Environment, Archaeology and Radiocarbon Dates

Notes from the Inari Region, Northern Finnish Lapland

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This paper presents an attempt in correlating the Holocene environmental development with the archaeological phases in the Inari region, northern Finnish Lapland, based on radiocarbon dates. The paper begins with a brief review of the Holocene environment in Inari (Lake Inarijärvi, vegetation, fauna). The archaeological topics include a discussion on early human presence, a review of the Stone Age in Inari (the Mesolithic, Sär 1 Ware, Kierikki Ware) and a presentation of special problems concerning the older Early Metal Age in Inari and the whole of northern Fennoscandia (periodization and terminology, Lovozero Ware, North Scandinavian Impressed Ware). Every now and then archaeologists mention the 'old wood effect' on radiocarbon dates of charcoal from fire places although they don't make serious efforts to find out to what degree this is a real problem and if so how to settle it. This paper ends with a short discussion of the matter and a tentative suggestion in the light of cases from Inari.

Introduction

Gold prospectors were the first to send archaeological finds from Inari to the State Historical Museum in 1871. In 1873 international archaeological attention was directed towards Inari when a British young man, Arthur J. Evans, travelled through Sweden and Finnish Lapland as far north as Inari. He was fascinated by the old Saami sacred island *Äijjih* (Fi. Ukko). He yielded to curiosity and carried out some digging in the cultural layer. Among bones and antlers he discovered a rare silver temple ring, which he took to England and placed in the Ashmolean Museum in Oxford (Nordman 1923). At present the ring is on display at *Siida*, the Saami Museum in Inari. (Carpelan 2003: 63, 89.)

In 1909 the first archaeological survey of Inari was carried out by Ilmari Itkonen (1913; the whole report is not published). Every now and then archaeological objects were sent to the National Museum of Finland (successor of the State Historical Museum) in Helsinki, among them some important contexts (Carpelan 1962; Tallgren 1926). However, archaeological investigations on a professional level began only in the 1960's. In due course the archaeological activities expanded and, so far, the 1980's and the early 1990's represent the period of the most intensive professional fieldwork in the region. Later, due to economical fluctuations, funding has been scanty. (Äyräpää 1937; Carpelan 2003; Europaeus 1914.)

Fieldwork has produced an extensive body of material but little has been published. The first attempt to compile an overall view based on the collected material was published only this year as part of a volume on the history of the Inari region (Carpelan 2003; Lehtola, ed. 2003). With this paper, including selected topics, I wish to direct attention to various interesting aspects pertaining to the archaeology of Inari, situated in the centre of northern Fennoscandia.

Dating and chronology are important themes. The dates quoted here are

Fig. 1. Location of Inari in Europe.

conventional radiocarbon ages before present (BP, i.e. radiocarbon years before AD 1950; t/2 = 5568±30 yrs) calibrated according to the 'Original Groningen Method' based on the median of cumulative probability, included in the Cal25 computer program, to correspond approximately with calendar dates BC (calBC). The margin of error corresponds to 1 ó. (Jungner 1998; Plicht 1993.) The dates with associated details are listed in the attached tables. More details about the dates provided by the University of Helsinki Dating Laboratory (lab. code: Hel) up to number 3501 are found in Jungner (1979) and Jungner & Sonninen (1983, 1989, 1996, 1998). Details about later Hel-dates and about Hela-dates (AMS technique) will be found in Jungner & Sonninen (forthcoming).

Brief review of the Holocene environment in Inari

Deglaciation. During the last Weichselian stadial, *Dryas 3*, the edge of the continental ice sheet formed marginal moraine ridges, which take a NW–SE direction between the Varanger fiord and the national border of Finland. Around 10000 BP / 9500 calBC the ice margin began to withdraw towards the SW and by ca. 9200 BP / 8400 calBC the Inari region was almost free of glacial ice. The ice margin had withdrawn ca. 210 km in ca. 800 radiocarbon years, which implies an average rate of ca. 260 m/yr. This approximates an estimate deduced from sediment varve counts. Calibration, however, gives a time span of ca. 1100 calendar years, which implies a reduced average withdrawal rate of 190 m/yr. A couple of centuries later the ice margin passed the River Tornionjoki, the western border of Finnish Lapland. (Hyvärinen 1997; Johansson 1995; Kujansuu *et al.* 1998.)

Lake Inarijärvi

Lake Inarijärvi (1386 km^2) is the central reservoir of the region. In the beginning, an ice-dammed lake appeared in the NE part of the present lake and its environs. It discharged over the water divide into the River Näätämöjoki. Around 9550 BP / 8950 calBC (my estimate) the withdrawal of the ice margin allowed this lake to drain into the valley of the present River Paatsjoki. The valley then formed an extended fiord of the Barents Sea and for a short time the water level of the Lake Inarijärvi basin coincided with that of the sea, which made the basin a part of this fiord. (Kujansuu *et al.* 1998; Synge 1969; Tanner 1930.)

By ca. 9400 BP / 8700 calBC the lake was entirely free of glacial ice cover but it retained a glacial character as long as meltwater from the withdrawing ice sheet continued to flow into the lake producing the deposition of varved clay. In addition, a number of smaller ice-dammed lakes formed in front of the ice margin and, one after another, they drained into Lake Inarijärvi. The flow of glacial meltwater dried up by ca. 9000 BP / 8150 calBC and with this the first 'Late-Glacial' or 'Proto-Inari' stage of the history of the lake ended. This was followed by the second or 'Post-Glacial' stage with rather stable conditions from the beginning to the present day. (Kujansuu *et al.* 1998.)

Tilting, due to the postglacial upheaval of the earth's crust, has caused shoreline displacement in the Lake Inarijärvi basin. The highest shore marks (e.g. Virtaniemi 131 m asl, Nanguvuono 145 m asl, Ivalo 151.6 m asl) represent a marine transgression and are located on the same tilted plane, with a gradient of 0.47 m/km. A number of lower shore marks have been noticed and, based on archaeological criteria, a Stone Age shoreline has been constructed but comprehensive shoreline studies of Lake Inarijärvi have never been carried out. However, it is clear that the shore has always been transgressive in the northeastern part of the basin and regressive in the southwestern part. The changing lake landscape is an environmental variable, which, among other things, hampers Stone Age research in the northeastern part of the basin. (Arponen & Hintikainen 1995; Siiriäinen 1982; Synge 1969; Tanner 1930)

Vegetation

Although this is not observed in the published pollen diagrams from the Inari region, the withdrawing ice margin was probably followed by a narrow zone of treeless vegetation, mainly herbs, on disturbed soil. In the diagrams, the documented succession begins with the deposition of organic sediment. In most cases the very beginning is not dated or the date is problematic, but the date from the *Retsamo* profile probably provides a good example: 9245±95 BP (Hela-171; Hicks *et al.* 2003) / 8470 (8590...8340) calBC. The ice margin may have passed the spot ca. 300 cal years earlier (ca. 9450 BP / 8780 calBC). This may be a plausible period of time for the establishment of an initial open vegetation cover and humus layer, which was soon invaded by shrubs and trees. Clearly, this type of vegetation expanded from NE towards SW.

The succession documented in the diagrams includes three Regional Pollen Assemblage Zones (PAZ), namely 1. *Betula*, 2. *Pinus–Betula–Alnus* and 3. *Pinus–Betula–Picea*. The *Betula* zone is divided in two subzones, 1a with Ericales and 1b with Lycopods and Ferns as defining groups. The *Betula* zone is found fully developed in the lowermost organic sediment at each sampling site, which means that locally its initial date may be 300 cal years later than the time that the ice margin passed the spot. It follows from this that the type of vegetation represented by zone 1, *Betula*, expanded from NE towards SW as the initial type of vegetation. (Hicks *et al.* 2003; Hyvärinen 1975; Kujansuu *et al.* 1998; Mäkelä & Hyvärinen 2000; Saarnisto 1973; Seppä 1996; Sorsa 1965.)

The transition to PAZ 2, *Pinus–Betula–Alnus*, is interesting because of the discussion concerning the route of immigration of the pine into the region (e.g. Eronen & Huttunen 1993; Hyvärinen 1975: 18; 1976: 172; Seppä 1996: 73–79). This point is also important for the study of human presence and subsistence there.

Table 1 includes eight sampling spots in

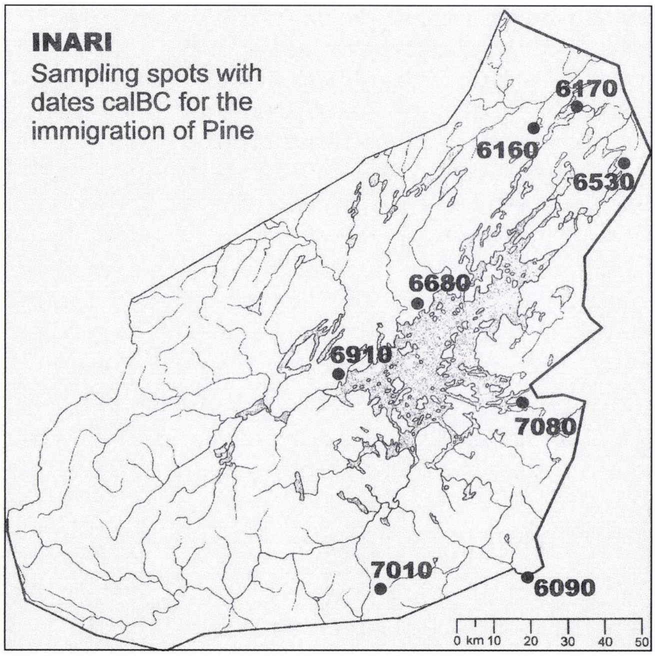
Table 1. Samling sites in Inari (and Sodankylä), Finnish Lapland, with pollen diagrams and radiocarbon dates relating to the transition to PAZ 2 (Pinus-Betula-Alnus). See Fig. 2.

Site	Env.	Alt. asl	Lab-num	Age BP	CalBC†	Max...Min‡
Luttojoki 1[1]	Lake	135m	Hel-220	7230±220	6090	6310...588
KaunispääXXV[2]	Bog	300m	B-566/-567	-	7010*	7250...682
VirtaniemiXXX[3]	Lake	121m	B-72/-623	-	7080*	7290...679
Retsamo[4]	Lake	152m	Hela-170	8005±80	6910	7040...677
Akuvaara[5]	Lake	170m	Hel-522	7770±220	6680	6980...644
Vätsäri 2[6]	Lake	210m	Hel-3840/-3841	-	6530*	6690...641
Rautuselkä[7]	Lake	136m	Hel-3518	7300±120	6160	6300...605
Suovalampi[8]	Lake	104m	Hel-541	7310±210	6170	6370...597

[1] Saarnisto 1973; [2] Sorsa 1965; [3] Sorsa 1965; [4] Hicks *et al.* 2003; [5] Hyvärinen 1975; [6] Mäkelä & Hyvärinen 2000; [7] Seppä 1996; [8]Hyvärinen 1975.

– * No direct radiocarbon date; the calibrated value is estimated graphically from time-depth curve based on calibrated dates. † Calibration performed using a method based on cumulative probability analysis, included in the Cal 25, Groningen Radiocarbon Calibration Program, version dec 1998 (see Plicht 1993). ‡ The margins of error (Max...Min) represent 1 σ. – The sampling spot Luttojoki 1 is located on the south side of the river Luttojoki and thus, strictly speaking, narrowly within the municipality of Sodankylä.

Fig. 2. Numbered spots indicate location of sampling sites with dates calBC for the immigration of *Pinus* into the Inari region. From south to north the sites are: Kaunispää XXV (7010 calBC); Luttojoki 1 (6090 calBC); Virtaniemi XXX (7080 calBC); Retsamo (6910 calBC); Akuvaara (6680 calBC); Vätsäri 2 (6530 calBC); Rautuselkä (6160 calBC); Suovalampi (6170 calBC). See Table 1.



the Inari region with published pollen diagrams. In five cases the transition from birch domination to pine domination is given a direct date while, in three cases the date of this point is estimated from linear depth-age curves (composed by me) based on calibrated dates. The same sampling spots with relevant calibrated dates BC are indicated on the map, *Fig. 2*. The dates appear to suggest that into and within the Inari region pine migrated from the south on the one hand and from the northeast on the other repeating, as I assume, a general trend where the initial expansion of pine proceeds along corridors provided by valleys and coastal strips, which provide the most favourable conditions for pioneering populations. Later in this paper I shall return to the question of the initial spread of pine in connection with a number of radiocarbon dates of charcoal from hearths.

The dates in *Table 1* and *Fig. 2* suggest that it must have taken at least 1000 cal years for pine as a forest tree to reach every part of the Inari region. Then, for 2000 cal years or so, pine clearly exceeded its latitudinal and altitudinal limits of today which means that the character of the landscape and the environment, including the fauna, differed from that of today in the region. In addition, it is important to note that the climate was somewhat warmer and more stable than today. It was also drier, which meant that ground water as well as lake levels were lower and areas covered by mires probably not as large as today. (Eronen *et al.* 1999; Hicks & Hyvärinen 1997; Hyvärinen & Alhonen 1994.)

What is said above refers to the postglacial climatic optimum in northern Fennoscandia. However, soon after ca. 5000 BP / 3800 calBC a cooling trend began followed by climatic instability and increasing humidity. The water levels began to rise and mires expanded. The cooling began to force pine to retreat from the altitudinal and latitudinal limits it had reached earlier. At the turn to PAZ 3, *Pinus–Betula–Picea*, ca. 3000 BP / 1220 calBC or a little earlier, when the spruce had expanded to the southern frontier of the Inari region, all relevant tree species had reached approximately the limits they still retain today. These changes must have had some effect on human life in the region. (Eronen *et al.* 1999; Hicks & Hyvärinen 1997; Hyvärinen & Alhonen 1994.)

In summary, the transitions between the Pollen Assemblage Zones referred to above are transgressive both in time and space and they do not coincide with the conventional Holocene chronozones, namely the Preboreal (10000...9000 BP / 9500...8150 calBC), the Boreal (9000...8000 BP / 8150...6900 calBC), the Atlantic (8000...5000 BP / 8150...3800 calBC), the Subboreal (5000...2500 BP / 3800...600 calBC) and the Subatlantic (2500... BP / 600... calBC) (Mangerud *et al.* 1974).

Fauna

It is not my intention to examine here the faunal history of the Inari region. I merely wish to point out that bone disintegrates rapidly in the acid soil of Finland, which is a serious drawback for relevant studies. However, fragments of burnt bone found at Prehistoric sites give researchers interesting, although somewhat problematic, material with zoological as well as cultural bearing. There are a number of radiocarbon dates from Inari and other regions of northern Finnish Lapland of archaeological contexts including fragments of burnt bones. It is not certain, however, that the earliest dated contexts represent the first appearance of a given species locally or regionally. Another method is to make comparative estimates based on what is known about the development of habitats although the earliest radiocarbon dates related to given species are considerably later. (Hakala 1997; Rankama 1996; 1997; Rankama & Ukkonen 2001; Ukkonen 1993; 2001; 2003.)

I find it possible to assume that wild mountain reindeer (*Rangifer tarandus tarandus*) entered the Inari region early in PAZ 1a, which implies that it spread from NE towards SW. Elk (*Alces alces*) and beaver (*Castor fiber*) probably entered the region from SE during PAZ 1b. Wild forest reindeer (*Rangifer tarandus fennicus*) is thought to have arrived from SE following the spread of PAZ 2 and this has to be assumed also for brown bear (*Ursus arctos*). In the Inari region wild reindeer and beaver remained the most important meat resource up to the early 19th century. (Hakala 1997; Rankama 1996; 1997; Rankama & Ukkonen 2001; Ukkonen 1993; 2001; 2003.)

During the climatic optimum ca. 6000...3800 calBC, when the birch woodland and the tundra-like vegetation were restricted to the highest mountain slopes and summits, the habitat of the mountain subspecies of the wild reindeer almost disappeared. At the same time the population of the forest subspecies consolidated. It has been suggested that a hybrid between these two subspecies may have originated in the Inari region. This, however, is difficult to substantiate because the wild reindeer population became extinct in the 19th century and available bone remains do not provide unambiguous indications. (Hakala 1997; Hicks & Hyvärinen 1997; Rankama & Ukkonen 2001.)

Early human presence in Inari

First visitors

Two opposite views concerning the origin of the initial colonisation of northernmost Finland have been suggested. According to one, the origin was in the south (Schulz 1996: 30–31; Rankama 1997: 9); according to the other, the pioneers originated from the North Norwegian Mesolithic (Carpelan 1996; Matiskainen 1996: 259).

In a recent paper (Carpelan 1999) I referred to finds made at two sites close to the Inari population centre at the western end of Lake Inarijärvi, suggesting that the first humans visiting the region originated in the coast of the Barents Sea, probably the Varanger fiord. The first finds indicating such a connection were made by Ari Siiriäinen (1982) surveying at the site *Inari 14 Vuopaja N*. An archaeological context attributable to such a visit is the *refuse concentration/1992,* which was later investigated by Sirkka-Liisa Seppälä at the site *Inari 13 Saamenmuseo* (see Carpelan 2003: 33). In addition to lithic material, this context included three lumps of birch bark pitch.

Samples of two pitch lumps were dated using the AMS technique, with the following results (see *Table 2*): 8760±75 BP / ca. 7830

Table 2. Radiocarbon dates of birch-bark pitches from Refuse Concentration/1992 at Inari 13 Saamenmuseo. See Fig 3.

Object	Lab-num	Age BP	CalBC†	Max...Min‡
KM 27205: 1054	Hela-430	8835±90	7960	8140...7800
KM 27205: 1057	Ua-4296	8760±75	7830	7970...7690
KM 27205: 1110	Ua-4363	8380±90	7430	7520...7330

† Calibration performed using a method based on cumulative probability analysis, included in the Cal25, Groningen Radiocarbon calibration Program, version dec 1998 (see Plicht 1993). ‡ The margins of error (Max...Min) represent 1 σ.

calBC (Ua-4296) and 8380±90 BP / ca. 7430 calBC (Ua-4363). The remarkable difference was confusing because, at excavation, the archaeological context had appeared consistent and closed. Statistically the dates Ua-4296 and Ua-4363 are significantly different at 95 % level. For control, a sample of the third pitch lump was dated (see *Table 2*) and the result, 8835±90 BP / ca. 7960 calBC (Hela-430) showed overlap with Ua-4296. Hela-430 and Ua-4296 are statistically the same. Ua-4363 may be an outlier. (See *Fig. 3.*)

I assume that the dates Ua-4296 and Hela-430 prove that humans visited the western end of Lake Inarijärvi as early as ca. 8800 BP / 7890 calBC. The visitors were pioneering explorers from some settlement on the shore of the Varanger fiord, culturally representing the early Period II (dated to 9000...7500/7000 BP / 8160...around 6000 calBC) of the north Norwegian Mesolithic or the Komsa culture (Olsen 1994: 29–36; Woodman 1993). It is not clear whether the visit(s) of the Komsa pioneers led to the incorporation of the region into their territory of regular exploitation or even settling. The radiocarbon dates from *Inari 14 Vuopaja N* (with marine mollusc shells, in addition to Period II lithic material; Siiriäinen 1982) may indicate that coastal connections still existed late in Period II (Carpelan 1999: 165).

The 'Komsa people' entered the Varanger fiord ca. 10000 BP / 9500 calBC in a heath–grassland environment with open birch stands (corresponding to the Inari PAZ 1a). Later, when explorers began to push inland, they started in a birch woodland environment with lycopods and ferns (corresponding to the Inari

Fig. 3. Lump of birch bark pitch (KM 27205: 1054) dated to 8835±90 BP / c. 7960 calBC (Hela-430) from refuse concentration/1992 at the habitation site Inari 13 Saamenmuseo. see Table 2; mm scale. Photo: MV.

Fig. 4. Vertical photograph of hearth 5/ 1992 at Inari 13 Saamenmuseo. with three spots for radiocarbon dated charcoal samples and corresponding lab codes indicated. Photo: MV/S.-L. Seppälä. See Fig. 1 and Table 3.

PAZ 1b). In the interior at higher altitudes they had to penetrate an area where the heath–grassland environment still prevailed. Again at lower altitudes, in the western end of Lake Inarijärvi, they ended up in a birch woodland environment with lycopods and ferns. (cf. Hicks *et al.* 2003; Hyvärinen 1975; Seppä 1996.)

Pioneers from the south

In the same paper I presented a model based on radiocarbon dates for the initial postglacial peopling of eastern Fennoscandia from a southern direction (Carpelan 1999). The model assumes that the northern border of the Early Mesolithic colonisation ca. 9600 BP / 8975 calBC coincided with a line drawn through the habitation sites at Pulli, southwest Estonia, and Veret'ye 1 in the Kargopol' district, the southwest Arkhangel'sk Oblast. In addition, the model assumes that the 'wave of advance' reached a parallel line drawn through the habitation site Myllyjärämä at Enontekiö, northern Finnish Lapland, 8320±110 BP / ca. 7370 calBC (Hel-2710). Directed towards east-northeast this line hits the western end of Lake Inari with its many Stone Age habitation sites and suggests that southern pioneers arrived there at the time when a Mesolithic band settled at Myllyjärämä. Is there evidence of this in the Inari material?

Hearth 5/1992

Testing at *Inari 13 Saamenmuseo* in 1987, Aki Arponen found a thick charcoal layer. A sample was radiocarbon dated to 8180±110 BP / ca. 7210 calBC (Hel-2635), at the time the oldest date from the Inari region. In 1992, Sirkka-Liisa Seppälä excavated the spot and discovered a large (2,2 by 1,2 m), almost rectangular stone-paved hearth with charred logs lined up more or less longitudinally (*Fig. 4*). This *Hearth 5/ 1992* appears to have remained intact. Additional radiocarbon dating gave the following results: 7940±120 BP / ca. 6850 calBC (Hel-3319) and 8290±110 BP / ca. 7330 calBC (Hel-3320). A scattered spread (see *Table 3*). (Arponen & Hintikainen 1995; Carpelan 1999: 165; 2003: 34.)

Statistically the extremes, Hel-3319 and Hel-3320, are significantly different at the 95% level. This means that the samples in question represent wood with a significant age difference of ca. 350 radiocarbon years or ca. 480 calendar years. Such a difference could result from a situation where one sample

Table 3. radiocarbon dates of charcoal from hearths at Inari 13 Saamenmuseo, Inari 350 Salosenniemi and Inari 13 Vuopaja.

Object	Lab-num	Age BP	CalBC†	Max...Mln‡
Inari 13 Saamenmuseo: H 5/1992	Hel-3320	8290±110	7330	7460...7180
Inari 13 Saamenmuseo: H 5/1992	Hel-2635	8180±110	7210	7370...7070
Inari 13 Saamenmuseo: H 5/1992	Hel-3319	7940±120	6850	7020...6680
Inari 350 Salosenniemi: H	Hel-2310	7040±120	5900	6010...5790
Inari 350 Salosenniemi: H	Hel-2309	6580±130	5520	5620...5400
Inari 13 Vuopaja: H 4/1987	Hel-2633	4020±120	2560	2760...2370
Inari 13 Vuopaja: H 4/1987	Hel-2631	4410±140	3090	3300...2920
Inari 13 Vuopaja: H 4/1987	Hel-2632	4140±90	2710	2840...2590
Inari 13 Vuopaja: H 3/1987	Hel-2628	5390±120	4210	4330...4070
Inari 13 Vuopaja: H 371987	Hel-2627	5340±90	4160	4280...4060

For Salosenniemi and Vuopaja the dates are listed in a downward stratigraphical order. – H = herath. † Calibration performed using a method based on cumulative probability analysis, included in the Cal25, Groningen Radiocarbon calibration Program, version dec 1998 (see Plicht 1993). ‡ The margins of error (Max...Min) represent 1 σ.

represents the heart and the other the outermost part of a huge tree trunk. This, however, is not the case here because the three samples from *Hearth 5/1992* represent complete sections of separate logs. Apparently the hearth had been loaded with parts of dry and dead pines that had germinated at different times.

At the *Retsamo* sampling site, not far from *Inari 13 Saamenmuseo*, the turn to PAZ 2, defined as the change from birch domination to pine domination in a pollen diagram, is dated to 8005±80 BP / ca. 6910 calBC (Hela-171; *Table 1*). Also this date is significantly different from the oldest date of charcoal from *Hearth 5/1992*. Does this mean that pines grew in the area already before the zone boundary? In a recent paper, I have pointed out that a number of early Mesolithic finds in Finland include remains of pine (charcoal, bark) the dates of which seem to precede the local change to pine domination (Carpelan 1999). I refer to the ongoing discussion on the patterns of pine migration (see e.g. Seppä 1997: 73–79).

The youngest date from *Hearth 5/1992,* which comes closest to the actual firing, falls early in PAZ 2, the period of pine domination. Then there must have been old pioneer pines left (some still living, others standing dry and dead, some already fallen) providing excellent fuel. In the Stone Age, firewood was probably taken by hand, bending and breaking dry wood.

Arrival date of the southern pioneers

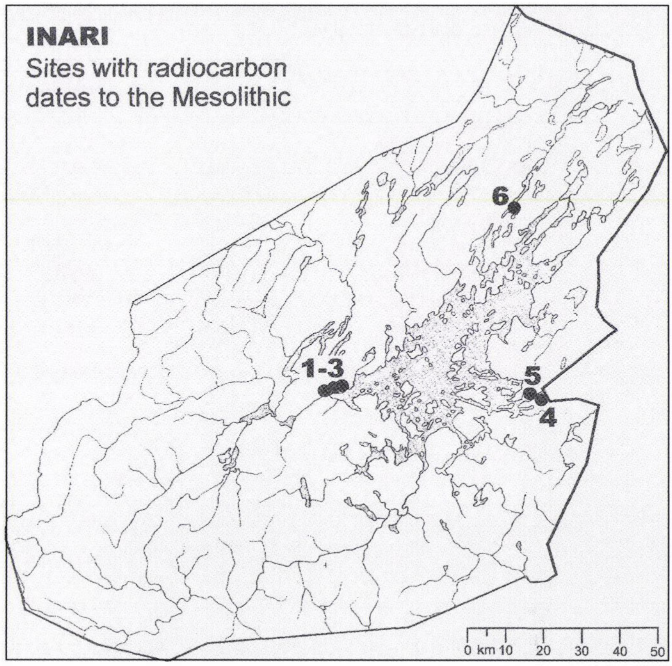
The youngest date from *Hearth 5/1992* comes closest to the actual firing, of course. The significant scatter of the three dates from the hearth raises the question of how long a time interval should be allowed for between the youngest date and the actual firing. It also raises the question of what the Myllyjärämä date really stands for. The sample may, by chance, correspond to the oldest sample from *Hearth 5/1992* at Saamenmuseo. Perhaps additional dating would have given a corresponding temporal distribution. I shall return to this in the light of the 'old wood effect' later in the paper. Referring in advance to this section I tentatively suggest that the reader should subtract 200 years from the calibrated values of the radiocarbon dates of charcoal samples.

Stone Age in Inari

The Mesolithic

The first people came to Inari from the coast of the Barents Sea ca. 8800 BP / 7890 calBC. *Terminus post quem* for the arrival of pioneers from the south is 8320±110 BP / ca. 7370 calBC (Hel-2710; Enontekiö 17 Myllyjärämä). A realistic date would be ca. 7170 calBC or somewhat later, when pine began to dominate in forests (PAZ 2). It is not known to what

Fig. 5. Numbered spots indicate location of habitation sites with radiocarbon dates to the Mesolithic in Inari. (1) Inari 13 Saamenmuseo; (2) Inari 13 Vuopaja; (3) Inari 14 Vuopaja N; (4) Inari 350 Salosenniemi; (5) Inari 37 Paatsjoenluusua; (6) Inari 331 Supru. See Tables 2, 3.



extent the coastal communities exploited the Inari area when the southern pioneers appeared and how the meeting of the two groups turned out there or closer to the coast.

All in all there are 21 Mesolithic dates from six sites in Inari, six early dates of which have been mentioned above. These six dates represent two contexts at one habitation site. The remaining 15 dates, all of charcoal samples from hearths, form a compact series ranging from 7600±90 BP / ca. 6440 calBC (Hel-3580, -3584) to 6580±130 BP / ca. 5520 calBC (Hel-2309). (*Fig. 5*; *Tables 3, 4.*)

Although these 15 dates derive from no more than six sites, I assume that the beginning of this series may be explained as the consolidation of a residential phase following a pioneering phase with a very thin population in an unstable social organisation. The consolidation would have resulted from a favourable environmental development, which would have stimulated population growth leading to a coherent social organisation. The reason for the end of this phase, on the other hand, is harder to imagine because it leaves a gap before the Subneolithic dates begin at ca. 6080 BP / 5000 calBC. If this distribution is not solely due to chance one may ask whether the gap may be due to a decreasing population, a decreasing number of sites and, consequently, decreasing chances to obtain dates. But, in the middle of the postglacial climatic optimum the reason for such a development would be difficult to imagine.

There are no published studies on the artefacts of the Mesolithic of northern Lapland. However, it is obvious that the early connections with the coast of the Barents Sea brought artefacts made of *chert* to the region and that (local?) *jasper* was also used. It is also clear that *quartz* was the general raw material for small tools throughout the Mesolithic and practically the sole raw material within the tradition of the 'southerners'.

As to larger tools made of rock, a piece of a ground gouge of slate (KM 27205: 95) was discovered in *refuse concentration/1992* at Inari 13 Saamenmuseo (mentioned above) and an axe of a slate slab produced in a technique familiar to the southern tradition, namely shaped by bifacial flaking and in part ground (KM 10479), was discovered at the habitation site Inari 14 Turula (Siiriäinen 1982: 10–11, Fig. 7). The fragment of a gouge resembles one discovered in the midden of the Mesolithic

Table 4. radiocarbon dates of charcoal from hearths relating to Mesolithic habitation in Inari listed in chronological order (14 dates from 6 sites). See Fig. 5.

Site	Lab-num	Age BP	CalBC†	Max...Min‡
Inari 13 Saamenmuseo	Hel-3580	7600±90	6440	6530...6330
Inari 13 Vuopaja	Hel-3584	7600±90	6440	6530...6330
Inari 14 Vuopaja N	Hel-3570	7530±150	6370	6510...6230
Inari 13 Vuopaja	Hel-3585	7410±100	6270	6370...6140
Inari 13 Saamenmuseo	Hel-3568	7330±130	6190	6330...6070
Inari 37 Paatsojenluusua	Hel-798	7310±200	6170	6360...5980
Inari 123 Vuopaja	Hel-3582	7110±140	5970	6120...5840
Inari 13 Saamenmuseo	Hel-3123	6920±130	5810	5930...5700
Inari 14 Vuopaja N	Hel-3571	6890±110	5780	5890...5680
Inari 13 Saamenmuseo	Hel-3124	6870±150	5770	5910...5640
Inari 14 Vuopaja N	Hel-3569	6850±110	5740	5840...5650
Inari 13 Saamenmuseo	Hel-3315	6760±150	5670	5800...5540
Inari 331 Supru	Hel-2117	6650±120	5580	5670...5490
Inari 350 Salosenniemi	Hel-2309	6580±130	5520	5620...5400

The early dates from Inari 13 Saamenmuseo Hearth 5/1992 and the earlier date from the Inari 350 Salosenniemi hearth are listed in Table 3. – † Calibration performed using a method based on cumulative probability analysis, included in the Cal25, Groningen Radiocarbon calibration Program, version dec 1998 (see Plicht 1993). ‡ The margins of error (Max...Min) represent 1 σ.

habitation site *Sæleneshøgda* on the Varanger fiord, municipality of Nesseby, Norway (Simonsen 1961: 27–42, Fig. 14 m). In addition, fragments of two (three?) ground axes of slate were discovered on the floor of *dwelling III* at the same site (Simonsen 1961: 36, 42). Simonsen (1961: 42) finds the gouge and the axes exceptional in the context and suggests that they may have been imported.

Sæleneshøgda represents Period II of the North Norwegian Mesolithic (Olsen 1994: 32–33, 38–40; Woodman 1993; according to Simonsen 1961: 42 Post-Mesolithic). The southern wave of advance had reached Inari and certainly Utsjoki (the northernmost municipality of Finnish Lapland), too, well before the end of Period II, which occurred between 7500 and 7000 BP (Olsen 1994: 34) or ca. 6340 and 5870 calBC (mean ca. 6100). From this follows the possibility that axes and gouges made of slate and other types of rock may have reached the Varanger fiord and the habitation site at Sæleneshøgda in the later part of Period II.

If it were proved that the North Norwegian Mesolithic in Period II did not have a corresponding tradition of producing ground axes and gouges of rock, the axes and the gouge from Sæleneshøgda probably would be imports from the southern immigrants in northern Finnish Lapland. This, again, would affect the interpretation and/or dating of *refuse concentration/1992* at Saamenmuseo: (1) as a closed context it could not precede the arrival of the southern wave of advance, which contradicts the pitch dates (although they are mutually contradictory, too; see above); (2) otherwise it is not a closed context, which contradicts the archaeological observations. Olsen (1994: 44–45) only discusses the Sæleneshøgda Mesolithic gouges from an intrasite social viewpoint but pays no attention to the present aspect. I leave the matter open although, for the time being, I prefer my interpretation presented earlier in this paper.

Sär 1 Ware

In Europe the general direction of the spread of the production of earthenware as an innovation was from southeast to northwest. Radiocarbon dates suggest that the technique was adopted ca. 6000 calBC in the Volga–Oka interfluve and ca. 1000 years later as far north as 65° northern latitude (Carpelan & Parpola 2001 Fig. 5). In northeastern Fennoscandia the first ceramic style was *Sär 1*, recently studied by Markku Torvinen (2000). Sär 1 Ware spread in the north as far as the River Paatsjoki and

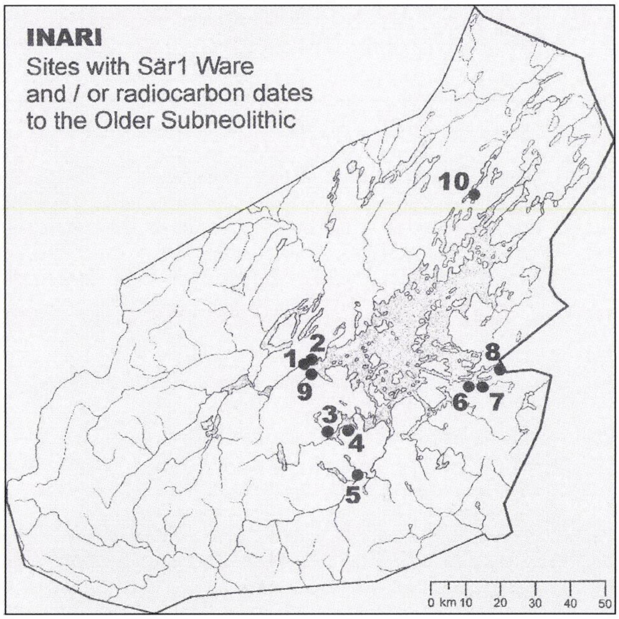


Fig. 6. Numbered spots indicate location of habitation sites with Sär1 Ware and / or radiocarbon dates to the Older Subneolithic in Inari. (1) Inari 13 Saamenmuseo; (2) Inari 13 Vuopaja; (3) Inari 762 Aunionlahdensuu; (4) Inari 653 Mustatlantot; (5) Inari 507 Rönkönraivio; (7) Inari 43 Heikkilä; Inari 406 Nellimjoensuu S; (8) Inari 368 Virtaniemen rajavartiosto; (9) Inari 46 Nukkumajoki 2; (10) Inari 331 Supru. No ceramics from sites (9) and (10). See Tables 3, 5, 6.

the southern shore of the Varanger fiord (Olsen 1994: 52–54; Simonsen 1961: 83–105, 252–263, 441–448; 1963 passim) and in the northeast to the Kola Peninsula (Gurina 1997 passim). The appearance of Sär 1 Ware, understood as derived from the *Sperrings 1 Ware* with possible influence from northeastern Russia (*Chernoborskaya Ware*), begins the Subneolithic in northeastern Fennoscandia (Torvinen 2000: 21).

In Inari , Sär 1 Ware has been found at eight sites (*Fig. 6*), the remains of one vessel at each except *Inari 13 Saamenmuseo* where the remains of three vessels have been discovered

Table 5. Radiocarbon dates of charcoal from hearths relating to Subneolithic habitation in Inari listed in chronological order (16 dates from 7 sites). See Figs. 6, 9.

Site	Lab-num	Age BP	CalBC†	Max...Min‡
Inari 13 Saamenmuseo[1]	Hel-3318	6080±150	5000	5200...4820
Inari 406 Nellimjoensuu S[2]	Hel-2678	6000±120	4900	5060...4750
Inari 331 Supru[1]	Hel-2116	5830±120	4680	4620...4550
Inari 46 Nukkumajoki 2[3]	Su-1664	5740±70	4590	4670...4510
Inari 46 Nukkumajoki 2[3]	Su-770	5630±120	4480	4620...4370
Inari 46 Nukkumajoki 2[3]	Su-996	5600±110	4440	4570...4350
Inari 46 Nukkumajoki 2[3]	Su-1197	5380±130	4200	4330...4060
Inari 13 Vuopaja[44]	Hel-2627	5340±90	4160	4280...4060
Inari 13 Vuopaja[1]	Hel-2629	5330±90	4150	4270...4050
Inari 13 Vuopaja[1]	Hel-3581	5310±140	3620	4290...3990
Inari 37 Paatsjoenluusua[1]	Hel-870	4840±140	3620	3780...3440
Inari 13 Saamenmuseo[1]	Hel-3314	4780±120	3550	3670...3410
Inari 13 Vuopaja[1]	Hel-2626	4330±90	2980	3130...2880
Inari 331 Supru[1]	Hel-2115	4230±120	2800	2980...2640
Inari 13 Vuopaja[4]	Hel-2633	4020±120	2560	2760...2370
Inari 451 Pikkukenttä W[1]	Hel-3051	3950±100	2440	2590...2300

1 Hearth at habitation site. 2 Hearth in dwelling with Sär1 Ware. 3 Charcoal layer on bottom of pit with unknown function. Youngest date from hearth with more than one date. The 10 oldest dates (down to Hel-3581) fall within the Sär1 period (Hel-3318 possibly connected to Sär1 Ware; Sär 1 sherd also found at Vuopaja). – † Calibration performed using a method based on cumulative probability analysis, included in the Cal25, Groningen Radiocarbon calibration Program, version dec 1998 (see Plicht 1993). ‡ The margins of error (Max...Min) represent 1 σ.

Table 6. radiocarbon (AMS) dates of charred crust from Subneolithic and Older Early Metal Age ceramics from Inari in chronological order (4 dates from 4 sites). See Figs. 6, 7, 8, 9, 14, 16.

Site	Ware	Lab-num	Age BP	calBC†	Max...Min‡
Inari 507 Rönkönraivio	Sär1	Hela-38	5830±85	4680	4770...4570
Inari 13 Vuopaja	Kierikki	Ua-4364	4805±85	3570	3660...3440
Inari 13 Saamus	Lovoz.	Ua-10110	2625±65	800	850...630
Inari 683 Niittyjänkkä	Vadøy	Hela-82	2960±90	1170	1300...1040

† Calibration performed using a method based on cumulative probability analysis, included in the Cal25, Groningen Radiocarbon Calibration Program, version dec 1998 (see Picht 1993). ‡ The margins of error (Max...Min) represent 1 σ.

(Carpelan 2003: 38). There are three radiocarbon dates pertaining to Sär 1 Ware (*Tables 5, 6*). Most important is the date of a sample of charred crust sticking to the inner side of potsherds from *Inari 507 Rönkönraivio W* (KM 24391). The date, 5830±85 BP / ca. 4680 calBC (Hela-38) is in line with other dates pertaining to the spread of Sär 1 Ware northwards from ca. 65° northern latitude (Carpelan 2003: 38 note 56). The 'old wood effect' does not apply to this date or others made of comparable samples. A charcoal sample from the hearth of a dwelling with Sär 1 Ware at *Inari 406 Nellimjoensuu S* was dated to 6000±120 BP / ca. 4900 calBC (Hel-2678; Sohlström 1992). Assuming charcoal of pine, the difference between this date and the date from Rönkönraivio W may well be explained as the result of the 'old wood effect' (see below). A third date, 6080±150 BP / ca. 5000 calBC (Hel-3318; mentioned above in connection with the end of the Mesolithic), from *Saamenmuseo* probably also pertains to the beginning of the local Subneolithic although the charcoal does not originate from a closed context with Sär 1 Ware. (*Fig. 7.*)

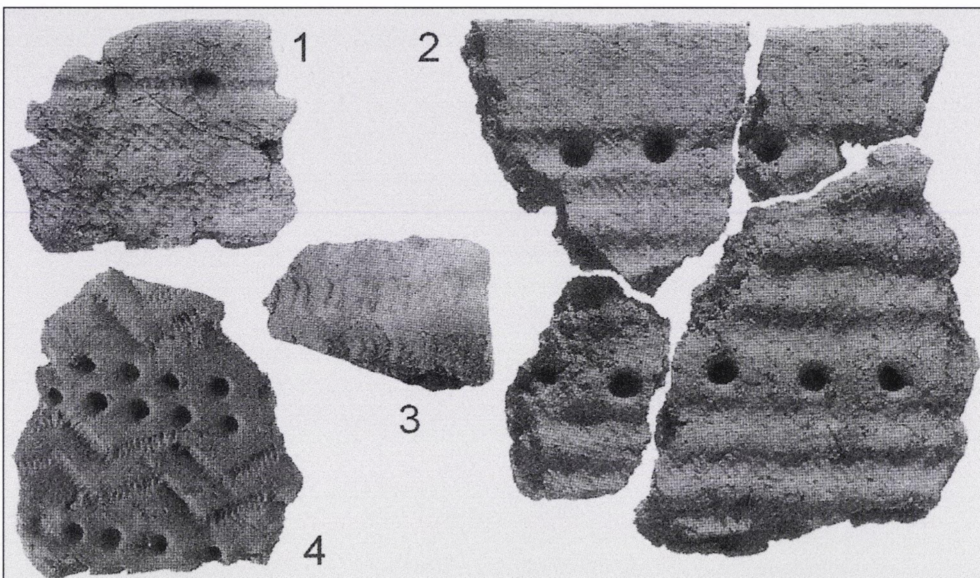


Fig. 7. Sär1 Ware from Inari. (1) Inari 406 Nellimjoensuu (KM 24376: 186); from dwelling with charcoal dated to ca. 4900 calBC (Hel-2678). (2) Inari 507 Rönkönraivio (KM 24391); charred crust from a sherd dated to ca. 4680 calBC (Hela-38). (3) Inari 13 Vuopaja (KM 27809:133); charcoal from three hearths not far from where the sherd was discovered dated to around 4150 calBC (Hel-2627, -2629, -3581). (4) Inari 13 Saamenmuseo (KM 27205: 315); charcoal from hearth not far from the ceramics dated to ca. 5000 calBC (Hel-3318). See text and Tables 5, 6. Not to scale. Adapted from Carpelan 2003. Photo: MV/ Ritva Bäckman.

There are no unambiguous chronological criteria for a determination of the end of the Sär 1 phase in Finnish Lapland, including Inari. With reference to eight AMS dates of charred crust from ceramics, Torvinen (2000: 17) gives the following chronological limits for the Sär 1 stage in the Bothnian coastal area: ca. 6140–5520 BP. On the other hand, with reference to 33 relevant radiocarbon dates of charcoal, charred crust and bone from Finland, northern Norway and the Kola Peninsula, he states that "... the Sär 1 period in Fennoscandia lasted from ca. 6200 to 5350 BP at its longest" (Torvinen 2000: 17). In this connection I wish to direct attention to *Inari 13 Vuopaja* where a Sär1 sherd is found and where charcoal samples from three hearths have been dated to ca. 5340...5310 BP / 4160...4140 calBC (see *Table 5*).

Torvinen's (2000: 16–17, 29) list includes an AMS date 5070±80 BP / ca. 3860 calBC (Hela-57) of charred crust from a Sär 1 sherd from the habitation site *Rovaniemi 340 Jokkavaara* but he has not discussed it, possibly regarding it an outlier (too young). Taking the charcoal dates at their face values this probably would be so but allowing for an 'old wood factor', the difference between the latest charcoal dates and the Jokkavaara date appears small. On the other hand, the Jokkavaara date corresponds to the early phase of the *Combed Ware Style 2* (cf. Pesonen 1999) and as such it would support Siiriäinen's (1971: 18) suggestion that in the southern part of its occurrence Sär 1 Ware was replaced by *Combed Ware Style 2*. For the time being, I find the end of the Sär 1 phase an open question (Carpelan 2003: 39). However, I tentatively suggest that the transition from Older Subneolithic to Younger Subneolithic took place at this stage.

Kierikki Ware

North of the River Kemijoki (close to the Arctic Circle) and west of the Kola Peninsula the Sär 1 phase was followed by an aceramic period dominated by western, North Scandinavian connections. The communities of northern

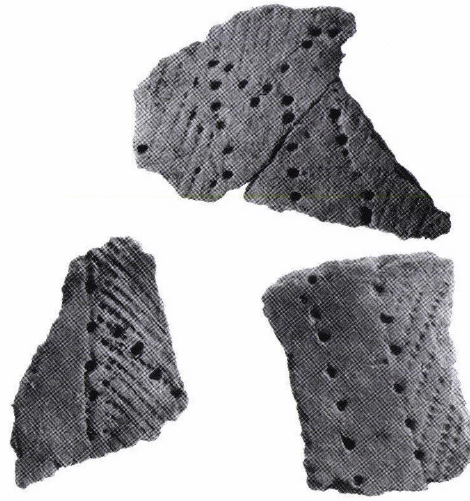


Fig. 8. Kierikki Ware from Inari 13 Vuopaja dated to ca. 3570 calBC (KM 9125: 1). See Table 6. Photo: MV/ Ritva Bäckman.

Scandinavia did not accept pottery either from the south or from the east until the beginning of the Early Metal Age. Nevertheless, the remains of a vessel of this period was discovered at *Inari 13 Vuopaja* (KM 5471; KM 9125; KM 23716; KM 24365; KM 27809). A sample of charred crust from a sherd is dated to 4805±85 BP / ca. 3570 calBC (Ua-4364; *Table 6*).

The vessel, made of clay tempered with crushed asbestos and decorated with a pattern of comb stamps and small pits (*Fig. 8*), in due course became a small problem in Finnish archaeology. It has been identified as representing *Combed Ware Style 2*, *Combed Ware Style 3* or *Pöljä Ware*, or it has been regarded as a derivative of *Sär 1 Ware*. Alternatively, in order to evade the problem, it has been introduced as the only representative of a special *Vuopaja Ware*. (Arponen & Hintikainen 1995: 20; Edgren 1964: 25; Luho 1948: 50; Meinander 1954: 163; Simonsen 1963: 216.) The basic difficulty is found in the fact that the study of Subneolithic ceramics made of clay tempered with crushed asbestos has long been neglected.

At present the position of the Vuopaja vessel is not hard to determine, I believe. Its place is within the *Kierikki Ware* with a distribution in eastern and northern Finland as far north as the Arctic Circle and in Russian Karelia. Kierikki Ware is named after an important habitation site, *Yli-Ii 9 Kierikkisaari*, on an island in the River Iijoki, northern Finland (Siiriäinen 1967; see also Carpelan 2003: 40 note 73). Three dates of charred crust from Kierikki Ware and corresponding dates of the subsequent Pöljä Ware suggest the following chronological limits for the Kierikki phase: ca. 4805–4410 BP / 3570–3090 calBC (Carpelan 2003: 40). The initial date indicates that Kierikki Ware appeared during the closing phase of Combed Ware Style 2.

The Vuopaja vessel is exceptional in an aceramic cultural environment. However, in the Kola Peninsula ceramics was constantly made and used, and ceramics, among them vessels of Kierikki Ware, were carried to the region from outside, obviously from Russian Karelia (Anpilogov 1982). I regard the presence of a vessel of the Kierikki type at Inari 13 Vuopaja as an offshoot of the traffic between Russian Karelia and the Kola Peninsula. A damaged *Volosovo type* flint arrowhead (KM 24365: 241; Carpelan 2003: 42 and Fig. a2 on p. 43) also discovered at Vuopaja may have been carried to the site at the same time. Volosovo type flint arrowheads have been found together with Kierikki Ware i.a. at Kierikkisaari (Siiriäinen 1967 Fig. 12 a–i).

As said above, the climatic optimum came to an end ca. 5000 BP / 3800 calBC and a cooling trend began followed by climatic instability and increasing humidity. The water levels began to rise and mires to expand. The cooling gradually forced pine to retreat from the altitudinal and latitudinal limits it had reached earlier. Was it perhaps a changing environment that triggered the North Scandinavian cultural expansion eastward? Above I suggested that the transition from Older Subneolithic to Younger Subneolithic took place at this stage (cf. *Table 5* and *Figs. 6, 9*).

Older Early Metal Age in Inari

Periodisation and terminology

In principle the Three-Period System (Stone Age, Bronze Age, Iron Age), introduced by C. J. Thomsen in 1836, is applied in Finnish archaeology. However, the Bronze Age and the Pre-Roman Iron Age are problematic

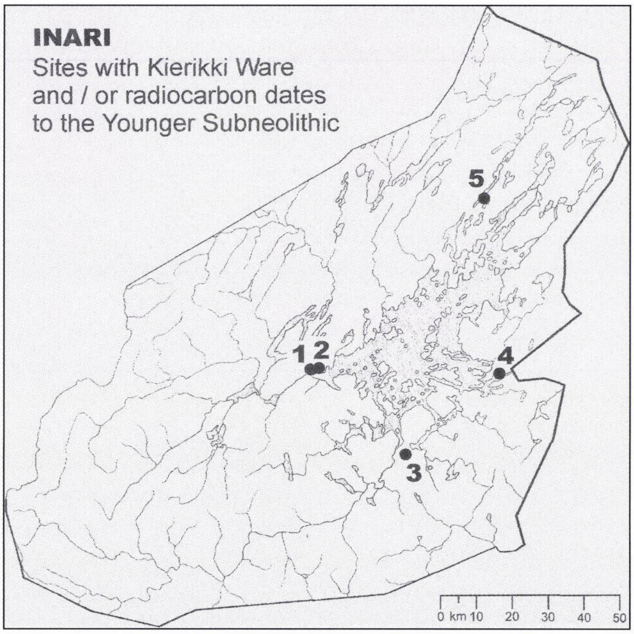


Fig. 9. Numbered spots indicate location of habitation sites with Kierikki Ware and / or radiocarbon dates to the Younger Subneolithic in Inari. (1) Inari 13 Saamenmuseo; (2) Inari 13 Vuopaja; (3) Inari 451 Pikkukenttä; (4) Inari 37 Paatsjoenluusua; (5) Inari 331 Supru. Ceramics from site (2) only. See Tables 5, 6.

periods because of scarcity of metal finds. Obviously, the most important part of the archaeological material pertaining to these periods consists of something else, especially ceramics. The situation is identical also in northern Sweden, Norway and Russia. In this respect the study of these periods resembles Stone Age studies and so they could be connected and called *Epineolithic*. In Finland this term was first applied by Alfred Hackman (1918) for a certain type of ceramics with, in his view, a Neolithic appearance but an early Iron Age date. Later this definition was forgotten and since the 1950's 'Epineolithic' meant any type of ceramics dating from between the Late Neolithic and the Roman Iron Age (Äyräpää 1951). This has caused some confusion in the use of the term in Finland.

On the other hand, the fact that metal artefacts do occur and that such artefacts were produced locally to some extent provides an additional aspect, which justifies the term *Early Metal Age*. The term has been used in this sense since the 1950's for northern Russia (e.g. Gurina 1953) and the Baltic states (e.g. Jaanits 1959). In the 1970's the term was introduced into Finnish archaeology (Carpelan 1979) and in the early 1990's it was adopted for North Norway (Olsen 1994).

In northern Sweden, again, the period is not seen as an entity but as two subsequent periods: the earlier called 'Epineolithic' and the later 'Earlier Metal Age' (Baudou 1995). In fact a corresponding division is applied both for North Norway and northern Finland, too, but named differently. In Norway 'Early Metal Age' mainly refers to the earlier subperiod and the term 'Kjelmøy' is used for the later subperiod (Olsen 1994). In Finland the terms 'Older' and 'Younger' Early Metal Age have been used and for the latter also 'Ceramic Iron Age' because iron objects were imported and also locally produced and because it was followed by a 'Post-Ceramic Iron Age' in the eastern and northern part of the country (Carpelan 2003).

The use of 'Epineolithic' for an earlier subperiod would be confusing in Finland for historical reasons. The use of 'Earlier Metal Age' for a later subperiod would also be confusing because it has been established as a covering term. Therefore I shall use the term *Early Metal Age* of a period defined by ceramics dating from between the Late Neolithic and the Later Roman Iron Age and which falls in an 'Older' and a 'Younger' subperiod. In Lapland an alternative name for the latter would be 'Kjelmøy'.

There are five dates of charcoal from hearths and two dates of charred crust from ceramics relating to the Older Early Metal Age in Inari (*Fig. 10*; *Tables 6, 7*).

Lovozero Ware

Excavations in the 1960's at the habitation site *Kemijärvi 104 Neitilä 4* (close to the Arctic Circle) and other sites in the neighbourhood brought to light potsherds with an appearance not noted in Finland before. A search in collections and publications later revealed that a small number of similar sherds actually had been found earlier at some sites in northern Finland although they had not attracted attention. The clay paste of the Neitilä sherds

Table 7. Radiocarbon dates of charcoal from hearths relating to Older Early Metal Age habitation in Inari listed in chronological order (5 dates from 4 sites). See Fig. 10.

Site	Lab-num	Age BP	calBC†	Max...Min‡
Inari 331 Supru	Hel-2114	3680±100	2070	2210...1930
Inari 451 Pikkukenttä W	Hel-3052	3570±130	1920	2110...1760
Inari 451 Pikkukenttä W	Hel-3053	3540±130	1820	2060...1720
Inari 13 Saamenmuseo	Hel-3317	3410±120	1720	1870...1570
Inari 13 Vuopaja	Hel-2630	3120±90	1380	1480...1260

† Calibration performed using a method based on cumulative probability analysis, included in the Cal25, Groningen Radiocarbon Calibration Program, version dec 1998 (see Picht 1993). ‡ The margins of error (Max...Min) represent 1 σ.

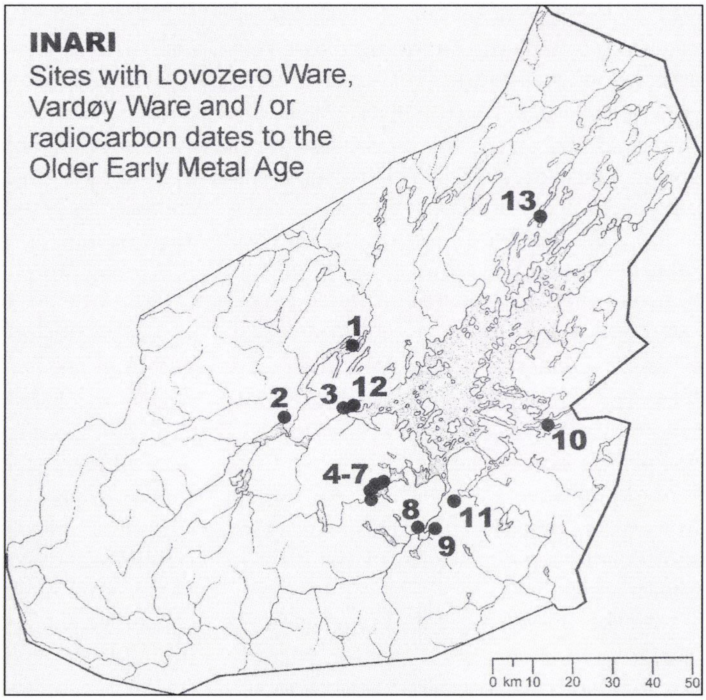


Fig. 10. Numbered spots indicate location of habitation sites with Lovozero Ware (L), Vardøy Ware (V) and / or radiocarbon dates to the Older Early Metal Age in Inari. (1) Inari 682 Vuopajanperä L; (2) Inari 423 Vaskojoensuu L; (3) Inari 13 Saamenmuseo L, V; (4) Inari 748 Kirakkajoensuu N2 L; (5) Inari 762 Aunionlahdensuu L; (6) Inari 764 Soidinvaara 2 L; (7) Inari 769 Soidinvaara 7 V; (8) Inari 683 Niittyjänkkä V; (9) Inari 505 Sylvenvaara L; (10) Inari 479 Annanlahti L; (11) Inari 451 Pikkukenttä W; (12) Inari 13 Vuopaja; (13) Inari 331 Supru. No ceramics from sites (11), (12) and (13). See Tables 6, 7.

was tempered with crushed asbestos and hair, and below the rim there was a zone with a simple incised grid pattern. It was thought that the type of ceramics represented by the sherds was somehow connected with Early Metal Age Textile Ceramics. (Kehusmaa 1972: 28–32, 45.)

In November 1979 I visited former Leningrad (now St. Petersburg) together with my colleague and friend, Matti Huurre. Dr. Nina N. Gurina invited us to study the results of her excavations in the Kola Peninsula. It turned out that the material from *Mys Semërka*, a habitation site on the western shore of the Lake Lovozero in the western central Kola Peninsula, included a great number of sherds resembling those discovered at Neitilä 4. Furthermore similar ceramics had been found at a number of other sites, many of them on the northern coast. It was clear that we had here a ceramic type that had not been described before. We scrutinized the material and compiled a summary of the typological characteristics, published here as *Fig. 11* for

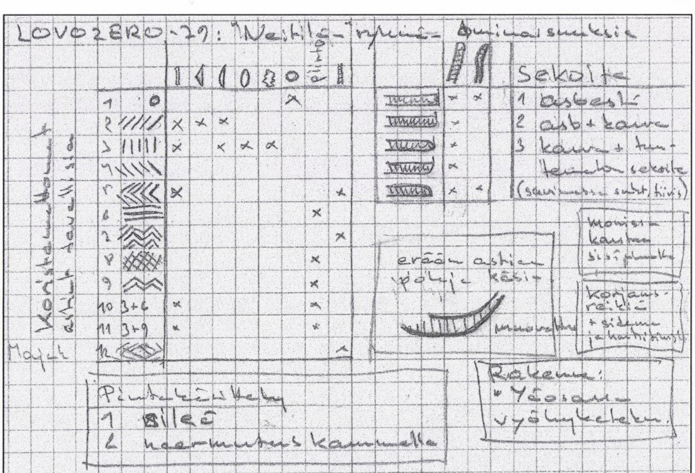


Fig. 11. Typological characteristics of Lovozero Ware summarised in 1979 in Leningrad by Christian Carpelan and Matti Huurre. The headline (in Finnish) says Lovozero-79: characteristics of the "Neitilä" group. Decoration, surface treatment, cross section of rim and composition of temper are summarised, in addition to observations about structure, cross section of the bottom of one vessel, presence of holes for repair and presence of charred crust on the inside of sherds.

the first time. We named the type of ceramics *Lovozero Ware* and appreciated that e.g. the ceramics from Neitilä 4 were part of it.

The clay paste of Lovozero Ware is usually tempered with crushed asbestos and often in addition (sometimes alternatively) with hair. There are also specimens without visible temper and occasionally, on the Varanger fiord (Solberg 1909: 66, Fig. 173), sherds tempered with crushed cockleshells have been discovered. The vessels are built of overlapping clay bands, and embedded inside the rim of some vessels bent asbestos rods are found one after another, forming a strengthening hoop (Gurina 1997 Fig. 9.1–7, 42.7–9; Helskog 1983 Fig. 40). This is an interesting technique not found among other asbestos tempered ceramics. Judging from sherds the biggest diameter of the orifice was ca. 40 cm and that of the bottom ca. 16 cm. The outer surface is smoothed or hatched and decoration modest, limited to a zone below the rim, or totally absent. A simple incised grid pattern is very common in addition to many others composed of incised or impressed elements. Small holes, cuts and notches appear instead of 'Neolithic pits'. (*Figs. 11, 12, 13.*)

In addition to the Kola Peninsula and northern Finland, the distribution of Lovozero Ware covers northern Sweden and North Norway. The name Lovozero Ware is not used in Russian archaeology, which does not distinguish between different types among 'Arctic Early Metal Age ceramics'. Neither is the name used in Sweden where Hulthén (1993: 13–25, 28–32) has distinguished two groups called 'Asbestos Pottery' and 'Hair-Tempered Pottery' among the ceramic material from northern Sweden (Norrland). According to her, the former corresponds to Jørgensen and Olsen's (1987; 1988) groups 3, 5 and 6 (see below) while the latter is not compared with other groups. Hulthén's classification is based on the characteristics of the clay paste only, in part inconsistently, and therefore I find it useless in this connection. However, when rearranged the ceramic material covered by these headings corresponds to Lovozero Ware on the one hand and North Scandinavian Impressed Ware (see below) on the other.

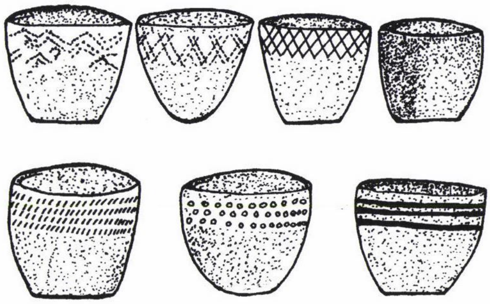


Fig. 12. Sketches of Lovozero vessels from Kola Peninsula. Adapted from Gurina (1997 Fig. 8).

In Norway Jørgensen and Olsen (1987: 14–15, 29; 1988: 17, 66–67) adopted the term 'Lovozero Ceramics' for 'Group 4' in their classification of North Norwegian ceramics but limited the number of distinguishing characteristics to include a smoothed surface and a zone with a simple incised grid pattern below the rim. On the other hand they established a parallel class called 'Pasvik Ceramics' or 'Group 3' (Jørgensen & Olsen

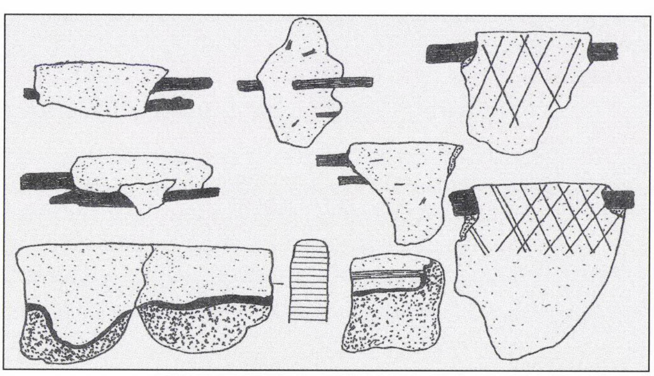


Fig. 13. Sketches of Lovozero Ware rim sherds with embedded asbestos rods. Adapted from Gurina (1997 Fig. 9).

1987: 13–14, 27–29; 1988: 15–17, 65–66) with striated or hatched surface and a zone with more varied ornamental elements in the upper part. According to them 'Pasvik Ceramics' is not found on the coast while 'Lovozero Ceramics' occurs both on the coast and in the interior (Jørgensen & Olsen 1987: 20–21, 24; 1988: 50–59).

I do not find this distinction justified. For instance, one of the best known specimens from coastal North Norway, discovered at a habitation site in the municipality of Lebesby (Gjessing 1935: 39–41, Plate VIII), combines hatched surface and grid pattern and is thus in contradiction to the classification and the alleged differing distribution of 'Pasvik' and 'Lovozero Ceramics'. Looking at the material as a whole Jørgensen and Olsen's groups 3 and 4 correspond to the original description of Lovozero Ware within which it is not possible to distinguish marked off distributions of given decorative or functional characteristics.

In Inari Lovozero Ware has been found as small sherds at eight sites (*Fig. 10*). The sherds reveal the variation in the decoration characteristic of this ceramic group. A sample of charred crust from a sherd discovered at *Inari 13 Saamenmuseo* (KM 27808: 811) was dated with the following result: 2625±65 BP / ca. 800 calBC (Ua-10110; *Fig. 14*; *Table 6*). This is the youngest known date so far. Lovozero Ware was probably in use until Kjelmøy Ware replaced it ca. 700 or in the 7th century calBC. On the other hand a number of crust dates of ceramics as well as charcoal (*Betula*) dates from contexts indicate that Lovozero Ware suddenly appeared in Finnish Lapland and North Norway ca. 3570 BP / ca. 1920 calBC. This is also the date for the Subneolithic/Early Metal Age transition in the region.

To my knowledge there are no dates available pertaining to Lovozero Ware and the Subneolithic/Early Metal Age transition in Sweden. In the Kola Peninsula, again, Gurina (1997: 73–96, 139, 151–152) dates the Subneolithic/Early Metal Age transition to 2500 BC. This, however, is not a calibrated date but a value obtained by subtracting 1950

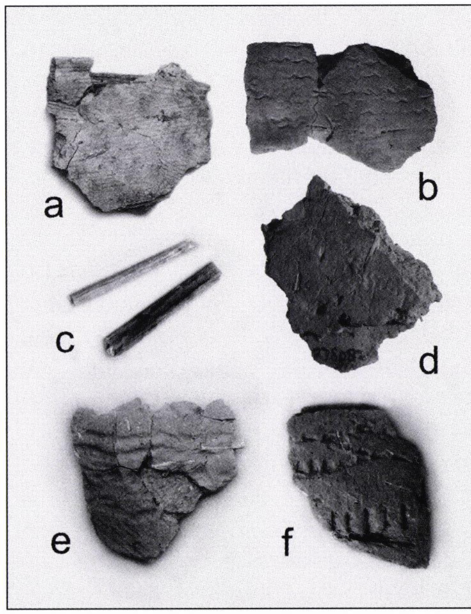


Fig. 14. Sherds of Lovozero Ware from (b) Inari 000 Kirakkajoensuu (KM 26822: 78) and (a, d–f) Inari 13 Saamenmuseo (KM 27808:933; 27808: 811; 27808: 724; 24364: 335); (c) pieces of asbestos rods for strengthening vessel rims (KM 27808: 911). Photo: MV/Ritva Bäckman (a, c, e); MV/Markku Haverinen (b, d); MV/Tatu Pohjavirta (f).

years from the original radiocarbon age BP. Consequently the Early Metal Age would have begun 4450 BP corresponding to ca. 3140 calBC. The date suggested by Gurina must be due to an error or a mistake, or it refers to something else (Carpelan 2003: 46 note 6).

The rapid spread of Lovozero Ware all over northern Fennoscandia marks a turning point in the historical process of the region. The question of the origin of Lovozero Ware is interesting and complicated as well as is the question of the character of and reason for its spread.

North Scandinavian Impressed Ware

Some time after the spread of Lovozero Ware another type of ceramics appeared in northern Sweden. Clay paste and the general shape of vessels resemble those of Lovozero Ware but decoration is absent and surface treatment is different: except for a narrow smooth zone below the rim the surface is always covered with impressions as of fabric. Because of this the type of ceramics was called *Textile Ceramics* and it was also thought that the surface treatment was due to the influence of the East European Textile Ceramics. However, already Solberg (1909: 71–72) noticed that the impressions were made with a stamp. Later Gjessing (1942: 275–276), after careful scrutiny, concluded that in the material from northern Norway the impressions were made with a stamp of some kind. He called the ceramic type *Imitated Textile Ceramics*. Since then, the terms *Textile Ceramics* and *Imitated Textile Ceramics* have occurred in the relevant archaeological writing without explicit definitions (see Carpelan 1970; 2003: 52). In Russia it is called 'Waffle Ware'.

In my opinion, following Jørgensen & Olsen (1987: 15–17; 1988: 17–20) and Hulthén (1993: 19–22), there are two different kinds of impressions in this ceramic material, which I prefer to call *North Scandinavian Impressed Ware*. This entity thus falls into two types, which I prefer to call after important find spots, namely *Sorsele Ware* and *Vardøy Ware*, in order to avoid the prevailing confusion (Carpelan 2003: 52). It should be understood that it may be impossible to identify specimens with worn-out surface to type but which, in spite of this, may be identified as representing North Scandinavian Impressed Ware.

The name Sorsele Ware I derive from a habitation site in the parish of Sorsele, Swedish Lapland, bearing this type of ceramics (Hallström 1929: 82–83). The impressions found on Sorsele Ware vessels are in my view made by clapping the wet surface with a spatula around which a twine of root or sinew had been coiled, or alternatively by shaping the vessel inside a basket made of such twine (otherwise Hulthén 1993: 22). The name Vardøy Ware I derive from a habitation site in the town of Vardøy, North Norway, bearing this type of ceramics (Gjessing 1935: 33–37, Plate V c). The impressions found on Vardøy Ware vessels are made by clapping with a spatula with an incised grid pattern. The clapping would represent a shaping technique. (Carpelan

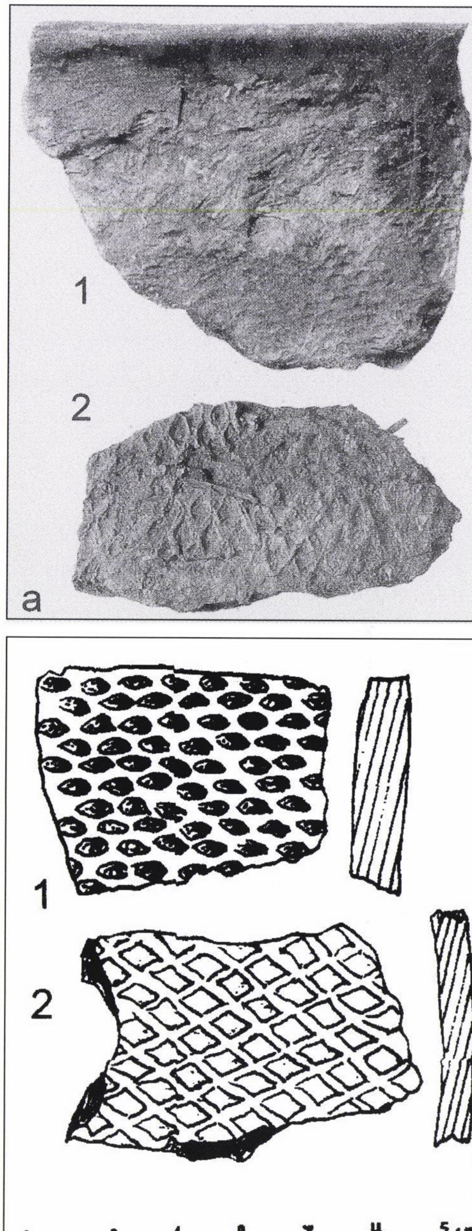


Fig. 15. Examples of North Scandinavian Impressed Ware. – a. (1) Rim sherd of Sorsele Ware from a habitation site on the lake Gautsträsk in the municipality of Sorsele, Swedish Lapland. From Hallström (1929 Fig. on p. 83). (2) Sherd of Vardøy Ware from a habitation site in the town of Vardøy, North Norway. From Gjessing (1935 Pl. V c). Not to scale. – b. (1) Sherd of Sorsele Ware and (2) of Vardø Ware, both from a habitation site at Lesjön in the parish of Bodum, Ångermanland, Sweden. Adapted from Hulthén (1991 Fig. 20). – Not to scale.

2003: 59.) (*Fig. 15.*)

Sorsele Ware has been found in northern Sweden and North Norway but not in Finnish Lapland or the Kola Peninsula. Vardøy Ware, again, has been found in northern Finland and the western part of the Kola Peninsula in addition to northern Sweden and North Norway. (Arponen 1992; 1994; Hulthén 1993; Jørgensen & Olsen 1987; 1988.) According to Arponen (1992: 12–13), Sorsele Ware appeared ca. 1600 calBC and was replaced by Vardøy Ware ca. 1300 calBC. This indicates both technical change and areal expansion as functions of time.

A type of 'Waffle Ware' occurs among the *Ymyahtah culture* of the Taimyr Peninsula and elsewhere in northern Central Siberia (Hlobystin 1987: 336–340, 409 Fig. 130). Comparison with Vardøy Ware led to an assumption that small communities had pushed westwards along the tundra zone and ended up in northern Fennoscandia (Okladnikov 1953: 156; 1970: 168–169). Afterwards the idea was abandoned because no 'Waffle Ware' has been found between Taimyr and northern Fennoscandia. The Siberian Waffle Ware also differs radically from Vardøy Ware in that the vessels have a row of pierced holes below the rim. In addition, Vardøy Ware appears to have originated in northern Sweden from where it spread eastwards.

In Inari, Vardøy Ware has been found at three sites (*Fig. 10*; Carpelan 2003: 52; Arponen 1994 mentions four sites). Charred crust from potsherds discovered at *Inari 683 Niittyjänkkä* is dated to 2960±90 BP / ca. 1170 calBC (Hela-82; *Fig. 16*; *Table 6*). Charcoal from a refuse pit at *Inari 13 Saamenmuseo*, including i.a. sherds of Vardøy Ware, is dated to 2530±110 BP / ca. 630 calBC (Hel-2634). The pit, however, cannot be regarded as a chronologically closed context and therefore this date which actually falls within the *Kjelmøy Ware* period (old wood factor!) provides a *terminus ante quem* for Vardøy Ware. There are no unambiguous datings for the end of the Vardøy Ware but nothing speaks in favour of a long coexistence with Kjelmøy Ware which appeared ca. 700 or in the 7th century calBC. (Carpelan 2003: 52, 56.)

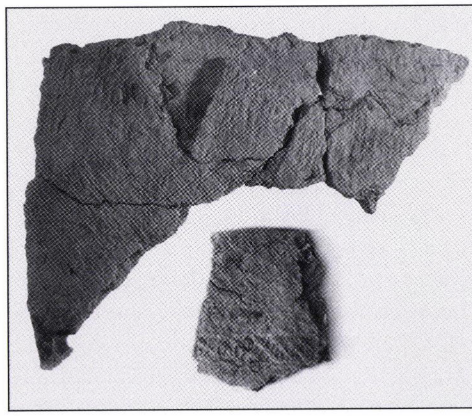


Fig. 16. Vardøy Ware from Inari 683 Niittyjänkkä dated to ca. 1170 calBC (KM 26240: 1, 3). See Table 6. Not to scale. Photo: MV/Ritva Bäckman, Tatu Pohjavirta.

As said, the eastward expansion of North Scandinavian influence represented by Vardøy Ware began ca. 1300 calBC and I suggest that it indicates demic infiltration. According to Petri Halinen (personal communication; see also Carpelan 2003: 52), the temporal distribution of pitfalls in northern Finnish Lapland shows two peaks: one in the later Stone Age and another close to 1000 calBC precisely coinciding with the expansion of Vardøy Ware. One may ask whether reindeer hunting with pitfall systems was the success factor behind this expansion. One may also ask whether a changing environment could have played a role in triggering this expansion.

The expansion of spruce had been triggered by the cooling trend which had begun soon after ca. 5000 BP / 3800 calBC followed by climatic instability and increasing humidity. It proceeded in due course depending on biological preconditions. Thus the advance of spruce to the southern part of the Inari region and to the westernmost part of northern Sweden ca. 3000 BP / 1220 calBC or a little earlier did not result from a sudden environmental change. I am not aware of sudden environmental changes in northern Sweden that might explain this expansion. Possibly this was due to demic and social reasons.

Old wood effect – Contributions from Inari

The problem

The Radiocarbon Method dates the point in time when (a part of) the organism represented by the sample exits the global carbon cycle, i.e. dies. It was soon understood that, for various reasons, there might be a significant time lag between this point and the time of the archaeological event to be dated. A time lag would result from the use of old wood, for instance.

In Finland C. F. Meinander (1971) was the first to have a series of charcoal samples from hearths at Stone Age habitation sites dated in order to construct a chronology for three types of pottery (see Jungner 1979). In his study he mentioned a number of sources of error, including the use of old wood, but it was not possible for him to estimate the real effect of this on his results.

Ari Siiriäinen (1969; 1972; 1974) developed a method for dating Stone Age shoreline sites on the basis of the geological shoreline displacement, the chronology of which, again, was dated with the Radiocarbon Method. Thus the dates obtained with Siiriäinen's method were comparable with radiocarbon dates from the sites themselves. The few dates then available (Jungner 1979; Meinander 1971) were made of charcoal samples from hearths. Siiriäinen noticed time lags between these dates and his own shoreline dates of the same sites. The 'old wood effect' provided a natural explanation although in some cases the time lag appeared too long even for this explanation.

Henrik Asplund (1995) and Petro Pesonen (1999) have paid attention to the very same dates. Pesonen compared these dates to a series of AMS dates of birch bark pitches used as padding in repairing cracks in the vessel walls. According to Asplund and Pesonen, only a part of the discrepancy may be explained with reference to the 'old wood effect'. Another reason might be found in a possible variation in the technical quality of dating through time. The doubtful dates were made in 1969.

Charcoal from hearths is the most common sample material for radiocarbon dating in Finland. This means that chronological considerations are mainly based on dates, which include a time lag resulting from the 'old wood effect'. In principle this is known but in practice ignored. It is not thought of as a real problem. Personally, however, I feel that there is a problem, which should be studied thoroughly. Time lags may tell us something about the environment and about usages in collecting firewood. It would also be important to find grounds for the comparison of charcoal dates with dates of samples with no 'own age'. In part by chance the archaeological investigations in Inari have provided data pertaining to this problem, some instances of which have already been mentioned above.

Three more hearths from Inari

In addition to *Hearth 5/1992* at Saamen-museo there are in Inari also other cases of hearths with more than one dated charcoal sample. Three of them with significant scatter of the results will be mentioned here.

Excavations in 1985 by Kaarlo Katiskoski at the prehistoric dwelling site *Inari 350 Salosenniemi* revealed a more or less intact hearth, among other things. The hearth had the shape of a pit and was filled with stones, soot and charcoal. Two samples from different depths were dated with the following results (*Table 3*): 7040±120 BP / ca. 5900 calBC (Hel-2310) and 6580±130 BP / ca. 5520 calBC (Hel-2309). Because the difference in age (c. 460 radiocarbon years or ca. 380 cal years) is statistically significant and the younger sample comes from a deeper level than the older one, wood of different age appears to have been put on the hearth in a random order. (Arponen & Hintikainen 1995: 23; Carpelan 2003: 35–36.)

Excavations in 1987 by Aki Arponen at the prehistoric dwelling site *Inari 13 Vuopaja* revealed several hearths. Three charcoal samples from different levels of *Hearth 4/*

1987 were dated with the following results (listed in stratigraphic order beginning with the uppermost date; see *Table 3*): 4020±120 BP / ca. 2560 calBC (Hel-2633), 4410±140 BP / ca. 3090 calBC (Hel-2631), 4140±90 BP / ca. 2710 calBC (Hel-2632). The difference in age between the oldest and the youngest sample (ca. 390 radiocarbon years or ca. 530 cal years) is statistically significant and even in this case the oldest sample does not come from the deepest level. Apparently this is again a hearth with wood of different ages put on the fire in random order. A fourth sample, taken from above the hearth, dated to 3120±90 BP / ca. 1380 calBC (Hel-2630), represents firing during the Early Metal Age (Arponen & Hintikainen 1995: 20; Carpelan 2003: 40.)

At the same site two charcoal samples from different levels of *Hearth 3/1987* were dated with the following results (listed in stratigraphic order beginning with the uppermost date; see *Table 3*): 5390±120 BP / ca. 4210 calBC (Hel-2628), 5340±90 BP / ca. 4160 calBC (Hel-2627). These dates are largely overlapping and statistically they are the same. Here, by chance, the age of the firewood is consistent. (Arponen & Hintikainen 1995: 20; Carpelan 2003: 40.)

In the light of four cases (Saamenmuseo, Salosenniemi and two at Vuopaja) it is clear that on the one hand there may be significant differences between the dates of different samples taken from the same hearth but on the other hand the dates may be quite close to each other. It is not possible to adequately estimate the time depth of the firewood of a hearth from one charcoal sample only and so, in this sense, "one date is no date". Neither is it possible to estimate the time lag between the youngest (often the only) date and the actual firing because normally there are no specific criteria to rely on. There is, however, one series of samples from Inari, which was collected and dated as an attempt to study the problem of the effect of old wood.

Dating of wooden dwellings

Saami winter village sites dating from the early Modern Age are interesting and important objects of study. In Inari 11 such sites have been found. One of them, *Inari 46 Nukkumajoki 2*, is located 1 km west of Lake Inari by the small River *Oaddivei* ('Sleep River', Fi Nukkumajoki). On an ancient glacio-fluvial delta the remains of 14 hut-dwellings are visible in a slightly winding line, in addition to the remains of two more hut-dwellings and two log cabins off the line. In all 3090 m^2 were excavated in 1978–1985, including nine hut-

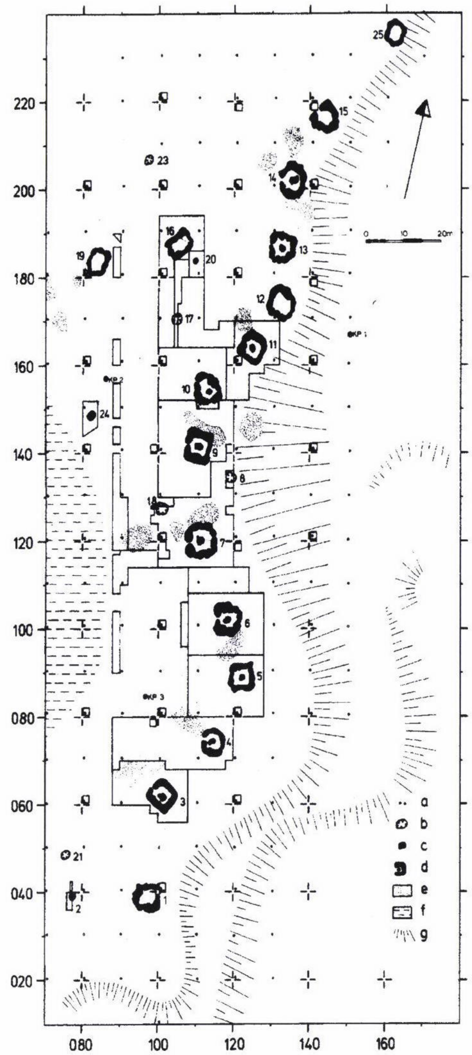


Fig. 17. Plan of Saami winter-village site Inari 46 Nukkumajoki 2 showing the remains visible on the surface, numbered 1–25, and the areas excavated in 1978–1985. The dwellings listed in Table 8 are numbered 3–7, 9–11, 16, 20. From Carpelan & Lavento (1996).

dwellings and the two log cabins. (Carpelan 1991; 2003: 71–76; Carpelan *et al.* 1996; Carpelan & Hicks 1995; Carpelan & Kankainen 1990; Carpelan & Lavento 1996.) (*Fig. 17.*)

The foundation of a hut was a hexagonal (at some other sites also octagonal) frame of logs forming sills leaning against a wall of sand. The wooden supportive structure and roofing of the tent-shaped building, covered with turf, leant against the sills. In the middle of the floor there was a rectangular stone paved hearth.

Because the wooden structures were in a bad state of decay, growth ring dating was not possible and therefore radiocarbon dating remained the sole option. A total of 27 samples of wooden structural parts of huts 3–7, 9–11 and 16 and of log cabin 20 were dated (1 to 4 per context) and furthermore, 6 samples of charcoal from the hearths of huts 3, 4 and 7 and from the floors of huts 5 and 11 (1–2 per context). (*Table 8.*)

According to the results, the differences between the calibrated dates of the extremes within each context range from 40 to 260 calendar years (the margins of error omitted).

Table 8. Radiocarbon dates of wood and charcoal from structures, hearths and floors of nine hut-dwellings and a log cabin at Inari 46 Nukkumajoki 2, in chronological order (33 dates from 10 contexts). See Figs. 16, 17, 18.

Context	Lab-num	Age BP	calAD†	Max...Min‡	Ref yr	Diff
Dwelling 16	Su-1638	330±60	1560	1495...1625	1750	190
Dwelling 5	Su-1273	390±70	1520	1455...1610	1650	130
Dwelling 11	Su-1443	400±80	1515	1450...1610**	1660	145
Dwelling 6	Su-1275	410±70	1505	1445...1605	1650	145
Log cabin 20	Su-1193	460±80	1460	1405...1580	1750	290
Dwelling 4	Su-837	490±70	1430	1350...1485*	1660	230
Dwelling 5	Su-1272	490±80	1430	1345...1510	1650	220
Dwelling 9	Su-1189	500±90	1425	1340...1515	1620	195
Dwelling 4	Su-836	500±70	1420	1340...1470	1620	200
Dwelling 7	Su-992	510±70	1415	1335...1455*	1660	245
Dwelling 16	Su-1639	540±60	1390	1330...1425	1750	360
Dwelling 6	Su-1276	540±70	1390	1325...1430	1650	260
Dwelling 9	Su-1192	540±80	1390	1325...1435	1620	230
Dwelling 10	Su-1438	540±80	1390	1325...1435	1590	200
Dwelling 11	Su-1442	550±90	1385	1320...1440	1620	235
Dwelling 4	Su-840	550±70	1380	1325...1425	1620	240
Dwelling 4	Su-838	550±80	1380	1320...1430	1620	240
Dwelling 9	Su-1190	570±80	1365	1315...1420	1620	255
Log cabin 20	Su-1445	570±80	1365	1315...1420	1750	385
Dwelling 9	Su-1191	590±10	1360	1305...1420	1620	260
Dwelling 16	Su-1637	580±60	1355	1315...1405	1750	395
Dwelling 3	Su-768	610±70	1350	1310...1395*	1660	310
Dwelling 10	Su-1437	620±70	1350	1305...1395	1590	240
Dwelling 5	Su-1271	650±70	1340	1295...1385	1650	310
Dwelling 11	Su-1444	660±11	1325	1245...1390**	1660	335
Dwelling 5	Su-1270	690±80	1310	1255...1375**	1660	350
Dwelling 4	Su-839	690±80	1310	1255...1375	1620	310
Log cabin 20	Su-1194	740±80	1265	1200...1350	1750	485
Dwelling 3	Su-767	770±70	1245	1180...1285	1620	375
Dwelling 7	Su-994	810±80	1205	1100...1265	1620	415
Dwelling 3	Su-766	820±70	1205	1100...1255	1620	415
Dwelling 10	Su-1436	900±70	1130	1055...1205	1590	460
Dwelling 7	Su-993	930±121	1000	995...1205	1620	520

Date x = calAD 1363; M = calAD 1380. Diff(erence) between date and ref(erence) y(ea)r: x = 290 cal yrs, M = 260 cal yrs. – * Charcoal from hearth, ** charcoal from floor. – † Calibration performed using a method based on cumulative probability analysis, included in the Cal25, Groningen Radiocarbon Calibration Program, version dec 1998 (see Picht 1993). ‡ The margins of error (Max...Min) represent 1 σ

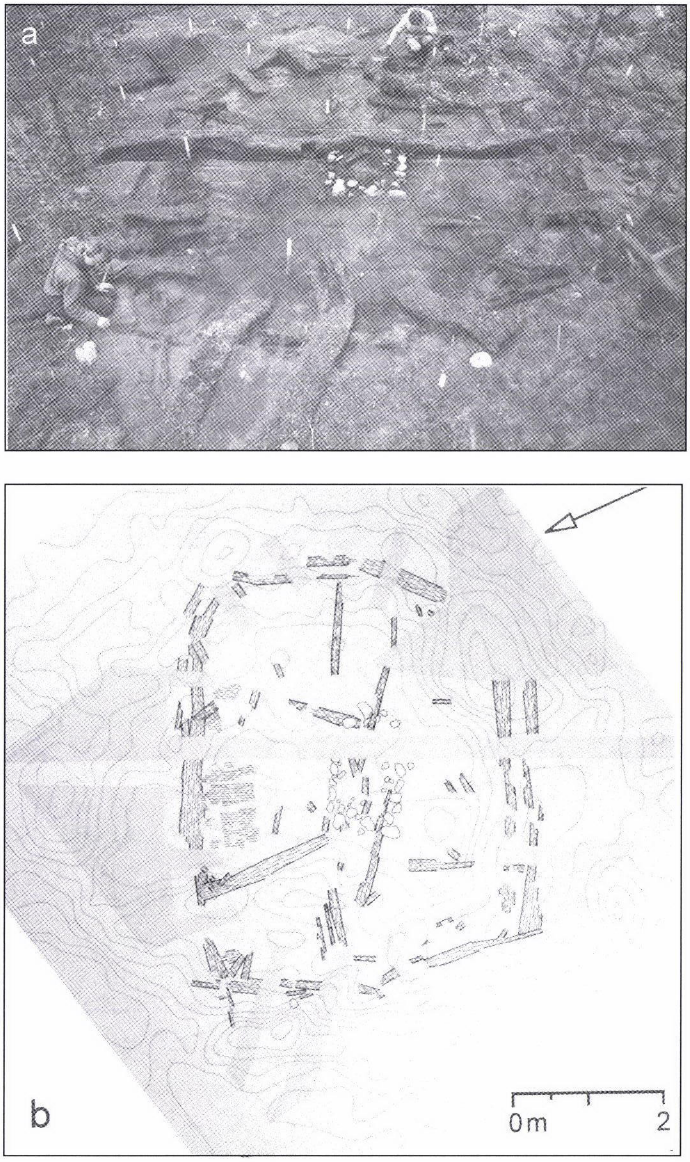


Fig. 18. Pictures illustrating dwelling 10 at Nukkumajoki 2. – a. Dwelling 10 under excavation in 1984. The frame of timber as well as the remains of the wooden structures of the roofing are visible. Photo: C. Carpelan. – b. Plan of dwelling 10. Orientation corresponds to Fig. 13 a. Drawing: M. Mustakallio-Jussila.

The charcoal samples extend the differences in four contexts (huts 3, 5, 7, 11), which results in a total range from 65 to 315 calendar years. (*Table 8*.) It is clear that wood of more or less the same age was used both for building and for firing – probably dead pines standing dry. In addition, it is worthwhile to note that in some dwellings part of the structures were charred after fire accidents.

Several criteria indicate that the Forest Saami began to build fixed wooden tent-shaped hut-dwellings late in the 16th century. At Nukkumajoki 2 this is corroborated by the finds from dwelling 10 (*Fig. 18*). On the other hand, thermoluminescence dates of hearthstones and radiocarbon dates of refuse bone indicate that the main habitation period at Nukkumajoki 2 ended in the 1660's. Furthermore, stratigraphic criteria suggest that huts 5 and 6 were built close to the end of the habitation period while the rest of the excavated dwellings, with the exception of hut 16, had been built earlier. It is known from written records that the Saami first began to build log cabins in the mid 18th century. This provides a *terminus ante quem non* for log cabin 20 and for hut 16, which probably was connected to the cabin as a storehouse. Log cabins became common as dwellings in the early 19th century. (Carpelan 2003: 68, 73, 83.)

This provides a number of tentative reference dates for an estimate of the difference between a radiocarbon date of a wood or charcoal sample and the activity it represents. The date of a structural part of a dwelling will be compared to the tentatively assumed building date as follows: for hut 10 AD 1590, for huts 3, 4, 7, 9, 11 AD 1620, for huts 5, 6 AD 1650, for hut 16 and log cabin 20 AD 1750. The date of charcoal from a hearth or a floor will be compared to the assumed date of abandonment (the last firing), which for the present cases is AD 1660.

The comparison, summarised in *Table 8*, indicates that the difference between the date of a sample and its tentative reference date ranges from 130 to 520 calendar years (the margins of error omitted). The mean is 290 and the median 260 calendar years. Although three values are smaller, the main distribution begins at 190 and continues more or less evenly to 415. Three values remain outside each end of this section.

Conclusion

It is quite obvious that 'ordinary' samples of wood and charcoal cannot provide precise datings of particular events but just rough *termini post quem*. Likewise it is obvious that one date of a hearth or a complicated structure, such as a building, is not enough. Of course each case has to be considered individually. However, as a general rule of the thumb, I suggest that in northern Finland (and probably the whole of Finland) 200 years should be subtracted from chronologies based on calendar dates of wood and charcoal samples assumed to be of pine. (It should be remembered that 200 radiocarbon years represent periods of different actual length in different parts of the time scale.) I encourage the reader to consider the charcoal dates listed in the present tables. The date for the arrival of the first southern pioneers to northern Lapland has to be reduced, for instance. Probably the chronology of the whole wave of advance has to be modified because it is based on wood and charcoal dates.

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