements involving exchange of northern products with iron. The northern elite, who controlled the trade, would have had much to gain from monopolizing the supply of iron to both the foragers in the north and east and the coastal, farming settlements. This would have granted access to products only the Sami could provide which was important both in their local prestige-goods economy and in their interaction with high-ranking members of southern communities. In addition, controlling the supply of and access to iron would have been important for their position and power and increased the farming settlements dependence of their leaders. Achieving and maintaining such a monopoly presupposes that initiatives were taken to suppress local iron production and such power could probably be exercised in the farming communities in Nordland and Troms. However, an agreement with those who controlled iron production in the south would have been vital. This is where Stenvik's hypothesis (2003 b:80-81) about "keeping company secrets" may have some validity. The southern iron producers would have been as interested in keeping up the northern trade as the north Norwegian tradesmen. By preventing the spread of iron production technology to the northern settlements, trade relations which gave access to northern products could be maintained. Access to such high status products from the north would have increased their status in the iron producing societies and place them in a powerful position vs. north Norwegian tradesmen as the only providers of iron. These products would also have been attractive on European markets. The Roman imports found in graves in Trøndelag are thus not only a result of iron trade to the south but also with products from North Norway, which were conveyed to the European markets.

By monopolizing the supply of iron, which probably was a highly prized product throughout the Iron Age, the northern elite would not only strengthen their socio-economical position within the Germanic coastal settlements in Nordland and Troms but also their bargaining position in relation to the Sami. By offering a steady and continual supply and being the sole provider of iron to the Sami societies in the north and east, the northern tradesmen secured the supply of products only the Sami could provide. Such a trade relation had to be based on reciprocity, as the elite among the farming settlements probably had no means to force trade-relations with the Sami (Odner 1983). The most important they could offer to keep up such relations, would have been iron.

Throughout the Iron Age, a shifting north Norwegian aristocracy would thus have had little interest in a local iron production in the north and would thus have benefited from suppressing local initiatives to produce iron. The political center of gravity in North Norway probably shifted over time between a few families, although those on the top of the social ladder would depend on the same resources to consolidate and maintain their position as socio-political and religious leaders. Thus, the small iron production in the Germanic settlements during the Iron Age would be a consequence of strategic choices made by their leading members.

It is not likely that the north Norwegian tradesmen's power to suppress local iron production was extended to the Sami population. Their reasons for not producing iron would have been different from those in the Germanic settlements, which could have to do with the social and settlement structures of these societies, which were very different from their Germanic neighbors.

8.7 Concluding Remarks

The acceptance of iron seems to have varied greatly throughout Europe, taking up to six to eight generations in some places (Alexander 1983:32). In all of North Norway, the transition from lithics to iron seems to have been quite speedy, and iron seems to have been quite common already from the beginning of the Iron Age.

The fragmentary and weak metallurgical tradition that seems to have existed throughout northern Fennoscandia during much of the last millennium BC may have played an important part in the acceptance of iron and the new technology, resulting in the establishing and carrying out of the first smelting. The early finds of iron and slag at Risvik ceramics sites and at Kjelmøy are therefore not a surprise, while on the other hand, the early dates for the production site at Hemmestad are definitely a surprise. The dates of Hemmestad to approximately 500 BC are as early as they are found in southern Scandinavia. However, the smelting activity ended soon after its initial phase and the practice of producing iron never obtained a permanent foothold in North Norway. Consequently, all three known north Norwegian smelting sites should be regarded as being exceptions to the rule, and during the Pre-Roman and Early Roman Period there was not one major iron production site which could have made a major contribution in supplying the iron-using communities of North Norway. The first use of iron in Nordland and Troms, which is seen within the context of settlements with Risvik ceramics, was probably a result of iron being obtained through many external contacts from the south while the first iron at settlements in Finnmark came from southeast and east.

The amount of archaeologically recovered iron in all of North Norway is small during the iron-using period BC which could be an indication of the amount of iron which was in circulation. However, this is a period with seemingly little use of lithic tools and it is reason to believe that some of the previous use of lithic materials had been replaced by the use of metals. It is therefore possible that metal-use was more comprehensive and widespread than indicated by the archaeological material.

Until now, three iron production sites have been found in North Norway, but more are expected to surface in the years to come. It is unlikely, however, that we will find productions sites in numbers such as those found and excavated in Trøndelag and further south. I find it improbable that North Norway was self-contained with iron at any time during the Iron Age. The supply of iron had to be secured from outside and it is likely that iron was part of exchange systems between settlements in the north and south. It has been established that there was a surplus of production in North Trøndelag in the Roman Period, and that iron production increased heavily during the Late Iron Age in Jämtland in Sweden as well as in Southeast Norway. For that reason, it is possible that these areas were the source for the north Norwegian iron from the Roman Period and later periods of the Iron Age.

The reason for the small amount of north Norwegian iron production is believed to be found in the socio-political structure of the Germanic settlements, and trade with both the Sami in the north and east, together with iron producers in the south, were an important part of the power base of the north Norwegian elite. If iron was an important part of this trade, they would have had every reason to discourage local initiatives to produce iron. This seems to have been the case throughout the Iron Age and when chiefdoms were replaced by a central power in the Medieval Period, the metallurgical traditions were limited to forging iron. Therefore, a lasting technological tradition based on local iron production was never developed in North Norway before the modern, state-sponsored companies were established in the early part of the 20th century.

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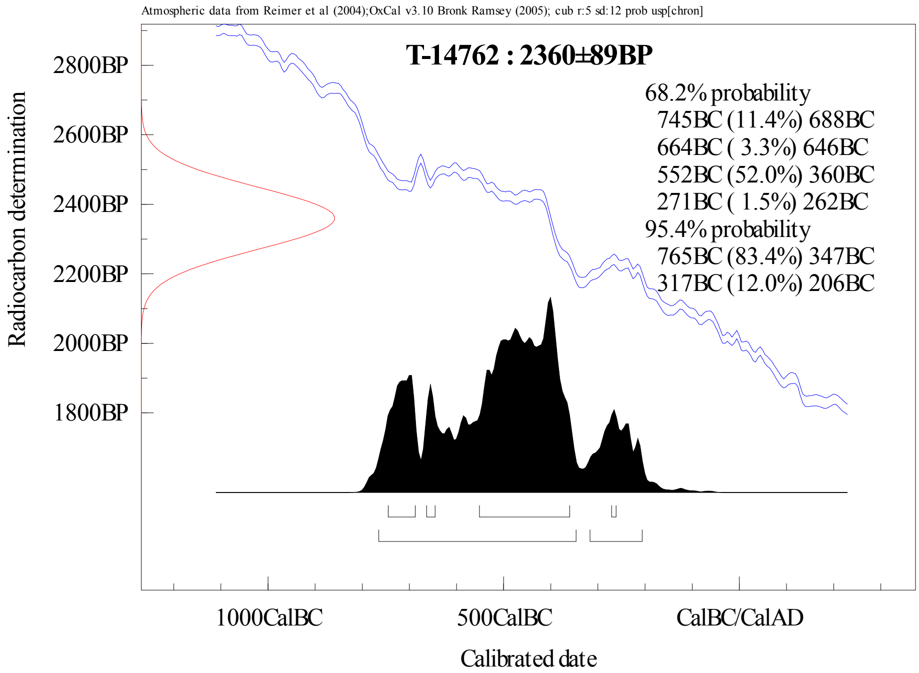
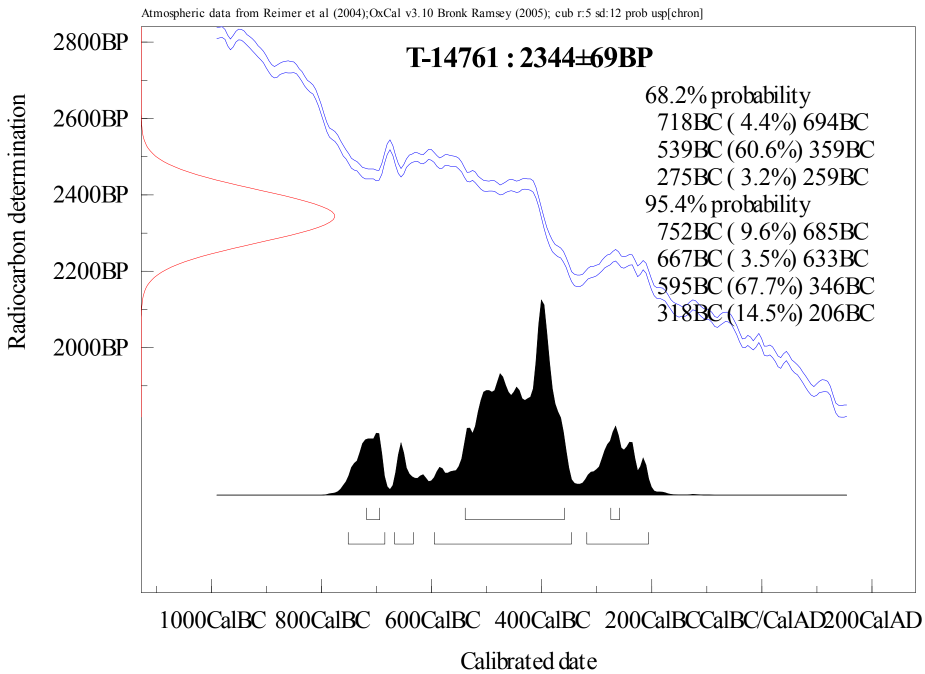
Specific Gravity Table For Ceramics, Metals & Minerals:
http://www.reade.com/Particle_Briefings/spec_gra.html Viewed January 2008.

APPENDICES

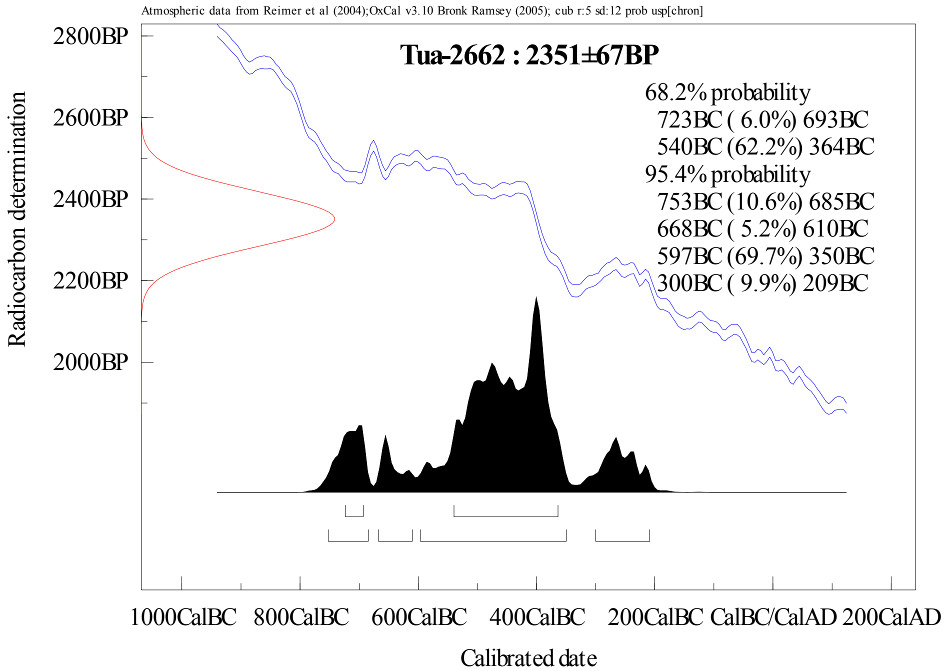
Appendix 1: Furnace I, Hemmestad



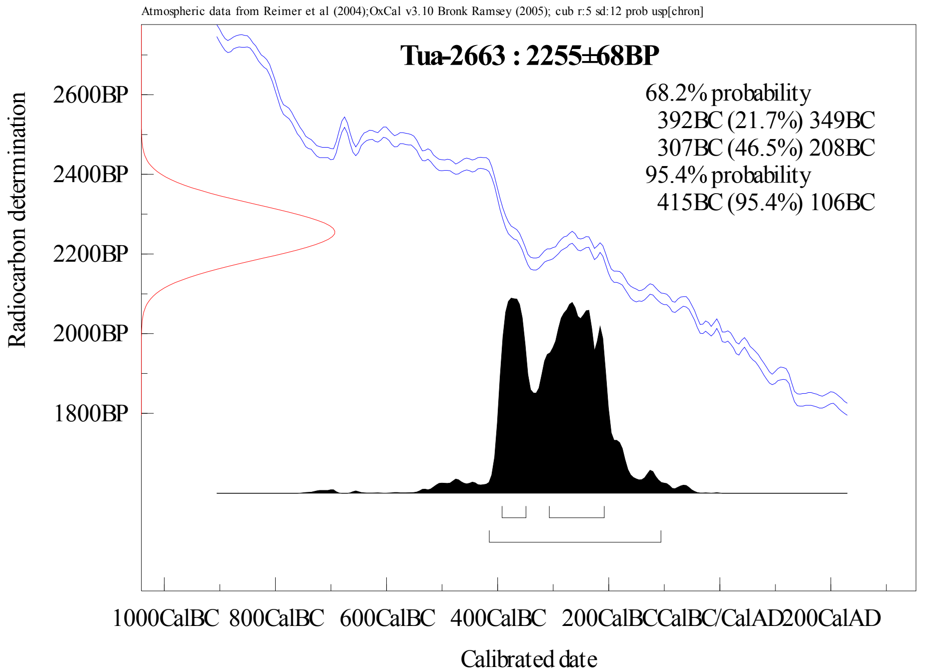
Appendix 2: Furnace I, Hemmestad



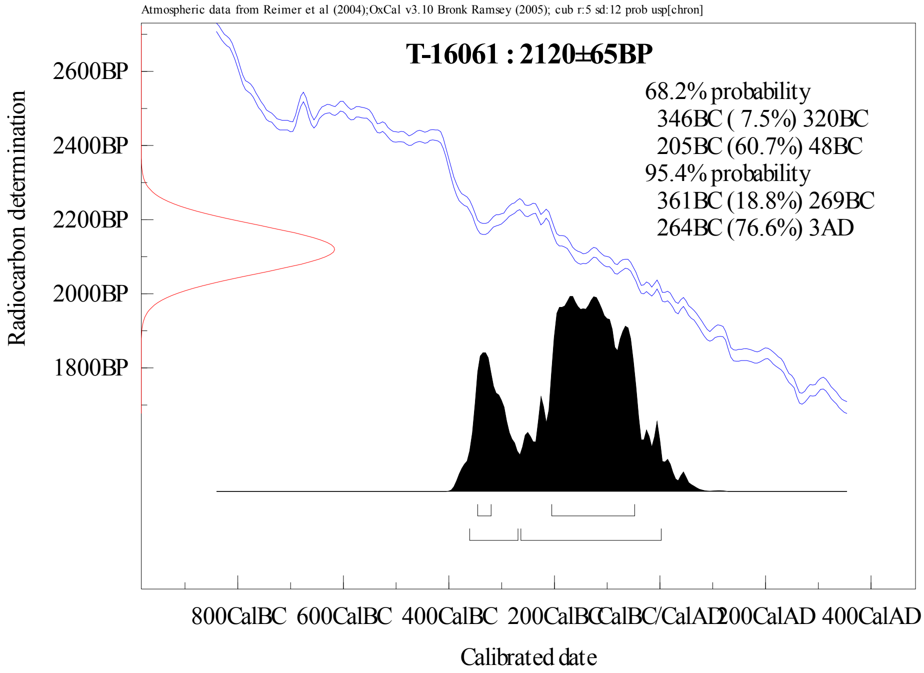
Appendix 3: Furnace II, Hemmestad



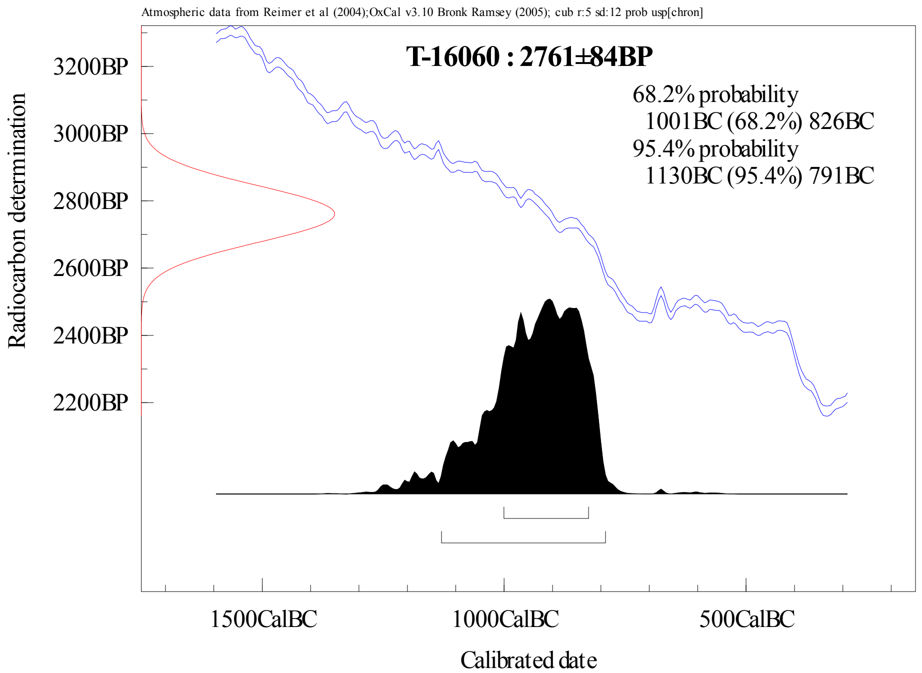
Appendix 4: Furnace II, Hemmestad



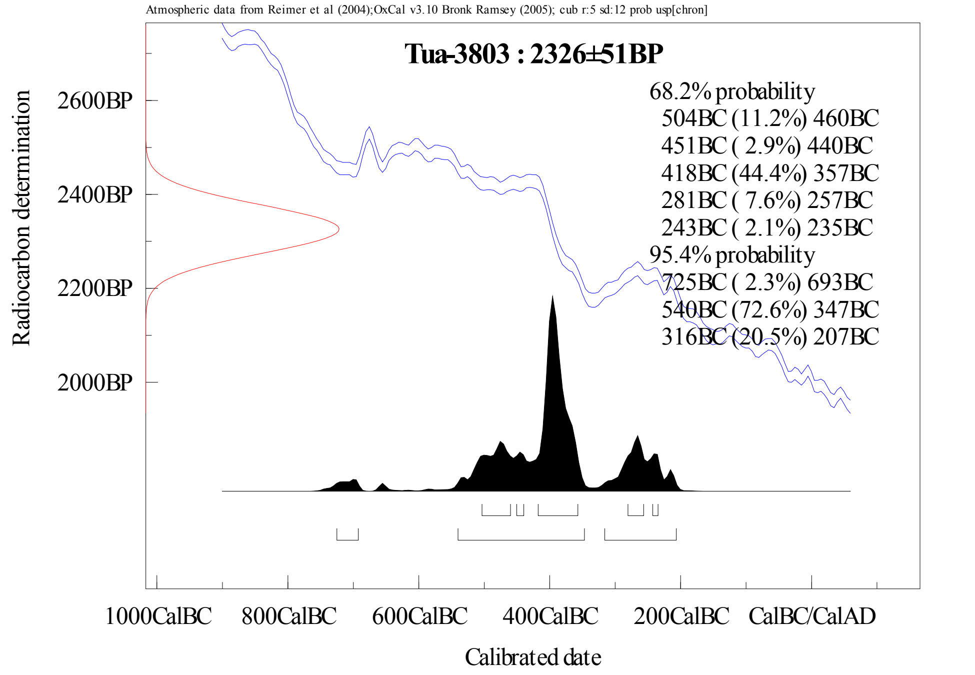
Appendix 5: Structure II, Hemmestad



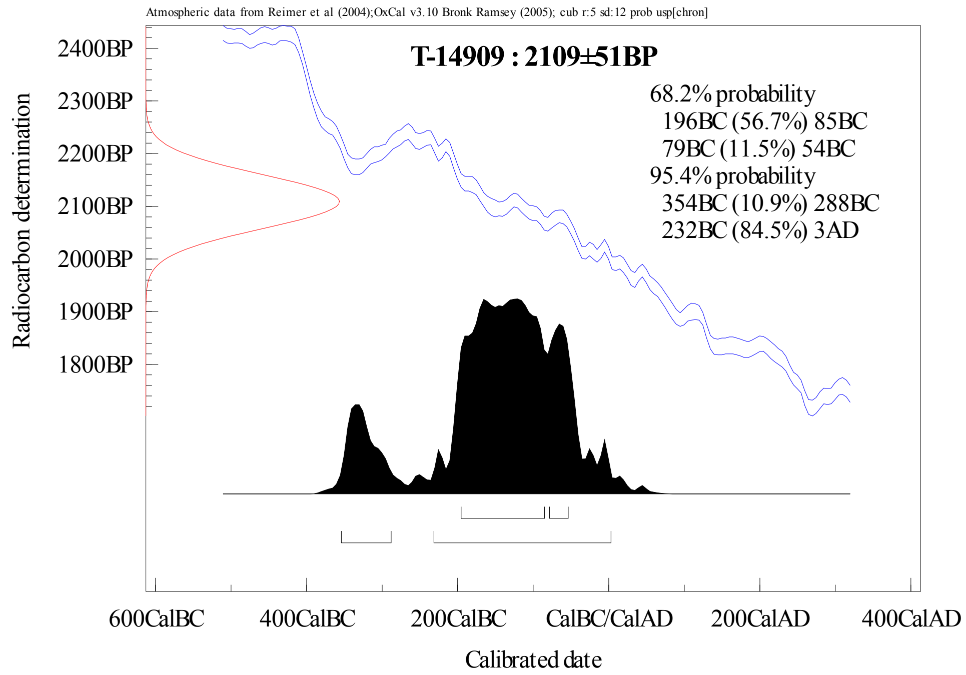
Appendix 6: Cooking pit I, Hemmestad



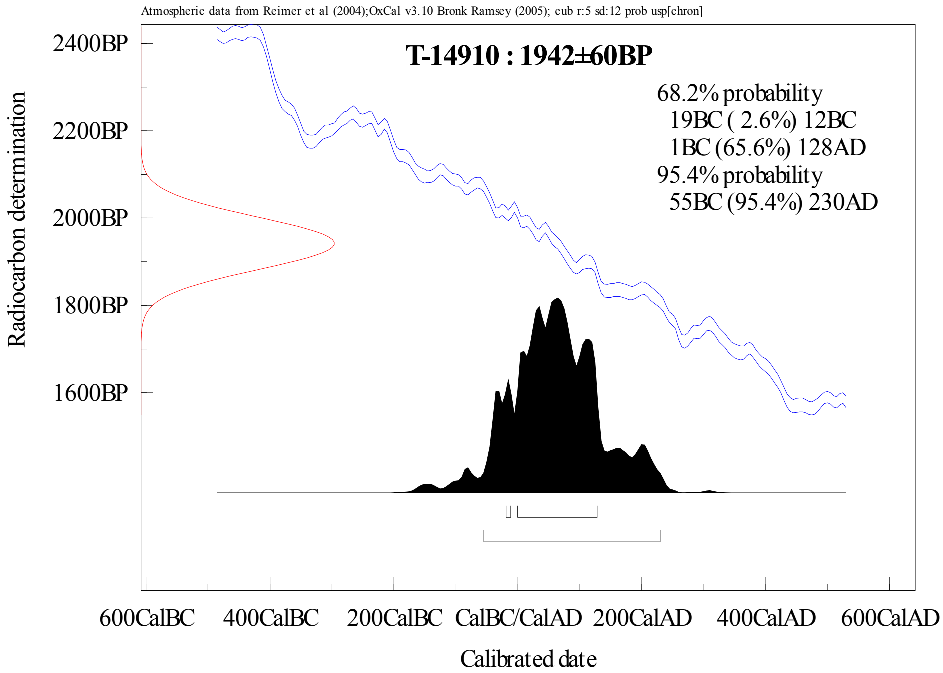
Appendix 7: Cooking pit II, Hemmestad



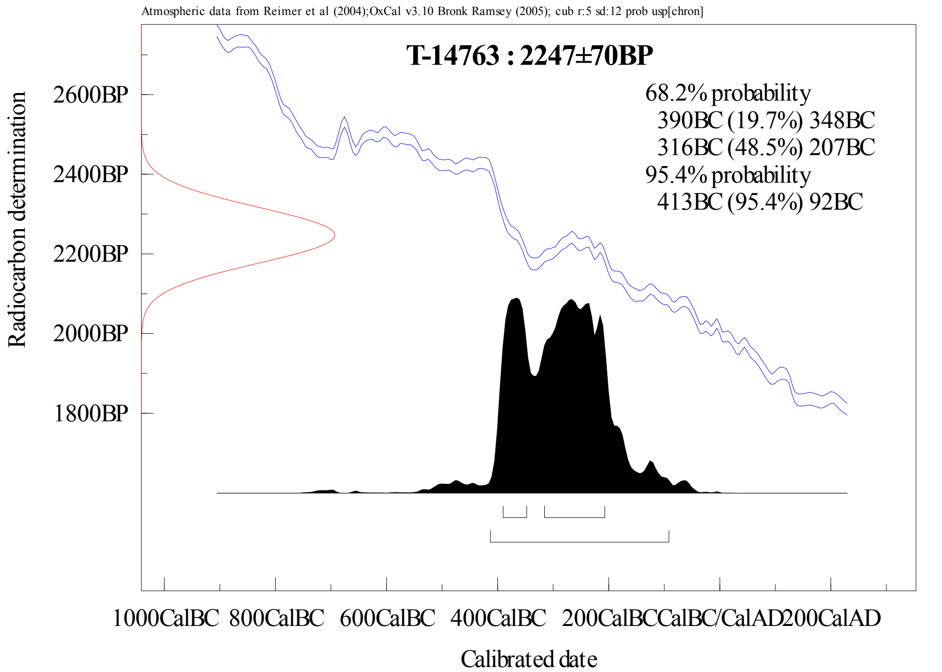
Appendix 8: Hearth I, Hemmestad



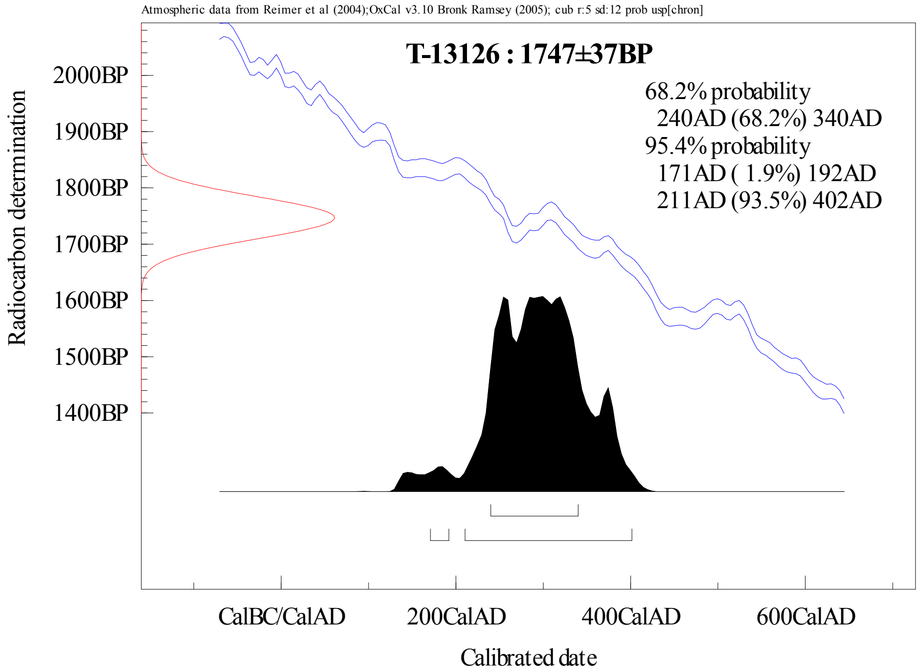
Appendix 9: Hearth II, Hemmestad



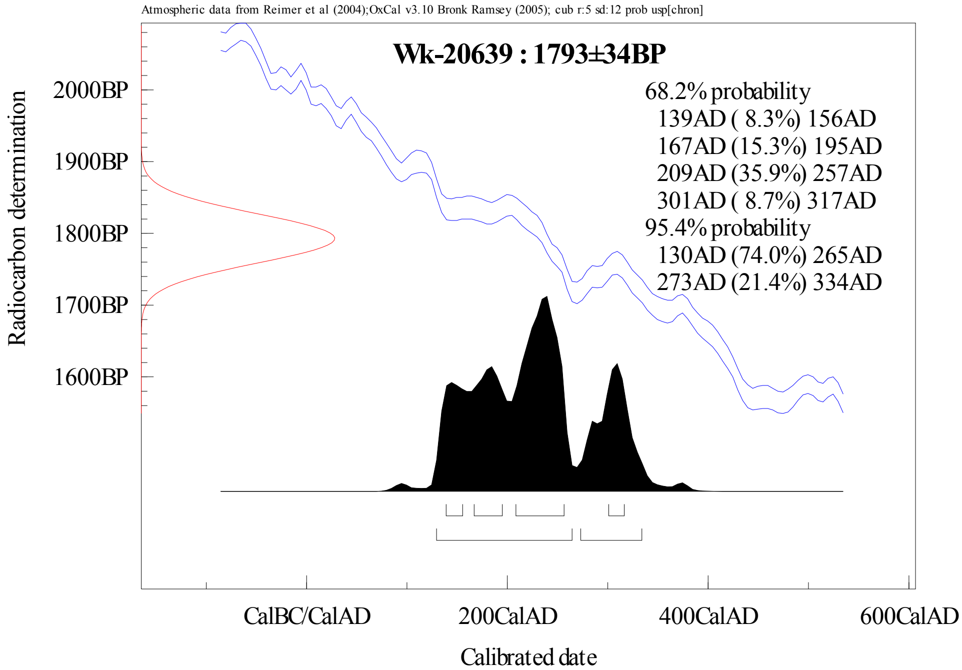
Appendix 10: Charcoal kiln, Hemmestad



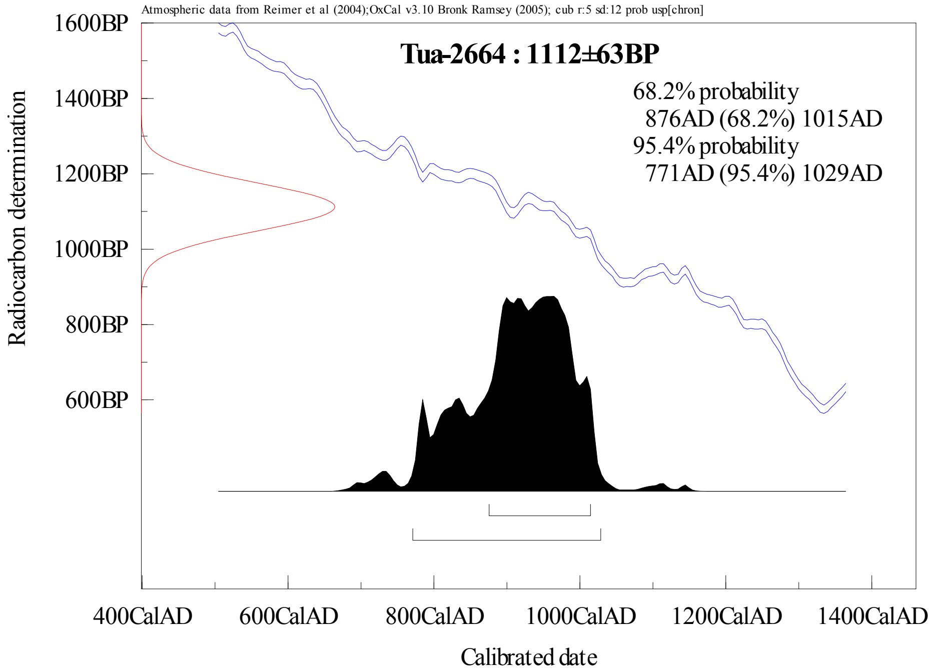
Appendix 11: Outside of furnace, Flakstadvåg



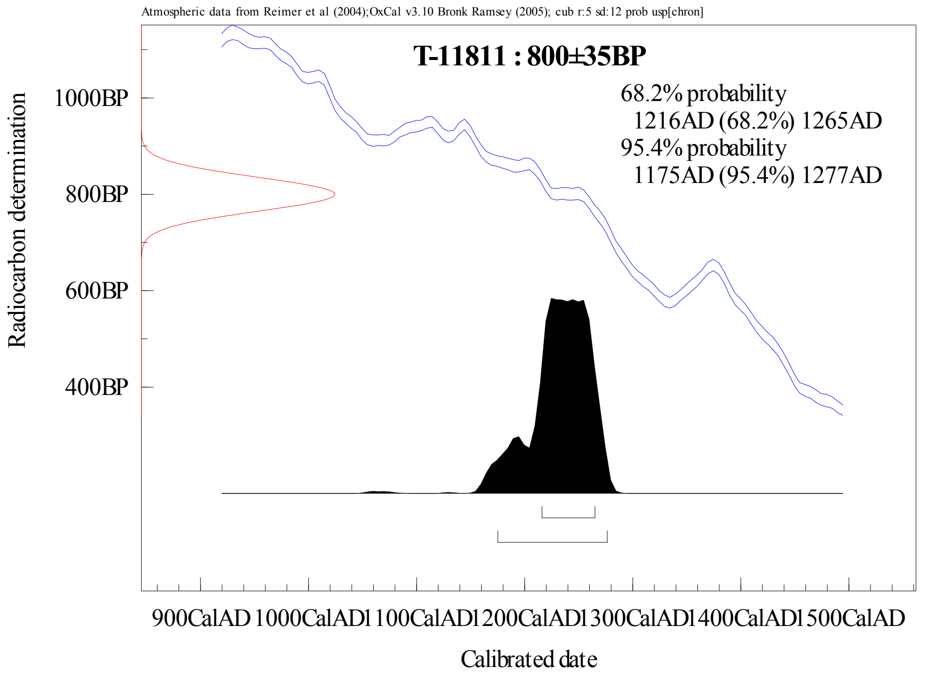
Appendix 12: Charcoal in slag, Flakstadvåg



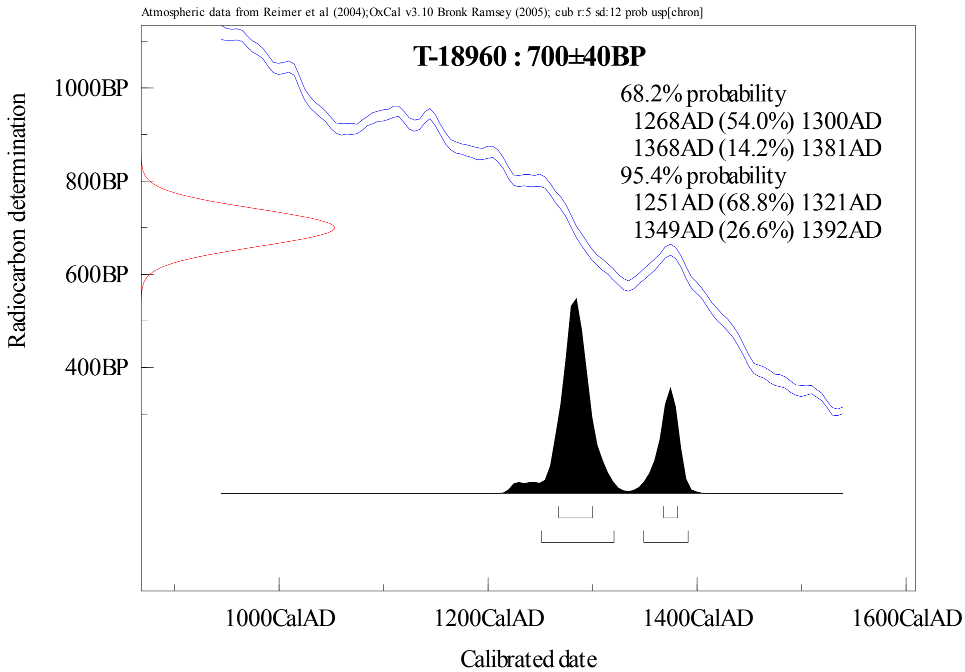
Appendix 13: Boathouse, Flakstadvåg



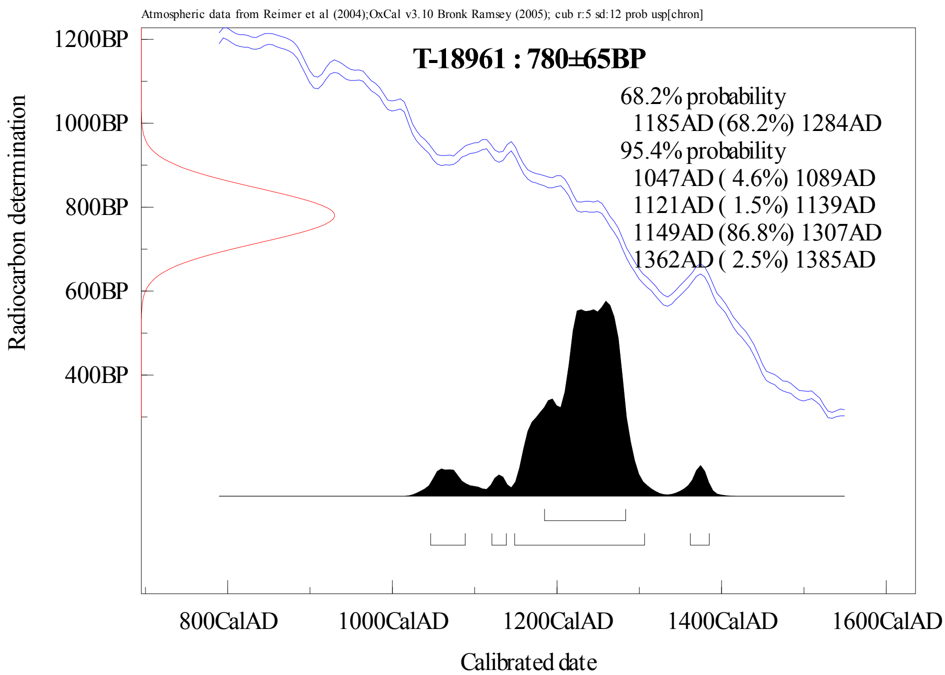
Appendix 14: Slag heap, Rognlivatnet



Appendix 15: Charcoal kiln I, Rognlivatnet



Appendix 16: Charcoal kiln II, Rognlivatnet



Appendix 17: Artifacts from barrow at Å in Andøy

Museum no.	Artifact
Ts. 1796	Celt
Ts. 1797	Celt
Ts. 1798	Celt
Ts. 1799	Celt
Ts. 1800	Axe (resembling R. 556)
Ts. 1801	Sickle or scythe (resembling R. 386)
Ts. 1802	Spear-head
Ts. 1803	Tool of iron resembling a hammerhead but without the handle hole
Ts. 1804	Two thin and flat pieces of iron, possibly fragments of a sword
Ts. 1805	Two large lumps of iron

Appendix 18: Artifacts from barrow at Stangnes in Tranøy

Museum no.	**Artifact**
Ts. 1033	Bucket-shaped pot
Ts. 1034	Strap buckle of bronze
Ts. 1035	Shield fragments
Ts. 1036	Shield grip
Ts. 1037	Axe of iron

Appendix 19: Artifacts from barrow at Buøya in Bø

Museum no.	Artifact
Ts. 2066	Wedge-shaped axe
Ts. 2067	Sword fragments
Ts. 2068	Spearhead fragments
Ts. 2069	Arrowheads fragments
Ts. 2070	Cruciform brooch
Ts. 2071	Zoomorphic brooch
Ts. 2072	Needle of bronze
Ts. 2073	Needle of bronze
Ts. 2074	Bucket-shaped pot

Appendix 20: Artifacts from barrow at Skogøya in Steigen

Museum no.	Artifact
Ts. 2685	Two-edged sword
Ts. 2686	Bronze fibula
Ts. 2687	Wedge-shaped axe
Ts. 2688	Shield boss
Ts. 2689	Spearhead
Ts. 2690	Spearhead
Ts. 2691	Two knife-blades and unidentified iron tool
Ts. 2692	Socketed axe

Appendix 21: Graves with blacksmith's tools, find context

No.	Farm	Municipality	County	Museum no.	Black-smith	Carpenter	Total	Weapons	Horse-riding equipment	Hunting equipment
1	Korsnes	Karlsøy	Troms	Ts. 2519-2525	11		11	Sword		
2	Tussøy	Tromsø	Troms	Ts. 3639 a-g	2	1	3	Sword		6 arrowheads, prong
3	Tussøy	Tromsø	Troms	Ts. 6749 a	1		1			
4	Balsnes	Tromsø	Troms	Ts. 874-882	3		3	Sword, 2 spearheads		3 arrowheads
5	Engenes	Tromsø	Troms	Ts. 528-535	2	1	3	Sword, spear-head, axe		
6	Årnes	Lenvik	Troms	Ts. 7364, Ts. 7367	3	1	4	Axe		
7	Sletten	Tranøy	Troms	Ts. 975-983	6	2	8	Sword, spear-head, axe, socketed axe	Bridle	
8	Lekangen	Tranøy	Troms	Ts. 959-963	1		1	Axe, socketed axe		
9	Sundsvoll	Bjarkøy	Troms	C. 5494-5505	3	9	12	3 swords, 3 spear-h.,7 axes, socketed axe		
10	Austnes	Bjarkøy	Troms	Ts. 907-915	2	1	3	Axe, socketed axe		
11	Nord-Rollnes	Ibestad	Troms	Ts. 2278-2288	7	1	8	Sword, axe		
12	Ytre Elgsnes	Harstad	Troms	Ts. 4762 a-w	9	4	13			
13	Borkenes	Kvæfjord	Troms	Ts. 2898-2911	3	5	8	2 swords, 2 axes, 2 socketed axes		
14	Haukebø	Harstad	Troms	Ts. 4124 a-d	2	1	3	Sword, axe		
15	Haukebø	Harstad	Troms	Ts. 10817 a-n	4		4	Sword, spear-head	Bridle	
16	Bleik	Andøy	Nordland	Ts. 2923-2924	2	1	3	2 swords, spear-head, axe		
17	Bø	Andøy	Nordland	Ts. 374-377	3		3			
18	Lanesskogen	Andøy	Nordland	Ts. 1762	2		2	Sword or spearhead, axe		
19	Sørmela	Andøy	Nordland	Ts. 4178 a-f	2	2	4	Sword, axe		
20	Steinsvik	Tjeldsund	Nordland	C. 20317	3	2	5	Sword, axe, socketed axe, spearhead		
21	Risøya	Hadsel	Nordland	Ts. 2954-2984	8	4	12	Sword, spear-head, axe, shield-boss, adze, several sword-hilts	Bridle	
22	Hadsel	Hadsel	Nordland	B. 3181 a-f	2	1	3	2 swords, spearhead, axe		
23	Husby	Hadsel	Nordland	Ts. 2918	1		1	Sword, axe, socketed axe		
24	Tannøy	Hamarøy	Nordland	Ts. 1225	3	2	5	Sword, axe		
25	Nes	Hamarøy	Nordland	B. 5161 a-q	3	1	4	2 swords, shield-boss, axe		
26	Myklebostad	Steigen	Nordland	Ts. 1811	2	1	3	Sword, axe		
27	Kilan	Flakstad	Nordland	Ts. 4160 a-m	2	2	4	Sword, axe, socketed axe		A "number" of arrowheads
28	Lund	Steigen	Nordland	Ts. 1168-1181	6	3	9			
29	Tro	Steigen	Nordland	Ts. 3027	1	1	2	Spear-head, axe		
30	Erikstad	Fauske	Nordland	Ts. 1722	1		1	Sword, 2 spearheads, axe, socketed axe	Bridle	
31	Seines	Bodø	Nordland	Ts. 1466-1467	2		2	Sword, axe		
32	Sørfinnset	Gildeskål	Nordland	Ts. 3654 a-h	1	2	3	Sword, axe, socketed axe	Bridle	
33	Øysund	Meløy	Nordland	Ts. 1641-1642	2		2	Sword, spear-head, axe, socketed axe		
34	Haugvik	Meløy	Nordland	Ts. 3496 a-i	1	3	4	2 axes, sockeded axe, 2 spear-heads		
35	Alsøy	Nesna	Nordland	C. 5617-5619	3	1	4	Sword, 2 spear-heads, axe		
36	Dønnes	Dønna	Nordland	T. 11906 a-k	2	2	4	2 swords, axe, spear-head		
37	Tjøtta	Alstadhaug	Nordland	T. 15139 a-i	2	2	4	2 swords, 2 spear-heads, axe, soc.axe		
Total					113	56	169			

Appendix 22: Analyses of slag and iron ore from sites in North Norway (Espelund 2005)

	FeO	Fe2O3	MnO	SiO2	Al2O3	P2O5	CaO	MgO	BaO	TiO2	K2O	Sum	R
Hemmestad													
Nedre													
Iron ore 2		84.16	2.0	7.96	3.26	0.394	0.51	0.56	0.02	0.09	0.31	99.24	8.12
Slag 1	79.96		1.93	10.6	4.00	0.215	0.95	0.70	0.10	0.13	0.43	99.08	6.44
Slag 2	60.8		1.96	23.00	8.18	0.291	1.78	2.00	0.04	0.26	1.11	99.57	2.28
Slag 3	58.07		12.31	16.3	6.35	0.364	1.71	1.17	0.39	0.19	0.68	98.334	3.60
Slag/Iron ore 2			0.98	2.89	2.51		3.91	3.57					
Flakstadvåg													
Iron ore		95.44	0.03	1.59	1.49	0.039	0.07	0.11	<0.01	<0.01	0.04	98.81	45.0
Slag	65.24		0.44	25.24	5.36	0.098	0.92	0.41	0.01	0.14	0.96	99.04	2.17
Slag/Iron ore			14.7	15.87	3.60		13.14	3.73					
Dverberg													
Iron ore		92.63	1.08	4.60	0.44	0.051	0.12	0.13	0.03	<0.01	0.04	99.12	17.0
Altevann													
Iron ore		83.19	5.06	4.90	2.94	0.249	0.58	0.21	0.25	0.07	0.23	97.68	13.5
Børselvfjellet													
Iron ore		94.09	0.45	3.35	0.31	0.045	0.05	0.25	<0.01	0.01	0.08	98.24	23.8

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