Barshalder 3
Rojrhage in Grötlingbo
A multi-component Neolithic shore site on Gotland

Martin Rundkvist, Christian Lindqvist & Karl Thorsberg

Stockholm Archaeological Reports 41, 2004
Department of Archaeology, University of Stockholm

Acknowledgements

This work has benefited from the comments of Agneta Åkerlund, Fredrik Hallgren, Mats P. Malmer, Inger Österholm, Ludvig Papmehl-Dufay and Niklas Ytterberg. Remaining weaknesses are all the authors' responsibility.

Funding for radiocarbon analyses was kindly provided by the National Heritage Board of Sweden and the analyses were undertaken by Göran Possnert of the Ångström Laboratory in Uppsala.

This publication has been produced and printed with the support of Stiftelsen Konung Gustav VI Adolfs fond för svensk kultur and Magnus Bergvalls stiftelse.

The manuscript was completed in August 2002.

Table of Contents

ISBN 91-631-4947-8
Cover art: Samuel Rundkvist Messner
Editing, maps, plans, photographs, graphic design: Martin Rundkvist, arador@algonet.se
Printed by Intellecta Docusys, Sollentuna

1. Introduction

Rojrhage 1:1 is a small property in Grötlingbo parish, southern Gotland, near the southern parish border toward Fide. A house was moved to the site in 1925, and in 1955 the property was parcelled out from the southern part of the plot allocated to the parish gravel pit, Uddvide Samfällt. Small archaeological rescue excavations took place on the property in 1930-31, 1947 and 1951-52 due to the fact that it was now the garden of a private house. Large-scale archaeological work took place 1960-1967, first due to the widening of the road and subsequently as a research excavation prompted by the rich finds. The trenches came to cover approximately 700 m^2. Such were the horticultural consequences of the excavations that the Swedish National Heritage Board was forced to buy the property in 1963 (KVHAA 1974:124-126), subsequently selling it to a tenant in 1975.

The property takes its name from the pastureland of which it was part before the Laga Skifte land amalgamation reform in the early 1890s. Rojrhage means "pasture with cairns". These cairns are Iron Age (1st millennium AD) grave markers and the Rojrhage pasture formed the northern third of the great Barshalder cemetery (Rundkvist 1996a, 2003). The Rojrhage 1:1 property is part of the Registered Ancient Monument area Grötlingbo Raä 54.

The excavations at the site were prompted by rich graves from the Migration – Vendel Period interface. However, it soon became evident that the graves were superimposed upon Stone Age deposits, and these are the subject of this work.

At the excavations little attention was paid to the Stone Age deposits beyond the collection of flint and pottery. Documentation standards were raised somewhat by Gustaf Trotzig in the 1963-1967 campaign, when the culture layer was treated separately from the Iron Age graves and a 2.5 m sampling grid was used. However, Trotzig's excavations were cut short by insufficient funding and by his promotion, and much of the Stone Age deposits were excavated hurriedly when the trenches were being stripped of remaining stones from the graves. The field notes were never organised into a formal report.

In working with the Iron Age graves for my doctorate and preparing a basic report of the excavations, I, Martin Rundkvist, had to bring order also to the Stone Age finds. I found this to be an excellent opportunity to learn something about Neolithic matters. Knowing my limits, I asked Karl Thorsberg to study the flint and Christian Lindqvist the bones, and kept the pottery and sundries for myself. None of this work's authors took part in the excavations at Rojrhage 1:1.

After I had type-set this work in early 2003, but before funding had been secured for its publication, Gunilla Eriksson published her doctoral thesis at the University of Stockholm, *Norm and difference. Stone Age dietary practice in the Baltic region*. It contains a paper on stable isotope analyses of bones from Västerbjärs in Gothem and Ire in Hangvar which has far-reaching implications for research into the Middle Neolithic of Gotland. Four of Eriksson's results are particularly relevant to the present work but were not at hand when it was written.

1. The marine reservoir effect for human bone from GRK burials in Gotland is c. 70±40 years.
2. The people of the Pitted Ware Culture on Gotland got their dietary protein almost exclusively from seals. Any contribution of pork and fish to their diet was negligible in quantitative terms.
3. Pig bones found at Pitted Ware sites on Gotland belong to animals with an entirely terrestric diet. This means that the pigs did not have access to the rubbish of Pitted Ware habitation sites. This rubbish would, judging from the isotope values of the human bones, have consisted mainly of bones and butchery refuse from seals. The corollary of this is that the pigs were not domesticated, but wild or feral.
4. The economy of the Pitted Ware Culture on Gotland included neither agriculture nor animal husbandry on any appreciable scale.

2. Shore displacement, Neolithic topography and site size

The 15 m-above-sea-level (m a.s.l.) line on the economic map (sheet 5J6a FIDE) runs through the excavated area at Rojrhage 1:1 between the house and the road (fig. 1). The site is on the NW slope of a ridge, close to the top. The 15 m a.s.l. line corresponds to the Littorina maximum (c. 5000 cal BC) in this part of Gotland (Munthe 1910, re-printed in Österholm 1989 fig. 5 & 2002c fig. 5), and formed a 700 m long and mainly less than 100 m wide NNE-SSW island or reef with the Rojrhage site just outside the northern end. The area was located at the southern coast of ancient mainland Gotland from the time of the Littorina maximum until the mid-first millennium AD when the still ongoing land upheaval closed the straits of Fide and Öja. The Littorina maximum provides a terminus post quem for all archaeological deposits discussed in this work.

The edges of the Neolithic deposits have not been sought outside the trenches, but there are indications that their landward limit to the SE may have been within the excavated area. Peter Manneke's excavations of 1960-61 between the house and the road turned up neither a culture layer beneath the Iron Age graves nor many Neolithic stray finds in their fills. Manneke, being known as a painstaking fieldworker, is unlikely to have missed much. Perhaps, then, the landward edge of the deposit may have been at the 15 m a.s.l. line.

As to the seaward edge, there are no Neolithic finds from the extreme seaward lines A and B of the excavation grid (fig. 1, tables 10a-c), which would place the NW limit of the deposit less than 20 m from the SE one and above at least 13 m a.s.l. This interpretation should however be treated with some caution because the area excavated in line A and B was located around the Late Roman Period grave mound Bhr 1967:33, in the fill of which much Neolithic material, presumably taken from the surrounding ground surface, had been re-deposited. The distribution of the Neolithic finds leaves an empty zone all around the mound.

The area NW of the trenches is still densely covered with Iron Age graves which have not produced any excavation records and would seem to preclude phosphate mapping. The 15 and 5 m a.s.l. lines are 220 m apart at the site, and the 5 m a.s.l. line corresponds to the shoreline about AD 1. Shore displacement between these levels is complicated by the repeated transgressions of the Littorina Sea. In any case, the maximum conceivable width of the Neolithic deposits is far less than 200 m. The Rojrhage deposit is located on the same level, slightly less than 15 m a.s.l., as the Neolithic sites of Stora Domerarve and Gullrum (see below).

Turning to the phosphate-maps published by Österholm (1989) and Samuelsson & Ytterberg (2002), they include five Neolithic shore sites that have been free to expand regardless of any limestone escarpments toward the back and sides: Ajvide in Eksta, Västös in Hall, Gumbalde in Lau, Hemmor in När and Gullrum in Näs & Hablingbo. All have their greatest extent along the ancient shoreline. Lengthwise, they vary from 350 to 600 m. Their widths vary from c. 25% to c. 50% of the length. It should be noted that the phosphate distributions at these sites may extend much further than the culture layers (Hedemark et al. 2000:10).

As to the NE-SW length of the Rojrhage deposits along the shoreline, there is only negative evidence from nearby excavations of Iron Age graves where no Neolithic finds have turned up. The limits are thus set by Manneke's excavations of 1960 (where seal bones, but no Neolithic artefacts, have been found in Bhr 1960:13 & 15) on Roes 1:36 property to the SW and archaeological rescue work 1899-1971 at the parish gravel pit to the NE, located about 200 m apart. The main trench at Rojrhage was 35 m long with Neolithic finds from end to end, and the Neolithic deposit is thus somewhere between 35 and 200 m long. Unless the Rojrhage deposit has different spatial proportions than the large sites or is discontinuous along the shoreline, then its width should be less than 100 m.

3. Neolithic deposit preservation

The deposit is described as follows in Trotzig's field notes. "Thickness generally c. 10 cm. Potsherds, bones and a few flint fragments were found scattered through the layer, which was only preserved in parts of the excavation surface. Most of the finds have been collected as stray finds during the excavation of the Iron Age graves. Here and there the layer seemed to thicken, and

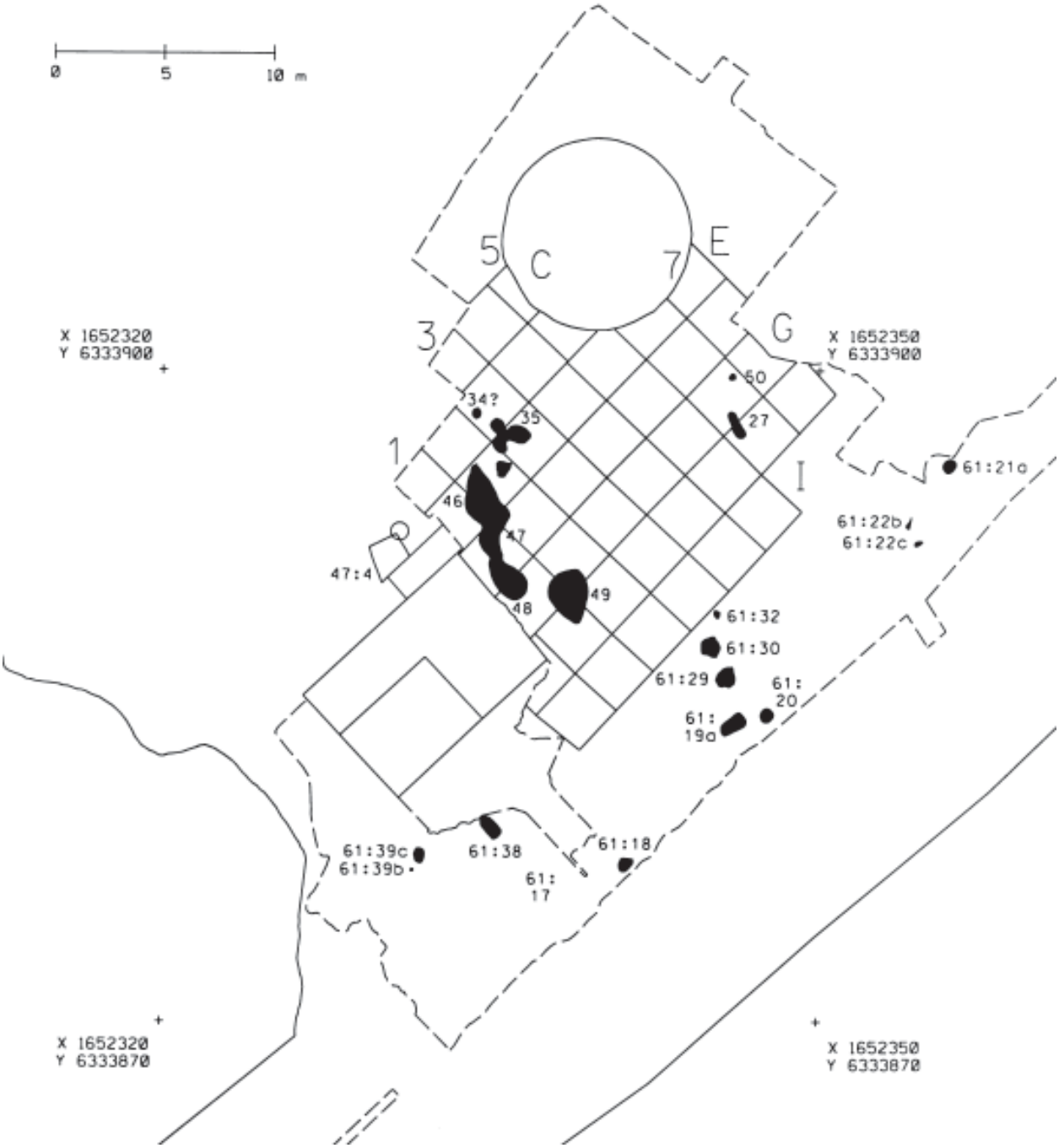


Fig. 1. Plan of excavations 1961–1967 at Rojrhage 1:1. Neolithic sunken features and excavation grid for Neolithic deposits indicated.

some of the hearth-like features discovered in association with the graves should originate in the Stone Age layer although it has not been possible to ascertain this."

There were 21 non-grave sunken features – including Trotzig's hearth-like features – in the excavated area (table 3a & fig. 1). 11 of them contained Neolithic artefacts, only one of them a probably intrusive Iron Age artefact as well as large amounts of Neolithic pottery. Bones of the same animal species (determined by Petra Molnar, Åsa M. Larsson and Christian Lindqvist) have been found regardless of whether artefacts where present or not. Most if not all of the features should thus date from the Neolithic. The finds from them were treated inconsistently during fieldwork, in some cases kept separate and in others collected with the finds from the relevant grid square. Consequently, and as only one of them had enough structure to actually be classified as a hearth during fieldwork, the finds from the sunken features have been allocated to or divided among their respective grid squares in the find distributions below (section 10).

Table 3a. Non-grave sunken features.

Feature	Pottery (g)	Flint (frags)	Bone
Bhr 1961:17 (3/61)	3	-	Ovicaprid
Bhr 1961:18 (4/61)	-	-	Dog
Bhr 1961:19a (5a/61)	-	1	-
Bhr 1961:20 (6/61)	-	-	Ovicaprid
Bhr 1961:21a (7a/61)	-	-	-
Bhr 1961:22b (8b/61)	6	-	Ovicaprid
Bhr 1961:22c (8/61)	-	2	Ovicaprid, dog, bird
Bhr 1961:29 (17/61)	-	-	-
Bhr 1961:30 (18/61)	-	-	-
Bhr 1961:32 (20/61)	-	-	-
Bhr 1961:38 (30/61)	-	-	-
Bhr 1961:39b (32/61)	-	-	Ovicaprid
Bhr 1961:39c (33/61)	-	-	Ovicaprid
Bhr 1967:27	In grid	-	Human (intrusive?)
Bhr 1967:34	-	-	Sheep, seal
Bhr 1967:35	In grid	-	In grid
Bhr 1967:46 (feature A)	246	3	Pig, seal, bird, fish
Bhr 1967:47 (Feature B)	13	3	Ovicaprid, seal, bird, fish
Bhr 1967:48 (Feature C)	51	-	Mammal, bird, fish
Bhr 1967:49 (Feature D)	-	1	Mammal
Bhr 1967:50 (SA hearth 1)	30	2	Ovicaprid

4. Stone Age surroundings

Excavations and my own work in documenting private collections have so far turned up a total of ten Stone Age sites in Österholm's next-to-southernmost site cluster, Hablingbo-Näs-Grötlingbo (1989:168 fig. 83), on the ancient southern coast of mainland Gotland, as follow from north to south (fig. 2). Unexcavated find spots with typologically unspecific finds are not included. Österholm's list refers to Österholm 1989:56-59 (also in Burenhult 1997b:XI, cf. Bägerfeldt 1992: 44-46).

1 Stora Domerarve 4:1, Stora Domerarve 1:3, Medebys 1:2, Medebys 1:9, Stjups 1:27 & Stjups 1:31. Hablingbo Raä 112. Site number 62 & 52 in Österholm's list. Coordinates W-E: 1648340, S-N: 6341320. 10-15 m a.s.l. Separate Late Mesolithic and Early Neolithic TRB deposits (Österholm 1989:126-140, 2002b) with an Iron Age component.

2 Petsarve 1:38 & Härdarve 1:2 among others. Eke Raä 20, 22, 86, 87, 92, 155. Not in Österholm's list. Coordinates W-E: c. 1655850, S-N: 6339600. 15-20 m a.s.l. Late Mesolithic and Late Neolithic deposit (Andersson 2000:98-99).

3 Brunns 1:21. Grötlingbo parish without Raä register number. Site number 56 in Österholm's list. Coordinates W-E: c. 1653500, S-N: 6338250. 15-20 m a.s.l. Mesolithic deposit.

4 Gullrum 1:20, Gullrum 1:11 & Stora Hajslunds 1:4. Näs Raä 17 & Havdhem parish without Raä register number. Site number 28 in Österholm's list. Coordinates W-E: 1649860, S-N: 6336850. 10-15 m a.s.l. Middle Neolithic GRK deposit (Hansson 1900). SHM 8962, 9120, 10055, 10808, 12136, 15274, 18311.

5 Suderkvie 5:1. Grötlingbo Raä 13. Site number 50 in Österholm's list. Coordinates W-E: 1653470, S-N: 6335730. 10-15 m a.s.l. Early Neolithic TRB deposit and Bronze Age slab cist excavated in 1959 (Manneke 1961). SHM 27151.

6 Kattlunds 1:26, the farmstead museum. Grötlingbo Raä 55. Not in Österholm's list. Coordinates W-E: 1653505, S-N: 6334770. 10-15 m a.s.l. Neolithic deposit discovered in 1971 in a 3 x 0.5 m trench beneath the Medieval farmhouse at Kattlunds. I have not been able to locate the finds, which dated from historic times except for a small collection of Neolithic pottery. The excavation report classifies the pottery as Pitted Ware but contains no descriptions or pictures of it (Falck 1971).

7 Grötlingbo parish gravel pit, Roes 1:28. Grötlingbo Raä 45. Not in Österholm's list. Coordinates W-E: 1652440, S-N: 6334155. 5-10 m a.s.l. 50 m^2 badly damaged deposit of ringed seal bones (*Pusa hispida*, determined by Johannes Lepiksaar in 1967) and nine flint fragments, excavated in 1966 (Rundkvist

2001). Possibly Early Neolithic judging from a stray-found fragment of a thin-butted flint axe. SHM 15609:3 & 32182.

8 Grötlingbo parish gravel pit, Norrkvie 1:16. Grötlingbo Raä 54. Not in Österholm's list. Coordinates W-E: 1652343, S-N: 6334015. 5-10 m a.s.l. Robbed LN slab cist excavated in 1927 (Hansson 1927). Two inhumations, part of a polished shaft hole axe, two blunt bone arrowheads and four burnished pottery fragments with wide incised lines. SHM 19055:08. Part of a miniature flint dagger of similar date was found in a Late Iron Age grave (Bhr 1957: 01, cf. Rundkvist 2003) less than 40 m from the cist.

9 Rojrhage 1:1. Grötlingbo Raä 54. Site number 8 in Österholm's list. Coordinates W-E: 1652340, S-N: 6333900. 10-15 m a.s.l. Multicomponent Neolithic deposit excavated 1930-1967 (Rundkvist 2002). See table 3b for inventory numbers.

10 Poultry farm, Roes 1:36. Grötlingbo Raä 193. Not in Österholm's list. Coordinates W-E: 1652120, S-N: 6333760. 10-15 m a.s.l. Late Mesolithic aceramic deposit, surface-collected by the landowner. Three pecked and ground greenstone axes and worked flint, kept in the Ohlsson collection (Rundkvist 1996b).

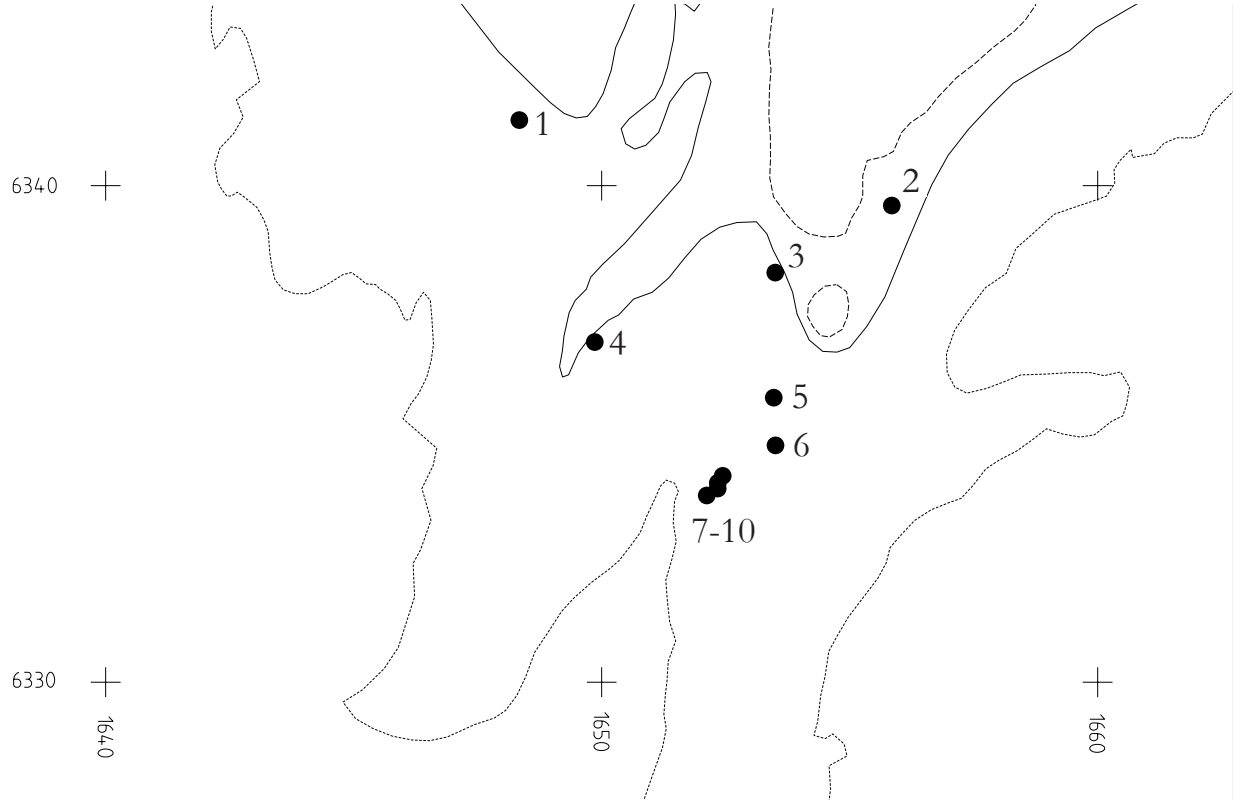


Fig. 2. South Gotland. Stone Age sites in Hablingbo, Eke, Näs and Grötlingbo parishes. Three shorelines are shown: the present one of the Baltic Sea, the upper limit of the Littorina Sea (c. 5000 cal BC) and the upper limit of the Ancylus Lake (c. 8500 cal BC).

Table 3b. Neolithic finds from Rojrhage 1:1.

Inv no.	Context (cf. Rundkvist 2003)	Neol. pottery	Flint	Igneous rock artefact	Bone artefact	Seal or fish bone
SHM 19535	Bhr 1930:07	-	X	-	-	-
Not submitted	Bhr 1931:20	-	X	-	-	No ost. an.
GF C9582:1-23	Bhr 1947:02 (A/47)	X	X	-	-	-
GF C9582:24-32	Bhr 1947:03 (B/47)	X	X	-	-	-
GF C9582:33-36	Bhr 1947:04 (C/47)	X	X	-	X	X
GF C9582:38-39,44	Stray finds 1947	X	X	-	-	No ost. an.
GF C10176	Bhr 1951:01	-	X	-	-	-
SHM pending alloc	Bhr 1960:10a (2a/60)	-	-	-	-	X
SHM pending alloc	Bhr 1960:10b (2b/60)	-	X	-	-	-
SHM pending alloc	Bhr 1960:11 (3/60)	-	-	-	-	X
SHM pending alloc	Bhr 1961:15 (1/61)	-	X	X	-	No ost. an.
SHM pending alloc	Bhr 1961:17 (3/61)	X	-	-	-	-
SHM pending alloc	Bhr 1961:17a (3a/61)	X	X	-	-	-
SHM pending alloc	Bhr 1961:19 (5/61)	-	X	-	-	X
SHM pending alloc	Bhr 1961:19a (5a/61)	-	X	-	-	-
SHM pending alloc	Bhr 1961:21 (7/61)	-	X	-	-	-
SHM pending alloc	Bhr 1961:22 (8/61)	-	X	-	-	-
SHM pending alloc	Bhr 1961:22b (8a/61)	X	-	-	-	-
SHM pending alloc	Bhr 1961:33a (21a/61)	-	X	-	X	X
SHM pending alloc	Bhr 1961:40 (34/61)	-	-	-	-	X
SHM 32623	Stone Age features	X	X	-	X	X
SHM 32623	Bhr 1967:01	-	-	-	-	X
SHM 32623	Bhr 1967:13	-	-	-	-	X
SHM 32623	Bhr 1967:20	-	-	-	-	X
SHM 32623	Bhr 1967:24a	-	-	-	-	X
SHM 32623	Bhr 1967:24b	-	-	-	-	X
SHM 32623	Bhr 1967:25abd	-	-	-	-	X
SHM 32623	Bhr 1967:25c	-	-	-	-	X
SHM 32623	Bhr 1967:26	-	-	-	-	X
SHM 32623	Bhr 1967:33	X	X	-	-	X
SHM 32623	Bhr 1967:34	-	-	-	-	X
SHM 32623	Bhr 1967:36	-	-	-	-	X
SHM 32623	Stray finds 1963-67	X	X	X	-	X

5. Pottery

5.1. Introduction

Neolithic pottery has been recovered at the site through rescue excavations of Iron Age graves in 1947, 1951, 1952, 1960 and 1961; and through excavation of the Neolithic deposit 1963-1967. The finds from 1947-1952 amount to only 17 fragments and have not been included in the present study as they are kept in the Gotlands Fornsal county museum, Visby. The finds from 1960-1967 amount to 4170 g Neolithic pottery and do not quite fill two storage cases at the SHM in Stockholm.

The vessels are described in a typological system with four main parameters: ware, diameter, vessel shape and decoration. To qualify for typological study of the co-variation of independent attributes (Malmer 1962:47-57), a fragment must be determinable in at least two of these dimensions.

All fragments can be studied as to ware, but this parameter does not lend itself to rigorous definitions. All fragments that allow measurement of diameter are identifiable vessel parts. This means that, in order to be used, each fragment must either be a clearly identifiable part of a vessel, exhibit decoration, or both. 1300 g (31% of the total) of the material satisfies these demands, amounting to 179 fragments, with an average weight per determinable fragment of 7.3 g. Of these fragments, only 21 lack decoration. This indicates that we are very likely dealing exclusively with decorated vessels.

All determinable fragments but three can be ascribed to beakers or larger pots. Of the three, two fit together and belong to an undecorated pottery disc (diam 9 cm) and one is a rim-fragment from a decorated pottery flask or miniature cup (fig. 4D, diam 2.5 cm).

5.2. Number and shapes of vessels

The first question to answer is how many pottery vessels are represented by the finds. To determine a minimum number I have studied the rim fragments, which display the greatest typological variation among the vessel parts. There are 44 rim fragments representing at least 36 different vessels including the flask or cup. This number disregards the fact that there are not necessarily any rim fragments preserved from every single vessel at the site, and the actual number must be higher as demonstrated below.

What kind of vessels were these, disregarding the flask or cup? The 14 measurable rim diameters vary between 12 and >35 cm with the median at 21 cm. Five bottom fragments have been identified, all of them rounded. A vessel shape with a turned-out rim, a short neck, a lightly marked shoulder, a steeply inclined belly and a rounded bottom seems to have been the rule. One fragment (the largest one) includes rim, neck and shoulder; two rim and neck; and three neck and shoulder. By far the most of the fragments cannot be placed precisely along the vessel's profile.

5.3. Decoration, pottery styles and chronology

34 elements of decoration have been defined and 27 of these combine on the fragments to form three distinct groups (table 5a & fig. 3). There is only one instance of each pairwise element combination except 13+31 and 36+53 of which there are each two. This low number of instances is not astonishing given the small size of the sample. The largest group combines 20 elements including all the pit types and represents Pitted Ware (GRK). The diagram also includes the dummy element no. 10 (damaged pits of indeterminable type) to underline (redundantly) the integrity of the group. The two remaining groups, with four and three elements respectively, represent TRB and Corded Ware (STR). The pottery from Rojrhage is, thus, a multi-component assemblage of Early and Middle Neolithic pottery styles. GRK predominates but TRB and STR are also in evidence. Österholm (1989:171, 175) was thus only partly right in classifying the site as a TRB settlement.

Adding vessels without preserved rims identified among the TRB and Corded Ware vessels, a total of 41 individual vessels can be discerned among the finds. This is still a minimum value, and closer study of the Pitted Ware would no doubt increase it.

Table 5a. Pottery decoration elements. References where applicable to the Ajvide GRK decoration classification system of Österholm (1989:103-109, 1997).

No.	Definition	No. of frags	Comb. group	Ö'holm's code
10	Pit, uncertain type	34	GRK	-
11	Pit, conical	12	GRK	2
12	Pit, U-shaped cross-section	13	GRK	1
13	Pit, orthogonal cross-section	19	GRK	1
14	Pit, central bottom knob	3	GRK	-
15	Pit, 8-shaped	1	GRK	-
20	Impression, uncertain type	7	-	-
21	Impression, square, triangular + rectangular c-s	1	-	-
22	Impression, pairwise shallow rhomboid	1	-	-
23	Impression, oblong, vertical, repeated horizontally, L 4-5 mm, 1.5-5 mm apart	5	GRK	-
25	Impression, oblong end wood, vertical, repeated horizontally, L 7-13 mm, 5-6 mm apart	3	GRK	-
27	Impression, shallow oblique cylinder edge	3	-	-
28	Impression, oblong, vertical, repeated horizontally, L 4-12 mm, >5 mm apart	5	TRB	-
30	Line, uncertain pattern	14	-	-
31	Line, acute angle pointing horizontally	8	GRK	9
32	Line, oblique cross-hatching, 3-5 mm apart	4	GRK	11
33	Line, vertical, across sherd, 4.5-8.5 mm apart	6	TRB	-
34	Line, oblique, repeated horizontally, switching direction after >=4 (…////\\\\…)	2	GRK	8
35	Line, horizontal, repeated, 3 mm apart	2	GRK	29?
36	Line, obtuse zigzag horizontally	13	GRK	73?
37	Line, obtuse Vs alternately up and down repeated horizontally	1	-	-
41	Cord, horizontal, repeated, >=3.5 mm apart	7	STR	-
42	Cord, horizontal, repeated, <3.5 mm apart	3	TRB	-
43	Cord stamp, >=3 horizontal, L 18 mm, 3.5-6 mm apart	1	TRB	-
44	Cord stamp, vertical, side by side forming continuous surface	1	STR	66
45	Cord-twined twig stamp, horizontal and vertical	2	-	68?
46	Cord stamp, vertical, L >11 mm, repeated, 5-8 mm apart	1	-	65
51	Rim, line, transversal, 1-2 mm apart	5	STR	-
52	Rim, line, acute zigzag	1	GRK	-
53	Rim, line, oblique	7	GRK	71
54	Rim, line, transversal, >3.5 mm apart	3	GRK	28
55	Rim, line, oblique cross-hatching, 4.5 mm apart	2	GRK	38
56	Rim, impression, oblong end wood, transversal, 4.5 mm apart	3	GRK	-
58	Rim, denticulate stamp, straight, transversal, 4 mm apart	1	GRK	-
59	Rim, double line, transversal, 2.5-5 mm apart	1	GRK	-
61	Denticulate stamp, straight, oblique, L >10 mm	1	GRK	72?
71	Outer rim edge, impression, oblique, 4-6 mm apart	2	GRK	-

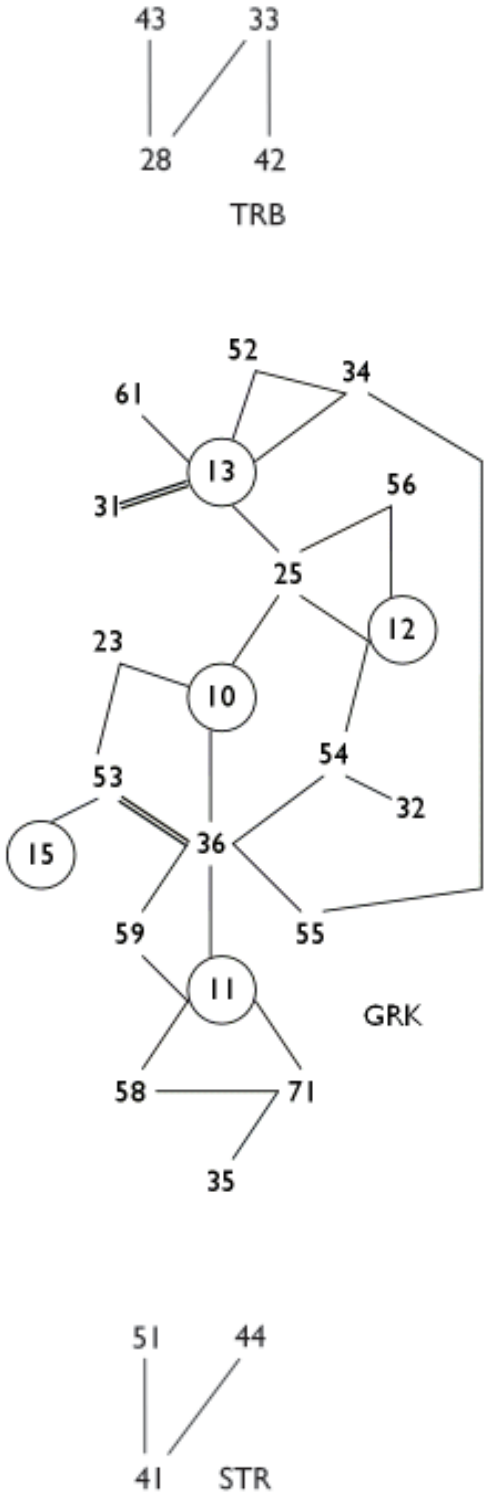


Fig. 3. Combination diagram of Neolithic pottery decoration elements from Rojrhage, cf. table 5a. Circles denote different types of pits. Each connecting line represents one potsherd. Double lines denote double instances of an element combination.

5.4. TRB pottery

The pottery of the TRB combination group (fig. 4) comprises nine fragments from five excavation contexts, probably representing five individual vessels. As only one of the fragments has a preserved rim, four must be added to the number of identifiable vessels at the site based exclusively on rims. The decoration elements of this pottery are widely spaced vertical oblong impressions (no. 28), widely spaced vertical lines (no. 33), closely spaced horizontal cord (no. 42) and vertical stacks of horizontal cord stamps (no. 43).

The typological determination of this pottery is hampered by the lack of determinable belly fragments. However, judging from the ceramic wares as shown below, there is a strong positive indication that the TRB vessels at Rojrhage had rounded bottoms and no decoration below the shoulder.

From a Scanian perspective, the vessels belong to the Mossby group of the later EN I (Larsson 1994:217-223, 1997:95 & fig. 4:9), c. 3800-3650 cal BC. The Mossby group concentrates upon southern and eastern Scania and has contemporary parallels in Bornholm (Becker 1947: 161-169; 1990:41-44, 160-163), which is particularly interesting in the Gotlandic context.

Compared to the eastern Danish TRB sequence, the two least incomplete vessels appear to belong to Koch's type III and the Svaleklint decoration style. Type III differs from type IV mainly through its lack of sub-shoulder line decoration. Koch dates type III to the first part of the Early Neolithic, EN I, with an absolute dating of 3800-3500 cal BC (Koch 1998:91-94).

The cord-twined twig stamp (no. 45) and oblique cylinder edge impression (no. 27) lack combinations in the Rojrhage pottery, but should belong with the TRB pottery judging from the Siretorp finds (Bagge & Kjellmark 1939, Pl. 61:2, 65:6, 67:10 & Pl. 62:1-5, 68:1-2, 68:10, 69:5) and the ware (see below). The fragment of a pottery flask or cup is also made from a ware most similar to the TRB pottery at the site. Its diameter is much smaller than that of the miniature cups found in Gotlandic GRK contexts, and none of them are decorated (Stenberger 1943:100, Taf. 35:1-3, Taf. 22 fig. 41:2; Janzon 1974:104-105). The vessel is thus more likely to have been a collared flask than a miniature cup and should be counted with the site's TRB component. The pottery disc, too, would belong here due to the type's scarcity in GRK contexts and absence from STR contexts. At a diameter of only 9 cm, it seems too small to be useful for bread baking.

Fig. 4A. TRB pottery from Rojrhage 1:1. SHM 32623. Grid square F1. Decoration nos 28 + 43.

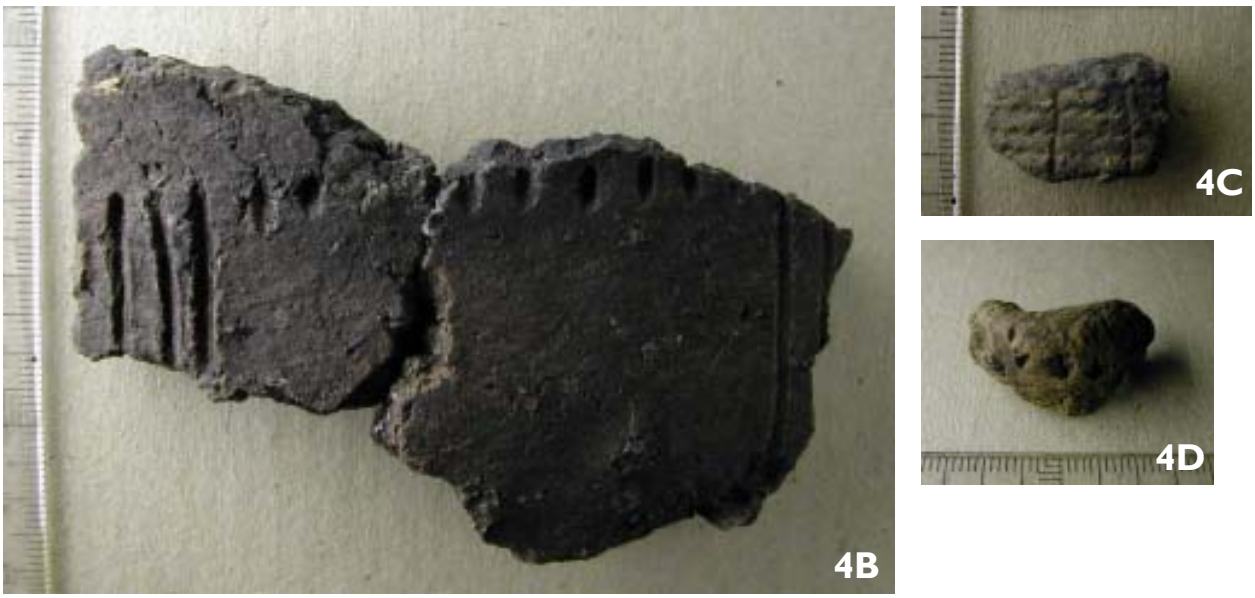


Fig. 4. TRB pottery from Rojrhage 1:1. SHM 32623.
4B. Grid square H0-I0. Decoration nos 28 + 33.
4C. Stray find 1963-1967. Decoration nos 33 + 42.
4D. Flask or miniature cup, rim. Sunken feature B.

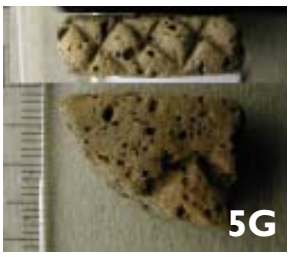
5.5. GRK pottery

The pottery of the GRK combination group (117 fragments) is characterised by pits, oblique line patterns, vertical and horizontal zigzag lines, and oblique lines on the rim (fig. 5). The low frequency of denticulate stamp decoration (two fragments plus two kept in the Gotlands Fornsal county museum) is remarkable. In the terminology of Nihlén (1927) and Schnittger & Rydh (1940), this decoration corresponds to the Hemmor-Gullrum style.

Compared to the pottery decoration of the stratified GRK site at Ajvide in Eksta parish, 22.5 km to the NNW (Österholm 1989:103-115, 1997), the combination of decoration elements at Rojrhage is most similar to that at Ajvide D Upper, levels 1-2. This can be exemplified by the ratio between fragments decorated only with conical (no. 11) and cylindrical (nos. 12-13) pits respectively. The ratio is 0.08 at Ajvide D Upper level 1, 0.13 at Rojrhage, and 0.19 at Ajvide D Upper level 2. The chronological dichotomy between conical and cylindrical pits also shows up in the combination diagram for Rojrhage's GRK component (fig. 3), where they are found at opposite ends of the combination cluster. Ajvide D Upper levels 1-2 represent the middle phase of Ajvide's three-step GRK sequence, post-dating the Littorina transgression deposit and predating area D Lower (cf. Lindqvist & Possnert 1997a:30-33, Lindqvist 1997a:71-73, Österholm 2002a).

In the 1980s it was believed that all the GRK burials of Ajvide dated to a late phase contemporary with the settlement at Ajvide D Lower. The absolute dates of the Ajvide finds have since been clarified through an extensive programme of radiocarbon analyses (Lindqvist & Possnert 1997a: 55-57; Possnert 2002). Burial began already in the middle phase concurrently with post-transgressional settlement at Ajvide D Upper. With correction for the reservoir effect, Lindqvist & Possnert date post-transgressional settlement at Ajvide D Upper and most graves (nos. 1, 2, 13, 28, 29, 36, 41, 53, 1/94: cf. Burenhult 2002) within the interval c. 2900-2600 cal BC. The graves contemporary with settlement at Ajvide D Lower (nos 6, 19 & 30), in their turn, are dated to the interval c. 2450-2100 cal BC.

Both the early and middle GRK phases at Ajvide belong to the Hemmor-Gullrum pottery phase (cf. Lindqvist & Possnert 1997a:33). In current terms of southern Scandinavian relative chronology, this translates to pre-Corded-Ware Middle Neolithic, phase MN A. Thus, even without the radiocarbon dates from Ajvide, Ajvide's middle GRK phase and the GRK component at Rojrhage may be assigned to a late part of MN A, corresponding to the interval c. 3000-2700 cal BC (Edenmo et al. 1997:136).



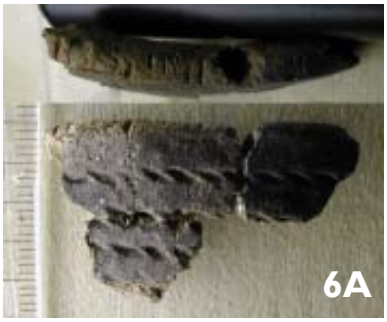


Fig. 5. GRK pottery from Rojrhage 1:1. SHM 32623.
5A. Grid square G1. Dec. nos 11 + 36 + 59.
5B. Stray find 1963-1967. Dec. nos 12 + 25 + 56.
5C. Stray find 1963-1967. Dec. nos 13 + 34 + 52.
5D. Grid square F4. Dec. nos 23 + 53.
5E. Grid square F3-F4. Dec. nos 13 + 31.
5F. Stray find 1963-1967. Dec. nos 32 + 54.
5G. Stray find 1963-1967. Dec. nos 36 + 55.

Fig. 6. STR pottery from Rojrhage 1:1. SHM 32623.
6A. Grid square F2. Dec. nos 41 + 51.
6B. Grid square F4. Dec. nos 41 + 44.

Fig. 7. Bone harpoon point. Sunken feature A. SHM 32623.

Charcoal, hazelnut shells and pottery crusts from the eponymous Hemmor site have, confusingly, mainly given much later radiocarbon dates, clustering in the interval 2764-2258 cal BC (Wallin & Martinsson-Wallin 1996:14, Hedemark et al 2000:11). Only two samples (Beta-135646, 4730±110 BP, charcoal; Ua-17465, 4535±70 BP, human bone, grave 1) from higher altitudes at the site have given dates in the interval 2900-3800 cal BC. The site is thus largely contemporary not with the early and middle GRK phases at Ajvide with Hemmor-Gullrum pottery, but with the late GRK phase at Ajvide, with Visby and Ire-Västerbjers pottery. The typology of the Hemmor site's pottery finds is outside the scope of this work, but it seems warranted to check anew whether the site's pottery is really mainly an exponent of the Hemmor-Gullrum style.

Decoration at Rojrhage is concentrated on the upper part of the GRK vessels, the criterion used by Malmer to separate the early (Fagervik III) phase from the late (Fagervik IV) phase at the Västerbjers cemetery (1962:736-737). Malmer notes that the genesis of the Fagervik III type, thus defined, may pre-date the cemetery. The Ajvide stratigraphy, where already the earliest GRK phase (D Upper levels 3-4) pre-dating the graves is characterised by Fagervik III pottery, indicates that this is actually the case. However, Malmer's (1962:732) suggestion that the beginning of the Gotlandic GRK cemetery horizon post-dated the appearance of the Battle Axe Culture (that is, the beginning of MN B, 2700 cal BC according to Edenmo et al. 1997:136) on the Swedish mainland is not borne out by the radiocarbon dates from Ajvide as reported by Lindqvist & Possnert. Rather, they seem contemporaneous at the available dating resolution.

Although the correspondence between the pottery styles of Ajvide D Upper 1-2 and Rojrhage is clear, it should be noted that only half of the Rojrhage GRK decoration elements have clear counterparts at Ajvide. Most importantly, horizontal lines of vertical oblong impressions (nos. 23 & 25, n=8) are absent from the Ajvide pottery. This may be due to chronology, in which case corresponding pottery might be sought among the finds from excavations during the 1990s between areas D Upper and D Lower at Ajvide (cf. Burenhult 2002 colour plate A). Otherwise, it may be an example of contemporaneous local traditions. The same argument applies to the dearth of denticulate stamp decoration at Rojrhage.

5.6. STR pottery

The pottery of the STR combination group (fig. 6) amounts to seven fragments from three excavation contexts, probably representing one individual vessel per context. One of these vessels has no preserved rim. The decoration elements of this pottery are widely spaced horizontal cord (no. 41), vertical cord stamp side by side forming a continuous surface (no. 44) and closely spaced transversal lines on the rim (no. 51). Compared to the Corded Ware sequence of mainland Sweden, the fragments from Rojrhage fit the definitions of Malmer's groups A-C (Malmer 1962:8, 12, 13). However, rim decoration such as that known from Rojrhage occurs only in group C (Malmer 1962 Abb. 5:6), which would place the pottery in group C. This group, known to Malmer only from settlement deposits and mainly as single fragments, dates to period 6 (Malmer 1962: 89), that is, the first phase of the Late Neolithic, after 2350 cal BC (Holm et al. 1997:215).

STR pottery is very uncommon on Gotland, with only two previously published instances: Stora Förvar on Stora Karlsö (Schnittger & Rydh 1940 Pl. 24:9, Malmer 1962 Abb. 16:3 & Tab. 2) and Ardags in Ekeby parish (Åhlén 1972:21, 8, fig. 3.2). However, the presence of surface-covering vertical cord-stamp mainly in the final phase of the Ajvide pottery (element no. 66 in Österholm 1989:103-109, 1997) indicates that many of Gotland's GRK sites may conceal small amounts of late STR pottery. This seems to be the situation in the Late MN B coastal zone of the Lake Mälaren area and Östergötland (Olsson & Edenmo 1997:186-188).

5.7. Ware

The following discussion of the ceramic wares treats the 133 fragments that could be allocated to the three decoration groups, TRB, GRK and STR. It is based on four variables recorded for each fragment: temper size (class 1-3), porous surface (yes / no), pink surface in fluorescent tube lighting (yes / no) and minimum thickness (mm).

Table 5b. Ceramic wares and pottery decoration groups.

	TRB	GRK	STR	Unadorned
Mean temper (!)	2.8	1.7	3.0	2.4
Porous	11%	56%	0%	5%
Pink	11%	22%	86%	0%
Mean thickness (mm)	7.7	7.1	6.6	8.4

Of these, all except the thickness are impressionistic and the results are thus of highly questionable value if any at all outside the context of this investigation. There is even a risk that my impressionistic criteria may have varied during the recording, but as the material is small and was studied during a short time span I assume them to have been constant. This is all sloppy method with many lamentable precedents in the annals of archaeology, and I can offer only two excuses. To quantify temper I would have had to thin-section the sherds. I cannot think of any workable stringent definition of a porous surface. As for the colour variable, I have no excuse, as I might have used a standard colour chart.

The minimum thickness of each determinable fragment with both inner and outer surfaces preserved (n=165) has been measured and varies from 4.5 to 13.4 mm with an arithmetic mean of 7.8 mm. The distribution is continuous from 5.5 to 9.8 mm. The mean fragment thickness of all determinable pottery exceeds that of all three decoration groups. This is because most of the 19 unadorned fragments determinable as to vessel part are above mean thickness, reflecting the fact that the decoration concentrates on the upper, thin-walled parts of the vessels.

The sample sizes for TRB (n=9) and STR (n=7) are small but should still permit an impressionistic characterisation. As shown in table 5b, the ceramic ware of the three decoration groups differs dramatically. The TRB ware is coarsely tempered and thick. The GRK ware is finely tempered and mostly has a porous surface. The STR ware is coarsely tempered, mostly pink, and thin.

The unadorned fragments determinable as to vessel part are coarsely tempered and extremely thick but neither porous nor pink, which indicates that most of them belong to the TRB vessels.

Small amounts of organic residue suitable for radiometric analyses have been observed on the insides of a few coarsely tempered and thick pottery sherds; none of them is, however, decorated.

5.8. The pottery's state of preservation

4170 g of recovered pottery and 41 identifiable vessels entail a mean recovered weight per vessel of <100 g. Large and sturdy pots of the types in question can weigh several kilograms each, and the finds are thus highly incomplete. This is hardly surprising given the probable functional nature of the deposit as refuse, the repeated use of the site into recent times, the limited extent of the excavations and the priority given during fieldwork to the superimposed Iron Age graves.

The fact that so much Neolithic pottery (149 g) was found in the earliest Iron Age structure at the site, the Late Roman Period grave mound Bhr 1967:33, gives some indication as to the post-depositional hardships endured by the Neolithic deposits. Although the later Iron Age graves were flatter, less fill-consuming, and seem mainly to have been placed on top of the ground surface, it seems that very little of the Neolithic deposits could have survived the Iron Age untouched. Also, due to its multi-component nature, the deposit constituted a palimpsest of repeated uses of the site all through the Neolithic. It had thus very likely already been thoroughly churned when it started to settle into place before the Bronze Age hiatus at the site. This is borne out by the observations that the fragments are small, that few fragments can be assigned to the same vessel, and that the TRB and GRK pottery mixed indiscriminately across the total pottery distribution. Interestingly, the latest pottery type, STR, was also the only one with a focussed spatial distribution in squares F2 and F4.

Most sherd breaks are covered with dirt but not visibly abraded. Only very few fragments show abrasion possibly due to wave action on a seashore, and, due to their scarcity, they were probably transported to the site in their abraded state.

6. Bone harpoon point

Three bone artefacts have been identified among the finds, only one of which can be determined as to function and type: the tip of a bone harpoon point from sunken feature A (fig. 7). Only one barb remains, finely sculpted. Since so little is preserved of the point it is hard to determine as to type. However, with the short barb and the long acutely tapered tip it has no good parallels among the finds from MN graves and settlements published by Stenberger et al. (1943), Janzon (1974) and Österholm (1989). Good matches are, however, found in harpoon points from excavation unit G6, Stora Förvar in Eksta parish (Schnittger & Rydh 1940, pl. I, fig. 4) and Hemmor in När parish (Wallin & Martinsson Wallin 1996:22 fig. 11, fourth harpoon point from the left). These points taper slowly from a wide flat base to an acute tip, with closely set equidistant barbs along one side formed by finely sculpted shallow oblique notches, and ending in a tip longer than the distance between two of the notches.

Given the complete dominance of Hemmor-Gullrum pottery at Stora Förvar G6 and the lack of parallels to the Rojrhage harpoon point in the Gotlandic MN B cemetery horizon, this type seems to be contemporary with the GRK pottery from Rojrhage and earlier than the cemetery horizon.

7. Ground igneous rock axes

Two ground igneous rock axes have been identified among the finds: one of them nearly complete and collected as a stray find, and the other represented only by a flake found in an Iron Age grave. Little can be said about the flake except that the axe had a rounded cross-section.

The nearly complete axe (fig. 8) is made from greenstone. It is missing the point of its tapered butt. Otherwise it is in good condition. Except for the break, its surface is polished all over. Its cross-section is roundedly rectangular. The edge is distinctly off-centre but not hollow. The extant maximum dimensions are 206.5 x 42.5 x 22.0 mm. The thickness 2/3 of the probable original length (c. 220 mm) from the edge is 19.4 mm.

Michael Petrén's (1992) eminent work with rectangular cross-section axes from Gotland has shown that the morphology of the igneous rock axes (as opposed to the flint axes) varies greatly, exhibits very weak typological clustering, and does not conform to the TRB and STR norms of the Swedish mainland. Petrén could divide the igneous rock axes into only two vague types: an EN-MN type with bulging broad sides and rounded neck, and an MN-LN type with flatter broad sides and straight neck. The Rojrhage specimen, though lacking its neck, has flat broad sides and thus belongs to the latter type. However, none of either Petrén's 173 igneous rock axes nor his 117 flint axes shows any close similarity to the Rojrhage axe's dimensions. His sample includes the finds from MN graves and settlements published by Stenberger et al. (1943), Janzon (1974) and Österholm (1989).

From a mainland Swedish perspective, the axe shows little similarity with the Late Mesolithic sub-rectangular cross-section axes of the Lake Mälaren area (Lindgren & Nordqvist 1997:59-61 & fig. 2:4). This supports a Neolithic date. According to Malmer's definition (1962:560), it is a cross-edged, thin-bladed igneous rock axe, a type with only three specimens known to Malmer from STR graves. The width and thickness of the Rojrhage axe are both within the intervals characteristic for the type. However, it is much longer in absolute and relative terms than all of Malmer's thin-bladed axes, both flint and igneous rock ones. Its relation to the grave finds of the Battle Axe Culture is thus uncertain. Igneous rock axes were a late (late MN B and early LN) feature of the northern limits of the Battle Axe Culture's area in Sweden, the Lake Mälaren area and Östergötland, where they took the place in the assemblage occupied by flint axes in more southerly areas (Malmer 1962:431).

As the axe differs markedly from the modes of common axe types, it is best interpreted as a local greenstone variation on the thin-blade theme (personal communication, Mats P. Malmer 2000). The Rojrhage axe would fit well in the established view of MN Gotland as located outside the area of the canonical Battle Axe Culture, but in close contact with it, as evidenced e.g. by the Scanian and Jutish battle-axes found in graves at Västerbjers (Stenberger et al. 1943).

A fine specimen like that from Rojrhage would probably originate from a votive deposit or a grave. The edge, however, exhibits use-damage. This tal-

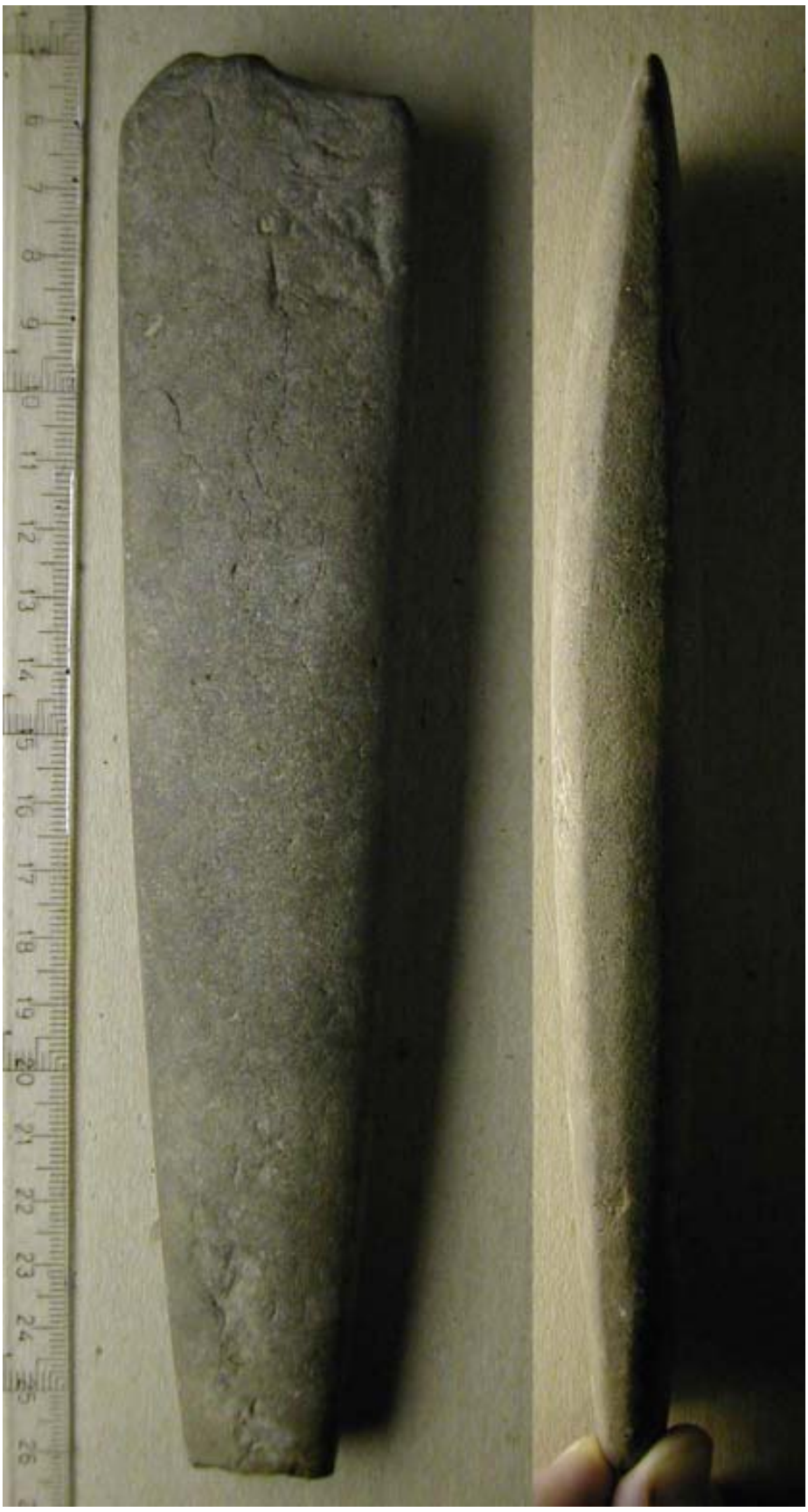


Fig. 8. Cross-edged, thin-bladed igneous rock axe from Rojrhage 1:1. Stray find 1963-1967. SHM 32623. Ventral broad side shown left.

lies well with Österholm's observation (1989:169 & fig. 84) that Gotlandic greenstone axes of all types from the Late Mesolithic through the Early Bronze Age tend to an edge angle of c. 80º, while sharper-edged axes like the Rojrhage specimen (edge c. 30º) are often damaged. Indeed, it seems obvious that an axe like this would break when used, and it was thus very likely made primarily for display or burial.

The Rojrhage axe lacks a detailed find context and belongs to a typologically unspecific artefact class. Therefore it cannot be dated any closer than Petrén's MN-LN.

8. Flint

In December 1999, 282 flint fragments were known from the site. This number will most likely be augmented in the future as further Iron Age cremations are analysed by osteologists. Neolithic artefacts have been mixed secondarily into the Iron Age contexts. Among the materials at hand are 21 fragments from a total of 18 Iron Age cremations analysed by osteologists, all of them excavated 1960-1961. No flint appeared when inhumations were analysed. To this number should be added 19 fragments collected already during fieldwork from 10 graves, only one of which was an inhumation. No flint fragments were registered

from the graves excavated 1963-1967. This is probably due to the separation at these excavations of Iron Age finds and finds from, or conjecturally belonging to, the underlying Neolithic deposits. The excavator alludes to such a practice in the field notes quoted above.

In all, 57 cremation graves have been excavated at the site. The total number of flint fragments from these once they have all been subject to osteological analysis may be predicted at 57 x (21/18) ≈ 67. Of these, 40 have already been collected, to which must be added an unknown number for 43 graves excavated 1963-1967. All this assumes a roughly homogeneous spread of flint across the area prior to the graves' construction.

Of the 282 known flint fragments, one was discarded at excavations in 1931 and 13 are kept in the Gotlands Fornsal county museum, Visby. The remaining 268 fragments (95% of the known ones and >86% of the predicted total number) are kept at the SHM. They were determined as to type by Karl Thorsberg on 28 May 1999 (table 8a).

8.1 Knapping technique

Despite the multiple Neolithic components displayed by the pottery from the site, the flint finds permit the reconstruction of a single coherent reduction process. A flint-saving method has been practiced: work has begun with multifacial cores from which flakes have been knapped. These flakes have been made as large and wide as possible without platform preparation, that is, unnecessary waste has been avoided. When the multifacial cores have become too small, reduction has continued on an anvil, since all collected cores are bipolar ones which have been used to the limit. The bipolar flakes are consistently smaller than the multifacial core flakes. The only exception from this chaine opératoire is a bipolar core made from a multifacial core flake. This core is also the only intact one.

The multifacial core flakes demonstrate at least three ways of knapping flakes from a multifacial core. Flakes with pseudo-facets on the impact surface were produced by connecting at the bottom of horizontal flake scars. Flakes with a level platform were produced by connecting far from the edge of the core without initial platform preparation. Finally, flakes with a V-shaped cross-section were produced by connecting inside the vertical scar of a previous flake.

The strong presence of bipolar technique is characteristic of Gotlandic flint knapping through millennia. Local flint nodules are simply generally too small to permit production of platform cores (Thorsberg 1997:50-51). Many of the morphologically unspecific fragments from Rojrhage display sharp-edged high speed fractures. This indicates the use of an anvil, probably during bipolar work judging from the finds.

No attempts were made to limit the width of the flakes, as shown e.g. by the practice of connecting inside flake scars. This reflects an ideal opposite to that of blade technique. Wide, thin and straight flakes were the intended products.

8.2 Intended products

Nothing at the site indicates production of complex flint tools like axes or daggers, nor of simple tools like scrapers. The flakes made were cutting tools that could be used on their own or fitted as edges onto composite tools.

The best products, wide flakes with cutting edges, seem to have been selected and removed, as probably also many of the bipolar flakes. However, no flake re-fitting to reconstruct cores has been attempted. The finds seem mainly to consist of knapping debris. The actual sites of tool *use* may have been anywhere.

8.3 Raw material

The raw material is hard to determine because Gotlandic flint is so variable, but there is no certain evidence for the use of any imported flint. The flint from grave 5/61 might possibly be South Scandinavian, but the greasy surface of the fragments may equally well be due to the flint having been knapped during the Iron Age leading to comparatively less time for patination.

Beside the small nodules of local beach flint, the knappers have used at least one ground flint tool as raw material. It has not, however, been worked differently than the common nodules.

8.4 Find contexts

Most of the flint finds derive from the Neolithic deposits. There are no significant differences in the flint from different parts of them. However,

Table 8a. Flint fragments.

Type	No.
Splinter from a multifacial core	2
Flake from a multifacial core	73
Bipolar core or fragment thereof	26
Bipolar flake or fragment thereof	59
Flake from ground tool	1
Flake knapped with metal hammer	3
Chunk	3
Unspecific	101
Sum	268

there are differences between the flint from the Neolithic deposits and the Iron Age graves. The flint from the Iron Age graves is more patinated, but most fragments are not visibly burnt with a cracked surface.

Fragments with a greatest measurement <10 mm are very uncommon but do occur among artefacts found during osteological analysis of the bones from the Iron Age graves. This indicates that although the deposits were, judging from the minimum size of the collected pottery fragments, screened, the smallest flint fragments were not collected during fieldwork.

8.5 Dating

On typological grounds, the flint finds may not be dated closely except for the observation that the reduction process at Rojrhage is the same one as identified at a number of Gotlandic GRK sites (Thorsberg 1997:53). However, a few arguments *ex silentio* may be suggested, fully acknowledging their weaknesses.

Mesolithic lithics would most likely contain a much larger component of igneous rock. One would also expect more blade technique with oblong flakes and prepared knapping platforms.

At the Neolithic site of Mölner in Väte parish, Gotland, with a main TRB component, there is knapping debris from complex flint tools and a large component of South Scandinavian flint (Thorsberg 1997:54-55). If Mölner can be taken as representative of Gotlandic EN sites, then an EN date can be excluded for the Rojrhage flint.

Early Bronze Age flint would most likely include debris from surface pressure flaking and platform preparation. The same may probably be said for the LN, although the Gotlandic record is weak on this point. These dates may thus also, provisionally, be excluded.

On the basis of these deliberations, one may thus most probably date the Rojrhage flint finds to the MN. Given the coherent reduction process perceived in the flint finds, it would seem that they represent only one of the site's chronological components, viz the late MN A. To explain the apparent lack of earlier and later lithics in the material, a comparison with the pottery may be instructive. Of the pottery fragments that could be ascribed to one of the three decoration element groups, only 12% belonged to TRB and STR. 12% of the determinable flint fragments amounts to only 20, which is of course not enough material to reconstruct a single lithic industry, let alone two. This argument presupposes a constant ratio through time between the amount of pottery and flint discarded at the site.

8.6 Iron Age flint

As noted above, the flint found in the graves exhibits deviant patination. Of the fragments from Neolithic contexts, only about 1% are burnt, while the ratio among the finds from the Iron Age graves is 12.5%. This is probably due to the cremation pyres and indicates that at least some of the cremations were performed on-site.

More remarkably, three of the fragments found in the graves have a wavy surface indicating that they were knapped with a metal hammer. None of the fragments found in the Neolithic deposits do. This hints at an Iron Age flint industry, possibly linked to mortuary ritual.

9. Bones and radiometric analyses

9.1 Sampling

Bone samples for dating were chosen on the following grounds. The selection was limited to species-determined bones from seemingly unadulterated Neolithic contexts. One sample per species was selected, and two extra human samples were added, bringing the total up to ten samples (table 9a, no dating was achieved for cod vertebrae). It was hoped that the human bones might provide the first occasion on Gotland to compare EN human $d^{13}C$ values with seal, fish and domestic animal values from the same context. Unfortunately, none of the two human cranial bones retained sufficient collagen for radiometric analysis, although a human tooth gave a date in the 1st millennium cal AD (Ua-16504). Instead an extra sample each of cattle and ovicaprid were selected. These were preferred over the wild species and pig because we considered them more likely to date from the EN and thus be relevant to the study of the neolithisation of Gotland. MN seal-hunting, fishing and pig-herding is already well attested on Gotland. No EN dates, however, resulted from the analyses. One of the cattle bones produced a date in the MN, which is rather uncommon.

A comparison of the species frequencies for the Neolithic deposits and the Iron Age graves at the site reveals interesting differences. Bones of cattle, pig, seals, birds and fish are common among the Neolithic finds but very rare among the Iron Age finds. They may actually all be residual in the Iron Age context. The bones of humans and dogs, on the other hand, were common in the graves and very rare in the substratum. The horses, bears and lynxes of the Iron Age graves are entirely unknown among the Neolithic finds. Ovicaprids are common in both contexts.

9.2 Hunting and fishing

Three seal species have been identified among the bones from Neolithic contexts at Rojrhage: grey seal (*Halichoerus grypus*, Sw. gråsäl), ringed seal (*Pusa hispida*, Sw. vikaresäl) and harp seal (*Phoca groenlandica*, Sw. grönlandssäl), see table 9b. There are remains of at least two very young ringed seals in the Rojrhage material, probably indicating breeding not far away and severe ice conditions. The abundance of grey seal at Rojrhage is unusual, as harp seal predominates among the seal bones from most other Neolithic sites on Gotland. Usually, grey seal predominates only at Early and Middle Mesolithic habitation sites, and is very rare at Late Mesolithic and Early-Middle Neolithic sites. Nevertheless, two grey seal samples from Rojrhage have been dated to the Neolithic, proving that the grey seal bones are actually approximately contemporaneous with the ringed seal and Neolithic domestic animal bones (table 9a).

The apparent difference in radiocarbon age, 251 (140-345) years, between the marine influenced seal dates and the domestic animal dates, is probably mainly due to the reservoir effect, not an actual difference in age. The fairly low $d^{13}C$ values of the seal bones, which is not unusual in the Baltic, especially in harp seal bones,

Table 9a. Radiocarbon dates. Go, Grötlingbo psh, Rojrhage 1:1, Raä 54, SHM 32623.

Lab no.	Sample no.	Context	d13C	Age BP	Std dev	Date cal 1 s	Corrected date, RE = -250 years BP	Corrected period
Ua-16500	1	Pig, dens, E3	-22.8	4435	70	3300-2920 cal BC	-	MN A
Ua-16501	3	Ovicaprid, dens, G1	-22.5	1230	65	710-890 cal AD	-	I.A. VII-VIII
Ua-16502	4	Grey seal, b. tymp., G1	-23.7	3810	110	2460-2040 cal BC	2040-1740 cal BC	LN I-II
Ua-16503	6	Harp seal, b. tymp., F4	-19.3	4650	100	3630-3570 cal BC	3320-2900 cal BC	MN A
Ua-16504	8	Human, dens, F1	-22.0	1730	100	140-430 cal AD	-	I.A. IV-VI
Ua-16505	10	Ovicaprid, tibia, H0	-23.2	1320	80	640-810 cal AD	-	I.A. VII
Ua-17545	11	Cattle, dens, F1-2	-23.0	4325	65	3020-2880 cal BC	-	MN A
Ua-17546	13	Ringed seal, dens, G5	-17.0	4670	60	3520-3360 cal BC	3310-2920 cal BC	MN A
Ua-17547	14	Grey seal, dens, H1	-17.0	4575	75	3500-3100 cal BC	3090-2870 cal BC	MN A

Table 9b. Skeletal element abundance (number of identified fragments/specimens, NISp.) in the seal (grey seal, ringed seal and harp seal) bone material from Rojrhage.

Skeletal element	No. of frags, NISp.	Grey seal	Ringed seal	Harp seal
Temporale	17	1	1	1
Occipitale	0			
Cranium-fr.	9			
Nasale	0			
Maxilla	0			
Mandibula	10		2+	1?
Dentes	8	3	1	
Vertebra	10			
Costa	6			
Sternebra	1			
Scapula	4			
Humerus	3		+	
Radius	1			
Ulna	1			
Carpi (7 sp.)	2			
Metacarpus, M.c. I-V	6			
Phalanx anterior, Ph. 1, I-V	5			
Ph. 2, I-V	1			
Ph. 3, I-V	0			
Coxae	8			
Baculum	1			
Femur	0			
Tibia	2			
Fibula	4			
Tarsi (7 sp.)	0			
Metatarsus, M.t. I-V	2			
Phalanx posterior, Ph. 1, I-V,	1			
Ph. 2, I-V	3			
Ph. 3, I-V	0			
M.p.	6			
Ph.	2			

may perhaps indicate that the calculated reservoir effect should be somewhat lesser and hence that there may in fact be a small difference in age between the seal bones and the domestic animal bones, the date of which is 3349-2707 cal BC (all calibrations according to Stuiver & Pearson 1993:1-23). However, compared to the calculated reservoir effect at Ajvide D upper (c. 305 years for seal bones, c. 215 years for human bones; cf. table 9c and Lindqvist & Possnert 1997a: 55-57, 1997b:73-74) and at "Grottan" (280 years, cf. table 9d), the age difference appears reasonable when interpreted as due to the reservoir effect.

The latest grey seal date from Rojrhage is interesting, provided that it is correct (its quite terrestrial $d^{13}C$ value is obviously incorrect), since it may indicate that the grey seal multiplied again when the harp seal declined in the Baltic Basin toward the end of the Neolithic.

Another exception to the predominance of the harp seal is found in the Neolithic levels (G.7-5) in the cave of Stora Förvar on the island of Stora Karlsö in Ekstа parish, where the harp seal is only the third in abundance after ringed seal and grey seal. The Neolithic ringed seals caught at Stora Karlsö were about 7 months old and the harp seals about 9-10 months old, indicating seal hunting during the late summer-autumn-early winter (Lindqvist & Possnert 1997a). Although some grey seal samples from the Neolithic levels in Stora Förvar have been dated to the Mesolithic, indicating residual material from lower levels (G.11-8), there are also grey seal samples that have been dated to the Neolithic (table 9e).

The reason for the shift from grey seal to harp seal predominance, indicated by most late Mesolithic and Neolithic habitation site materials, may be a combination of two factors. On one hand, competition as pelagic species in the same ecological niche; on the other, a harsher winter climate, that is a greater abundance of permanent ice in the Baltic Basin, caused by the Sub-boreal climatic shift. This probably meant very severe ice conditions in the Arctic, causing a southward relocation of the harp seal and the establishment of a population in the Baltic Basin enduring as a relict for at least 1500 years.

It should be noted that porpoise – although quite common in the final Mesolithic materials, and sometimes occurring also in the Early Neolithic ones – does not occur at these sites. Due

also to severe ice conditions in the Baltic Basin, the grey seal may have been forced to the south-west and even past the straits of Öresund and the Bälts. It is an interesting thought that the large grey seal canines in grave number 2 at the Ajvide D upper Pitted Ware (Middle Neolithic) cemetery, Eksta parish, may have been traded from the south-west. However, the finds of grey seal at Rojrhage and in the Neolithic levels of the cave of Stora Förvar seem to indicate that the animal could still survive, perhaps seasonally, perhaps to some extent breeding, around south-western Gotland, whereas the grey seal was absent further to the north. Perhaps this is also an indication that the grey seal, which breeds during the autumn and early winter in colonies on islands and sheltered bays in the North Atlantic (as they probably did on the island of Stora Karlsö and on the shore terrace below the escarpment at Visborgs Kungsladugård, Visby parish, during the early Mesolithic; see Lindqvist & Possnert 1997a; Lindqvist 1997c), finally began to adapt to ice-breeding during the late winter and spring in the Baltic Basin. Later, during the Bronze Age and early Iron Age, the grey seal bred further north in the Åland archipelago.

Two species of fish have been identified in the Rojrhage material: cod (*Gadus morhua*) and pike (*Esox lucius*), see table 9f. Of these the cod predominates, as it does at most final Mesolithic and Neolithic habitation sites on Gotland. The cods were caught during the late summer or autumn at an age of at least 2-4 years and a length of 45-83 cm (table 9g). However, the fish bones are few, and herring is lacking, which is possibly due both to taphonomy and excavation technique. Where fine-mesh sieving has been conducted, herring is sometimes the predominant species, at least at sites from the middle of the Middle Neolithic (Ekman 1974; Lindqvist 1988 & 1997c). At "Grottan", Överstekvarn II, many fish bones, mainly of cod, were recovered from the Early Neolithic levels.

Bird bones are likewise rare. They have not as yet been identified as to species. Petra Molnar (1998) has identified goosander (*Mergus merganser*, Sw. storskrake) among the bones from the Iron Age graves.

Judging from the relative abundance based on the number of bone fragments, hunting and fishing do not seem to have been of greater importance than animal husbandry at Rojrhage.

Table 9c. Neolithic AMS radiocarbon-dated animal bone and tooth samples from Jakobs/Ajvide, Eksta parish. (The apparent difference between the seal and pig dates, c. 250 (140-355) years, may well be due to the reservoir effect, and hence they are probably contemporaneous in true age.)

Context	**Species**		**Skeletal element**	**14C years BP**	**d13C ‰ vs. PDB**	**Lab. no.**
Jakobs/Ajvide B	Harp seal	*Phoca groenlandica*	Temporale, dx.	5020 ±60	-18.8	Ua-3251
Ajvide D	Harp seal	*Phoca groenlandica*	Temporale	4465 ±65	-16.6	Ua-3541
Ajvide D	Harp seal	*Phoca groenlandica*	Mandibula, dx.	4425 ±65	-16.5	Ua-3542
Grave 29	Harp seal	*Phoca groenlandica*	Temporale, dx.	4505 ±70	-17.3	Ua-10431
Grave 19	Harp seal	*Phoca groenlandica*	Temporale, dx.	4730 ±75 ?	-16.3	Ua-17276
Grave 41	Seal	*Phocidae*	Dens C.	4460 ±75	-16.0	Ua-17278
Grave 2	Grey seal	*Halichoerus grypus*	Dens C.	4450 ±65	-15.1	Ua-10428
Grave 2	Hedgehog	*Erinaceus europaeus*	Mandibula, sin.	4150 ±65	-21.4	Ua-10429
Grave 41	Hedgehog	*Erinaceus europaeus*	Mandibula, sin.	4210 ±65	-21.0	Ua-17280
Grave 41	Pig	*Sus scrofa/Castor*	Dens C.	4285 ±80	-21.0	Ua-17279
Grave 29	Pig	*Sus scrofa*	Dens C.	4195 ±70	-22.1	Ua-10430

Table 9d. Neolithic AMS radiocarbon-dated animal bone and tooth samples from "Grottan" at Överstekvarn II, Lummelunda parish. (The apparent difference between the seal and cattle dates – 280 years – may to a large extent be due to the reservoir effect, and hence they are probably roughly contemporaneous in true age.)

Level	Species		Skeletal element	14C years BP	d13C ‰ vs. PDB	Lab. no.
9-6	Harp seal	*Phoca groenlandica*	Temporale, sin.	4980 ±65	-17.8	Ua-3543
9-6	Cattle	*Bos taurus*	Metacarpus	4700 ±80	-20.5	Ua-2658

Table 9e. Neolithic AMS radiocarbon-dated animal bone and tooth samples from the cave of Stora Förvar on the island of Stora Karlsö, Eksta parish. (There are a couple of apparently earlier marine animal dates from G.7 which may be contemporaneous with the Early Neolithic domestic animal dates. If so, the calculated reservoir effect was c. 210 (135-290) years during the Early Neolithic.)

Level	Species		Skeletal element	14C years BP	d13C ‰ vs. PDB	Lab. no.
G.5	Grey seal	*Halichoerus grypus*	Mandibula, dx.	4410 ±75	-14.6	Ua-2945
G.4	Grey seal	*Halichoerus grypus*	Temporale, sin.	4240 ±70	-15.5	Ua-17179
G.7	Ringed seal	*Phoca hispida*	Mandibula, dx.	4460 ±80	-16.4	Ua-2939
G.6	Ringed seal	*Phoca hispida*	Mandibula, dx.	4115 ±75	-18.0	Ua-17178
G.6	Harp seal	*Phoca groenlandica*	Mandibula, dx.	4575 ±95	-16.2	Ua-2942
G.5	Harp seal	*Phoca groenlandica*	Mandibula, sin.	4120 ±65	-17.0	Ua-17187
G.4	Harp seal	*Phoca groenlandica*	Mandibula, sin.	4165 ±70	-16.0	Ua-17176
G.7	Harp seal	*Phoca groenlandica*	Mandibula, sin.	5205 ±85	-18.0	Ua-17174
G.7	Porpoise	*Phocoena phocoena*	Vertebra	5225 ±60	-15.9	Ua-3246
G.7	Sheep	*Ovis aries*	Ulna, sin.	5070 ±75	-21.9	Ua-4952
G.7	Cattle	*Bos taurus*	Radius, sin.	4935 ±75	-21.3	Ua-3248
G.7	Pig	*Sus scrofa*	Tibia, sin.	4800 ±60	-20.8	Ua-3247
G.10	Pig	*Sus scrofa*	Costa II, dx.	4325 ±85	-21.7	Ua-4950
G.8	Pig	*Sus scrofa*	Nasale, sin.	4095 ±85	-20.5	Ua-2934

Skeletal element	No. of frags, NISp.
Vomer	1
Premaxillare	3
Maxillare	4
Operculum	1
Branchiostegale	3
Cleithrum (of pike)	1
Postcleithrum	1
Parasphenoid	3
Vertebra atlas/cervicale	11
Vertebra precaudale	8
Vertebra caudale	10
Ve. fr.	11
Costa fr.	1
Pisces indet.	2
Sum	60

Table 9f (left). Number of bone fragments/specimens (NISp.) of fish (*Pisces*), mainly of cod (*Gadus morhua*) – one bone from Rojrhage is of pike (*Esox lucius*).

Table 9g (right). Approximate age, length and catching season for cod (*Gadus morhua*) based on vertebrae from Rojrhage.

Vertebra	Age (yrs)	L (cm)	Summer	L. sum. / E. aut.	Autumn	L. aut.
1	3	66		1		
2	4	83		1	1	?
3	3-	45		1	1	
4	-4	52		1		
5	5	-		1	1	
6	-4	-	1	?		
7	4	-		1	1	
8	3	-		1	1	
9	2	-		1	1	
10	4	70		1	1	?
11	3	54		1		
12	2-	48	1	?		
13	2	65		1	1	?
14	3	-		1		
15	2	-				
Sum			2	12	8	?

9.3 Animal husbandry

During the Mesolithic all larger terrestrial game species were absent from Gotland due to zoogeographical isolation. For example, aurochs, wild boar and wild ovicaprids were absent, and thus had to be introduced by humans. This was accomplished through voyages by boat across the Littorina Sea, possibly also involving cargoes of leaf and hay fodder and cereals. Pollen of grazing indicators such as narrow-leafed plantain (*Plantago lanceolata*) and later also cereal pollen have been identified in lakebed cores of the early Subboreal period from main Gotland and Stora Karlsö.

All the important domestic species are represented in the Rojrhage material: cattle (*Bos taurus*), pig (*Sus scrofa*) and sheep (*Ovis aries*) or goat (*Capra hircus*). Of these, cattle and ovicaprids are markedly more abundant than pigs, which seems to be typical for the Early Neolithic Funnel Beaker culture subsistence economy, whereas pig dominates in the Middle Neolithic Pitted Ware culture subsistence. This is an Early Neolithic pattern already registered at other habitation sites on Gotland. At least this is the case in levels 9-6 at "Grottan", Överstekvarn II in Lummelunda parish and in levels G.8-7 in the cave of Stora Förvar on the Island of Stora Karlsö, and probably at Stora Domerarve II, Hablingbo parish. While the date of the domestic animal bones from G.7 in the cave of Stora Förvar is 4030–3581 cal BC and that of the cattle bone from "Grottan" at Överstekvarn II is 3647-3149 cal BC, that is, clearly Early Neolithic dates; the date of the cattle bone from Stora Mafrids is 2923-2790 cal BC and that of the Rojrhage domestic animal bones is 3349-2707 cal BC, clearly Middle Neolithic dates, although earlier than most dates from Pitted Ware Culture sites (table 9h).

Table 9h. Early dates for domestic animal bones from Gotland.

Site	Species	Radiocarbon age BP	Age cal BC 1 s	Age cal BC 2 s
Stora Förvar G.7	Sheep	5070 ±75	3964-3779	4030-3698
Stora Förvar G.7	Cattle	4935 ±75	3788-3647	3941-3541
Stora Förvar G.7	Pig	4800 ±60	3647-3581	3699-3378
"Grottan" 8-6	Cattle	4700 ±80	3626-3363	3647-3149
Stora Mafrids	Cattle	4295 ±35	2916-2885	2923-2790
Rojrhage	Pig	4435 ±70	3301-2922	3349-2900
Rojrhage	Cattle	4325 ±70	3022-2885	3094-2707
Stora Domerarve II	Charcoal	4750 ±140	3663-3360	3891-3097
Stora Domerarve II	Charcoal	4425 ±135	3343-2897	3502-2695

Table 9i. Periodical subdivision of the Neolithic on Gotland, with faunal changes seen in the bones finds from habitation sites. Impressionistic abundance scale 1-5.

Period	Levels at Stora Förvar	Pottery style	Seals	Porpoise	Fish (cod)	Sheep	Cattle	Pig	Horse	Dog
Late Mesolithic		-	5	4	5	-	-	-	-	-
E.N.		Funnel Beaker	2	1	3	3	4	1	-	-?
Early M.N.	G.6, G.7, (G8?)	Funnel Beaker / Sät.-Fag. II	3	1	3	2	3	3	-	-?
Middle M.N.	G.6, G.7, (G8?)	Sät.-Fag. III / Hemmor-Gullrum	4	1	4	-	-?	4	-	2
Late M.N.	G.5, G.6	Sät.-Fag. IVa / Visby	4	1	4	1	1	3	-	2
Late M.N. / early L.N.	G.4, G.5	Sät.-Fag. IVb / V / Ire-Västerbjers	4	1	4	1	1	3	1	2
L.N.	G.4	Gallery grave	1	-	1	3	2	1	2	1
Bronze Age	G.4	Bronze Age	-	-	-	4	2	1	3	1

The cattle dates from Stora Mafrids and Rojrhage are unusually late ones for the Early Neolithic-Early Middle Neolithic period, since cattle bones are entirely lacking at most middle Middle Neolithic/Pitted Ware "Hemmor-Gullrum/Säter III" cultural layers, e.g. at Ajvide D upper (Lindqvist & Possnert 1997a; Storå 1997 & 2001). I, Christian Lindqvist, divide the Middle Neolithic of Gotland into at least three parts: early MN (=late Funnel Beaker, with cattle, sheep and pig, as during the EN), middle MN (=Hemmor-Gullrum/Säter III, with pig and dog, but cattle and sheep are lacking!) and late MN (=Visby-Ire-Västerbjers/Säter IV-V or IVa-IVb, with pig, dog, a few cattle and sheep and rare horse; see Lindqvist 1997c, Lindqvist & Possnert 1997a). (Table 9i.)

The fact that bones of domestic animals are more abundant at Rojrhage than those of seal and fish is of great interest. At "Grottan", Överstekvarn II the domestic animal bones are more abundant than the seal bones, although many fish bones were found at the site. It is probable that the subsistence economy at the inland habitation sites, such as Ardags in Ekeby parish, Gräne and Mölner in Väte parish, was entirely based on animal husbandry. Unfortunately, no Early Neolithic radiocarbon dates exist from these localities.

Table 9j. Measurements of teeth of cattle (*Bos taurus*) from Gotland, with comparative material. *After During 1986:94 tab. 34. "St. Förvar*" includes all levels, including IA/Medieval!

Site	Tooth	Length (mm)	Width (mm)	Period
Rojrhage F.2	M.2?	27.2	21.4	EN, MN
Rojrhage F.1-2	M. sup.	26.8	23.6	EN, MN
Rojrhage F.1-2	P. sup.	19.2	20.8	EN, MN
"Grottan", Överstekvarn II	M.1	25.0; 30.2	20.2; 18.0	EN
"Grottan"	M.2	26.7	22.4; 18.0	EN
"Grottan"	M.3 inf.	32.7	12.2	EN
Stora Förvar*	M.3	27.0-29.0	15.0-20.0	N
Alvastra pile dwelling*	M.3	28.0-35.0	(20.0-22.3)	EN-early MN
Aurochs, female*	M.3 inf.	45.5	19.0	

Several of the measurable bones and teeth of cattle and pig from Rojrhage correspond in size to finds from other Early and Middle Neolithic habitation sites on Gotland and elsewhere in Scandinavia. Hence, it is fairly unlikely that any large portion of the unburnt bones and teeth of these species found at Rojrhage should derive from the late Iron Age cemetery on top of the Neolithic deposits. The cattle and pigs of the Iron Age were generally far smaller than their Neolithic forebears.

9.3.1 Cattle (*Bos taurus*)

While the unfortunately extinct "Gotland cow" or "Småland cow" breed that existed on Gotland until the late 19th century was small (height at withers: 112 cm, weight: 350 kg; Hallander 1989:138-149, 140, 144, fig. 69-70, 192/193 pl. 11), Early Neolithic cattle was rather large judging from bone measurements. According to the distal width of a *tibia* and *metacarpus* from Rojrhage, and the length of a *calcaneus* and distal width of a *metacarpus* from "Grottan" at Överstekvarn II, these cattle from Gotland seem to have occupied the same size interval as the cattle from the Alvastra pile-dwelling in Östergötland on the mainland, as well as those from Troldebjerg and Bundsø in Denmark, all of which had a height at the withers of 113-139 cm. They were, however, clearly smaller than the aurochs, the female of which according to reference skeletons reached a height at the withers of 146-147 cm (according to Johannes Lepiksaar c. 150 cm), while the male reached nearly 200 cm. This can be compared to the skeleton of a "dwarf ox" (Sernander 1898:334-335) found in a bog at Dammen, Fröjel parish, which has been interpreted as an aboriginal wild dwarf ox subspecies on Gotland (Österholm 1989). However, its bone measurements correspond to a height at the withers of 90-101 cm, that is, even smaller than the Gotland cow of recent centuries. Due to binding, stalling and insufficient fodder during the long winters, Swedish Medieval cows sometimes grew, as for example at Lödöse in western Sweden, no larger than 100 cm in withers height (Lepiksaar 1977:83, 90). Hence, it appears – when compared to

Table 9k. Measurements of bones of cattle (*Bos taurus*) from Gotland, with comparisons (and approximate height-at-withers calculations).
*After During 1986:101 tab. 43.
"St. Förvar*" includes all levels, including IA/Medieval!
#Height at withers after M.c. and M.t.: Matolcsi 1970/71:113; von den Driesch & Boessneck 1974:336 tab. 4; Sjøvold Ms. 1986; During 1986:105 tab. 47.

Site	Skeletal element	Width (mm)	Length (mm)	Approx. height at withers (cm)	Period
"Grottan", Överstekv. II	Ve. Atlas	>124.2	80.5		EN
Dammen	Ve. Atlas	109			Medieval?
Stora Förvar G.7	Humerus	65.3	-		EN-MN I
Stora Förvar G.7	Radius	80.8	-		EN-MN I
Dammen	Radius		235	101	Medieval?
Dammen	Femur		280	90	Medieval?
Rojrhage G.1	Tibia, dist.	67.5	-		EN, MN
Stora Förvar*	Tibia, dist.	55.0-59.0	-		N
Alvastra pålb.*	Tibia, dist.	55.8-68.0			EN-early MN
Bundsø*	Tibia, dist.	57.0-70.0			MN
Rojrhage	Carpi ulnare	?37.3	?24.4		EN, MN
Kudruküla	Carpi ulnare	45.5	44.6		Narva pottery
Rojrhage G.2	Centrotarsale?	55.9	57.8		EN, MN
Alvastra pile dw.*	C.t.	47.8-55.8			EN-early MN
Aurochs, female*	C.t.	65.0			
Stora Förvar G.7	Talus	40.8	62.7		EN-MN I
Stora Förvar*	Talus	32.0-42.0	53.0-65.0		
Alvastra pile dw.*	Talus	41.3-50.9	61.8-76.5		EN-early MN
Bundsø*	Talus		60.0-74.0		MN
"Grottan", Överstekv. II	Calcaneus/m?	43.5	130.4		EN
Dammen	Calcaneus		110		Medieval?
Stora Förvar*	Calcaneus	31.0-41.0	111.0-145.0		N
Alvastra pile dw.*	Calcaneus	(27.7-38.5)	126.5-134.7		EN-early MN
Aurochs, female*	Calcaneus	51.0	162.0		
Rojrhage G.1	Metacarpus III+IV	58.3	-		EN, MN
"Grottan", Överstekv. II	M.c.	55.0	-		EN
Dammen	M.c.	45	167	101	Medieval?
Stora Förvar*	M.c.	50.0-65.0	168.0	84.7-106.3#	N (EN-IA)
Alvastra pile dw.*	M.c.	54.2-67.1	196.5-219.0	114.6-138.6#	EN-early MN
Troldebjerg*	M.c.	53.0-73.0	192.0-214.0	113.3-135.5#	Early. MN
Bundsø*	M.c.	56.8-71.0	196.0-204.0	114.1-129.1#	MN
Aurochs, female*	M.c.	68.5	238.0	143.5-145.3#	
Stora Förvar*	Metatarsus III+IV	43.0 (juv.)	171.0 (juv.)	77.0-96.1 (juv.)#	N
Alvastra pile dw.*	M.t.	47.8-67.0	248.0-250.0	129.8-140.5#	EN-early MN
Bundsø*	M.t.	51.0-64.0	224.0-237.0	113.4-133.2#	MN
Aurochs, female*	M.t.	65.5	273.0	145.5-147.0#	
"Grottan", Överstekv. II	Phalanx 1	27.0	59.0		EN
Dammen	Ph. 1		45.0		Medieval?
"Grottan"	Phalanx 2	25.0	39.0		EN
"Grottan"	Ph. 2	25.0	38.5		EN
"Grottan"	Ph. 2	25.1	38.1		EN
Dammen	Ph. 2		23.0		Medieval?
"Grottan"	Phalanx 3	52.0	69.5		EN
"Grottan"	Ph. 3	50.2	67.0		EN
"Grottan"	Ph. 3	50.0	66.6		EN

the large Early Neolithic cattle – probable that the "dwarf ox" from Dammen was in fact a starved Medieval cow.

The bone measurements, e.g. the distal *Metacarpus* width (45 mm) of the Dammen cow are comparable to the measurements of cattle bones from the period after AD 1200. Vretemark has shown that this measurement decreased from 50-53 mm to 47-50 mm about AD 1200 in the town of Skara, Västergötland; and from the interval 50-53 mm in the Viking Period (10th century) Birka material to 47-49 mm in the High Medieval material from Stockholm (Helgeandsholmen, after c. AD 1270). This is interpreted as a result of a decreasing grazing and meadow area and fodder per animal, when cereal agriculture intensified (Vretemark 1997).

The difference in size between the small Dammen cow, with a distal *Metacarpus* width of 45 mm, and the larger "Grottan" and Rojrhage specimens, 53 and 57 mm, is probably due both to the more favourable climate and less restricted grazing during the Stone Age and to the fact that the earlier cattle had been domesticated for a much shorter time. It is furthermore quite possible that Neolithic cattle, as well as pigs and sheep, was herded loose throughout most of the year (table 9j & 9k). Unfortunately, neither the Dammen nor the Libbenarve bones (see below) have been possible to locate for radiocarbon dating.

9.3.2 Pig (*Sus scrofa*)

All anatomic parts of the domestic animals from Rojrhage, including the pigs, are represented, which indicates that butchering has occurred at the site and that transportation of certain cuts to or from the site is unlikely. The pigs have been treated like the other domestic animals. Relatively many domestic animals have been slaughtered at an early age. Crushing of the long bones to gain access to the nutritious marrow, and further decay through trampling and other taphonomic processes have made the bones fragmented, eroded and porous, and hence – with a few exceptions – difficult to identify and measure. A 45.4 mm long *talus* of pig from Rojrhage indicates a height at the withers of c. 81 cm, which compares well with the maximum of 83-84 cm in the material from the cave of Stora Förvar, level G.7, and 81 cm in the Stora Mafrids material, although the pigs at Gullrum seem to have reached 89-90 cm. The earliest pigs on Gotland were large: they were probably recruited from the wild boar population on the Swedish mainland and apparently not from the smaller domestic pigs of Central Europe or Denmark. Neither were they recruited from the East Baltic area, where the wild boars were larger than the Swedish ones (Jonsson 1986). Scandinavian wild boars vary according to reference skeletons between 78 and 100 cm, living animals vary between 85 and 102 cm, maximum 110 cm (Brehm 1931:477, Siivonen 1968/76:126, Curry-Lindahl 1975/82:263).

A set of complete rear long bones of "wild boar" from the bog of Libbenarve myr, Havdhem parish (Sernander 1898:337), indicate a height at the withers of 84-93 cm, that is, the

Table 9l. Measurements of molar teeth of pig (*Sus scrofa*) from Gotland, with comparative material after During 1986:128 tab. 60. (Wild boar: 41-50 mm; domestic pig: 23-40 mm according to Clason 1967:63).

Site	Tooth	Length (mm)	Width (mm)	Note	Period
Rojrhage E.3	M.3 sup.? inf.	>36.7	17.1	Dom?	EN, MN
Alvastra pile-dw.*	M.3 sup.	36.1-42.5	19.0-22.5	Dom/wild	EN - early MN
Troldebjerg*	M.3 sup.	32.0-36.7		Dom	Early MN
Bundsø*	M.3 sup.	29.0-38.0	17.5-21.0	Dom	MN
Wild boar*	M.3 sup.	34.5-44.7	21.5-24.0	'Dom'/wild	

Table 9m. Measurements of tibiae of pig (*Sus scrofa*) from Gotland, with comparative material *after During 1986:130 tab. 62. "St. Förvar*" includes all levels, including IA/Medieval! (Distal width of wild boar: 37-43 mm; domestic pig: 24-35 mm according to Clason 1967:63).

Site	Skeletal element	Width (mm)	Note	Period
Stora Förvar G.7	Tibia, dist.	32.8	Dom	EN
Stora Förvar G.4	Tibia, dist.	29.5	Dom	LN-BA
Stora Förvar*	Tibia, dist.	34.0-36.0	Dom	N
Gullrum*	Tibia, dist.	27.0-37.0	Dom/wild	MN
Alvastra pile dw.*	Tibia, dist.	32.1-38.7	Dom/wild	EN-early MN
Bundsø*	Tibia, dist.	31.0-32.0	Dom	MN
Wild boar*	Tibia, dist.	33.0-42.0	'Dom'/wild	

Site	Skeletal element	Width (mm)	Length (mm)	Approx. height at withers (cm)	Note	Period
Stora Förvar G.7	Radius (juv.)		81.9	>43	Dom	EN-MN A
Stora Förvar G.6	Radius (juv.)		147 ?	>77?	Dom	MN A
Stora Förvar G.4	Radius		128.4	68	Dom	LN-BrA
Stora Förvar G.4	Radius		123.8	65	Dom	LN-BrA
Stora Förvar G.4	Radius		81.5	43	Dom	LN-BrA
Stora Förvar G.4	Radius		79.9	42	Dom	LN-BrA
Stora Förvar G.4	Radius		79	42	Dom	LN-BrA
Stora Förvar G.4	Radius		79	42	Dom	LN-BrA
Stora Förvar G.6	Ulna (juv.)		211 ?	>84	Wild?	MN A
Libbenarve myr	Femur		256	93	Wild?	N?
Libbenarve myr	Tibia		213	84	Wild?	N?
Stora Förvar G.7	Fibula (juv)		132.5	>56	Dom	EN-MN A
Rojrhage E.2	Talus	26.4	45.4	81	Wild?	EN-MN
Stora Mafrids	Talus, fr.	23.7	>45.3	>81	Wild?	EN-MN
Grottan, Överstekv. II	Talus	16.9; 18.5	35.3	63	Dom	BA?
Stora Förvar G.7	Talus		46.1	83	Wild?	EN-MN A
Stora Förvar G.7	Talus		43.7	78	Dom/wild	EN-MN A
Stora Förvar G.7	Talus		43.3	78	Dom/wild	EN-MN A
Stora Förvar G.7	Talus		39.6	71	Dom	EN-MN A
Stora Förvar G.6	Talus		36.5	65	Dom	MN A
Stora Förvar G.6	Talus		33.3	60	Dom	MN A
Stora Förvar G.4	Talus	21.3	43	77	Dom/wild	LN-BrA
Stora Förvar G.4	Talus	19.8	40.2	72	Dom	LN-BrA
Stora Förvar G.4	Talus	17.6	35.4	63	Dom	LN-BrA
Stora Förvar GH.3	Talus	16.3	31.3	56	Dom	IrA
Stora Förvar*	Talus		37.0-49.0	66.2-87.7#	Dom/wild	N
Gullrum*	Talus		42.5-50.0	(76.1-89.5)#	Dom/wild	MN
Alvastra pile dw.*	Talus		37.0-49.5	83.2-88.6#	Dom/wild	EN-MN A
Bundsø*	Talus		41.0-46.0	73.4-82.8#	Dom/wild	MN
Kudruküla	Talus	28.4; 30.4	52.7	94.3	Wild	Narva pottery
Wild boar*	Talus		43.7-56.0	(78.2-100.2)#	Wild	
Rojrhage Anl. A	Calcaneus (juv., fr.)	25	>67	>63	Dom	EN-MN
Stora Förvar G.7	Calcaneus/m? (ad.)		89.7	84	Wild?	EN-MN A
Stora Förvar G.6	Calcaneus (juv.)		77.6	>73	Dom	MN A
Stora Förvar G.6	Calcaneus (juv.)		65.8	>61	Dom	MN A
Stora Förvar G.6	Calcaneus (juv., fr.)		>65.6	>61	Dom	MN A
Stora Förvar G.5	Calcaneus (juv.)	26.7	85.5	>80	Dom/wild?	MN B
Stora Förvar G.5	Calcaneus (juv.)	24.7	79.5	>74	Dom	MN B
Stora Förvar G.5	Calcaneus (juv.)	25.6	79.3	>74	Dom	MN B
Stora Förvar G.5	Calcaneus (juv.)	24.6	71.7	>67	Dom	MN B
Stora Förvar G.5	Calcaneus (juv.)	22.2	67	>63	Dom	MN B
Stora Förvar G.5	Calcaneus (juv.)	19.6	>66.5	>62	Dom	MN B
Stora Förvar G.5	Calcaneus (juv.)	20.2	64.5	>60	Dom	MN B
Stora Förvar G.5	Calcaneus (juv.)	22.2	>64.2	>60	Dom	MN B
Stora Förvar G.5	Calcaneus (juv.)	26.5	80.9	>76	Dom	MN B
Stora Förvar G.5	Calcaneus (juv.)	22.5	69.5	>65	Dom	MN B
Stora Förvar G.5	Calcaneus (juv.)	21	62.8	>59	Dom	MN B
Stora Förvar G.5	Calcaneus (juv.)	19	56.7	>53	Dom	MN B
Stora Förvar G.5	Calcaneus (juv., fr.)	>25.4	>72.8	>68	Dom	MN B
Stora Förvar G.4	Calcaneus (juv.)	23.7	71.6	>67	Dom	LN-BrA
Stora Förvar G.4	Calcaneus (juv.)	18.5	60	>56	Dom	LN-BrA
Kudruküla	Calcaneus/m? (juv.)	29.1	87.8	>82.0	Wild	Narva pottery
Stora Förvar G.6	Metacarpus III		81.6			MN A
Stora Förvar G.4	M.c. III	9.2	57.1			LN-BrA
Stora Förvar G.6	Metacarpus IV		84.1			MN A
Stora Förvar G.7	Metatarsus III		82.3	76.9	Dom	EN-MN I
Libbenarve myr	Metatarsus		100		Wild?	N?
Stora Förvar G.6	M.t. III		91.3	85.3	Wild	MN A
Stora Förvar G.4	M.t. III (juv.)		45.3	>42.3	Dom?	LN-BrA
Stora Förvar*	M.t. III		89	83.1-89.4#	Dom/wild	N
Alvastra pile dw.*	M.t. III		95	88.7-93.9#	Wild	EN-MN A
Stora Förvar G.6	Metatarsus IV		98.3	86.9	Wild	MN A
Stora Förvar G.5	M.t. IV		70.7	62.5	Dom	MN B
Stora Förvar*	M.t. IV		94.0-99.0	83.1-91.2#	Dom/wild	N
Alvastra pile dw.*	M.t. IV		71.5-107.0	63.2-96.5#	Dom/wild	EN-MN A

Tables 9n:1 & 9n:2. Approximate calculations of withers height based on long extremity bones of pig (*Sus scrofa*) from Neolitic habitation sites on Gotland, with comparative material.
*after During 1986:131 tab. 63.
"St. Förvar*" includes all levels, including IA/Medieval!
#Height at withers according to Talus and M.t. III & IV after Teichert 1969 tab. 7; von den Driesch & Boessneck 1974:341 tab. 9; Sjøvold Ms. 1986; During 1986:133 tab. 66.

Site	Skeletal element	Width (mm)	Length (mm)	Period
Stora Förvar G.6	Phalanx 1, III-IV?	10.6	27.5	MN A
Stora Förvar G.6	Ph. 1, post.	17.4	45.6	MN A
Stora Förvar G.6	Ph. 1	17.1	46.2	MN A
Stora Förvar G.6	Ph. 1	17	43.5	MN A
Stora Förvar G.5	Ph. 1 (ad.)	17	45.8	MN B
Stora Förvar G.5	Ph. 1 (ad.)	18.2	41	MN B
Stora Förvar G.5	Ph. 1 (juv.)	16.2	37.7	MN B
Stora Förvar G.5	Ph. 1 (ad.)	-	41.2	MN B
Stora Förvar G.5	Ph. 1 (juv.)	-	37.1	MN B
Stora Förvar G.5	Ph. 1	18.2	35.4	MN B
Stora Förvar G.5	Ph. 1	10.6	27.5	MN B
Stora Förvar G.4	Ph. 1 (ad.?)	16.2	38.5	LN-BrA
Stora Förvar G.4	Ph. 1 (juv.)	13.3	27.8	LN-BrA
Stora Förvar*	Ph. 1		37.0-43.0	
Gullrum*	Ph. 1		38.0-45.0	MN
Alvastra pile dw.*	Ph. 1		33.0-58.2	EN-MN A
Rojrhage Anl. A	Phalanx 2, III-IV	21.1	26.9	EN-MN
Stora Förvar G.7	Phalanx 2		26.9	EN-MN A
Stora Förvar G.6	Ph. 2, anter.	16.9	26.8	MN A
Stora Förvar G.6	Ph. 2, post.	16	30.5	MN A
Stora Förvar G.5	Ph. 2	15.4	25.9	MN B
Stora Förvar G.4	Ph. 2	13.3	27.8	LN-BrA
Stora Förvar*	Ph. 2		22.0-27.0	
Gullrum*	Ph. 2		22.0-29.0	MN
Alvastra pile dw. *	Ph. 2		26.8-29.0	EN-MN A
Rojrhage Anl. A	Phalanx 3, III-IV	14.5	30.3	EN-MN
Stora Förvar G.7	Phalanx 3		31.9	EN-MN A
Stora Förvar G.5	Ph. 3		34.1	MN B
Stora Förvar G.5	Ph. 3		35.3	MN B
Stora Förvar G.5	Ph. 3		31.7	MN B
Stora Förvar G.5	Ph. 3		33.6	MN B
Gullrum*	Ph. 3		28.0-33.0	MN
Stora Förvar*	Ph. 3		31.0-33.0	
Alvastra pile dw.*	Ph. 3		31.8-37.5	EN-MN A

Table 9o. The Neolithic faunal remains from Rojrhage 1:1, osteological analysis by C. Lindqvist 1999.

Species		Frags	Comments
Mammals, unidentified	*Mammalia indet.*	2313	Fragments probably mostly representing domestic animals, i.e. excluding seal bones.
Human	*Homo sapiens*	13	
Seals	*Phocidae indet.*	107	Excluding bones identified as to seal species.
Grey seal	*Halichoerus grypus*	7	
Ringed seal	*Pusa hispida*	13	
Harp seal	*Phoca groenlandica*	2	
		129	Total seal bones.
Fox?	*Vulpes vulpes?*	3?	
Cattle	*Bos taurus*	101	
Pig	*Sus scrofa*	35	
Sheep or goat	*Ovis aries sive Capra hircus*	82	
		218	Total domestic animal bones.
Birds, unident.	*Aves indet.*	29	Total bird bones.
Goosander	*Mergus merganser*		
Fish	*Pisces indet.*	57	Total fish bones.
Cod	*Gadus morhua*	(>50)	
Pike	*Esox lucius*	(1)	

same size as the pigs of the Neolithic, e.g. from Gullrum (table 9l, 9m & 9n). Perhaps this bog find indicates that Neolithic pigs were herded loose in the in the same way as on the Mediterranean Islands (Lewthwaite 1984, Lindqvist & Possnert 1997a:66 with refs.) and in Spain, Hungary and Russia (Brehm 1931:487-488, 490) in recent centuries, as was the forest pig ("acorn pig") in Sweden and Norway (Brehm 1931:494, Lepiksaar 1977:91) into the 19th century and later.

9.3.3 Dog/fox (*Canis sp.*)

Dogs (*Canis familiaris*), which judging from bone finds seem to have been large, may have been introduced on Gotland to serve as sheepdogs or watchdogs during the Neolithic. Foxes (*Vulpes vulpes*), which judging from bone finds seem to have been small, had already lived for two millennia on Gotland at the introduction of agriculture. Of these canid species only traces have been found at Rojrhage. A couple of bone fragments (a *Phalanx 1, V, sin.*, a *Scapula* fragment and a *Fibula?* fragment) may derive from a very small dog or, more probably, a fox. As both species have also been identified in the Iron Age materials, these bones may be intrusive.

Table 9p. Species list based on the osteological material (no. of fragments, NISp.) from Rojrhage, Grötlingbo parish, Gotland. Of birds, goosander (*Mergus merganser*) has been identified among the bones from the Iron Age graves (Molnar 1998).

	Species		No. fr., NISp.
1	Human	*Homo sapiens*	13
2	Cattle	*Bos taurus*	102
3	Sheep or goat	*Ovis aries, poss. Capra hircus*	79
4	Pig	*Sus scrofa*	34
5	Dog	*Canis familiaris*	1?
6	Red fox	*Vulpes vulpes*	2?
7	Grey seal	*Halichoerus grypus*	7
8	Ringed seal	*Pusa hispida*	13
9	Harp seal	*Phoca groenlandica*	3
	Indet. seal	*Phocidae indet.*	107
11	Goosander	*Mergus merganser*	
	Indet. bird	*Aves indet.*	29
12	Cod	*Gadus morhua*	57-
13	Pike	*Esox lucius*	1

10. Intra-site find distributions

All three main find categories – pottery, flint and bones – display the same general distribution across the excavated area (tables 10a-c). The main concentration forms an arc from squares I0 and H0 via E2 and E3 to G6 and H6. This distribution avoids only one of the Iron Age graves, the abovementioned mound, and should thus have some significance for the interpretation of the Neolithic finds.

As mentioned previously, the TRB and GRK pottery mix across the area, but the STR pottery is focused near the middle of the arc. Neither the GRK pottery nor the flint finds exhibit typological variation within the distribution. Given

the homogeneity of the artefacts' distribution, it is rather surprising to find significant variation among the bones of the identified animal species. Cattle and sheep bones concentrated at the 0-end, while bones of pig and seal were evenly distributed across it. The interpretation of such a distribution in a multi-component deposit formed by the refuse of centuries and then badly damaged by later features can, of course, only be a matter of speculation.

Table 9q. Summary of the osteological material (number of fragments, NISp.) from Rojrhage 1:1.

Context	*Homo*	*Bos*	*Ovis/ Capra*	*Sus*	*Canis/ Vulpes*	*Halich-oerus*	*Pusa*	*Phoca groenl.*	*Phoci-dae*	*Mamm. Indet.*	*Av-es*	*Pisc-es*
C.4	1?	-	5	-	-				-	131	-	-
C.5	-	-	-	-	-				-	14	-	-
D.3-4	-	-	-	-	-				-	-	-	2
D.22	-	-	-	-	-				-	2	-	-
E.2 a	-	-	1	1	-				2	8	-	-
E.2 b	-	-	2	-	-				1	137	-	-
E.3	-	2	-	3*	1?				19	193	3	26*
E.4	1?	-	-	-	2?		1		2	38	1	1
F.1	1	-	1*	1	-				6	115	-	-
F.1-2	-	6	1	3?	-				2?	67	-	-
F.2	-	2	5*	-	-				2	19	-	5
F.4	3?	1	-	3	-	1*		1*	12	100	1	2
F.5	-	1	1	2	-		1		-	41	-	-
F.6	-	1	-	-	-				-	-	-	-
G.1	-	32*	5*	-	-	1*	3?	-	14?	198	-	10*
G.2	-	3	1	-	-				-	10	-	-
G.3-4	-	2	-	-	-				-	20	-	-
G.4	-	-	-	-	-		3*		4	12	-	-
G.5	-	3?	1	2	-		1		7	48	-	-
G.6	-	1	-	-	-			1	2	13	-	-
G.7	-	-	-	-	-		1		2?	23	-	-
H.0 I.0	-	2?	3	-	-				4	72	1	-
H.0	4?	-	6	-	-	2			1?	48	1	-
H.1	-	3	3	-	-	1*			-	42	-	-
H.5	-	-	-	-	-				-	31	-	-
H.6	-	-	-	-	-				-	4	-	-
I.0	-	9?	-	4	-		1		6	53	-	-
Feat. A	-	-	1?	5	-		1		6	53	6	6
Feat. B	-	1?	8	-	-	1			3	159	5	1
Feat. C	-	1?	-	1?	-				-	38	2	1
Feat. D	-	-	-	-	-				-	186	-	-
SA hearth 1	-	-	5	-	-				-	299	-	-
Stray	3	32	33	10?	-?	1?	1?	-	12	139	9	3

Table 10a. Distribution of Neolithic pottery (grammes) from Neolithic contexts at Rojrhage. The numbers in tables 10a-c have been adjusted proportionally upwards for find-yielding squares along the edges of the trench that were not excavated in their entirety.

	0	1	2	3	4	5	6	7
C	-	-	-	0	33	29	-	-
D	-	0	2	21	21	0	-	-
E	-	109	189	302	103	0	0	0
F	-	444	361	30	319	79	0	0
G	-	602	28	0	82	73	115	0
H	282	7	0	0	0	9	3	0
I	159	0	0	0	0	0	-	-

Table 10b. Distribution of flint (fragments) from Neolithic contexts at Rojrhage.

	0	1	2	3	4	5	6	7
C	-	-	-	0	8	26	-	-
D	-	0	0	1	1	0	-	-
E	-	1	15	16	6	0	0	0
F	-	8	4	0	27	6	7	0
G	-	7	3	3	3	11	10	1
H	11	2	0	0	0	5	1	0
I	0	0	0	0	0	0	-	-

Table 10c. Distribution of bone (fragments) from Neolithic contexts at Rojrhage.

	0	1	2	3	4	5	6	7
C	-	-	-	0	137	40	-	-
D	-	0	2	1	1	0	-	-
E	-	35	178	247	46	0	0	0
F	-	363	99	0	124	46	1	0
G	-	304	61	11	30	62	17	39
H	191	96	47	0	4	31	304	0
I	114	0	0	0	0	0	-	-

11. Phasing, site function and cultural interpretation

As shown by the artefact studies and radiocarbon dates, the Rojrhage deposit exhibits three temporally separate Neolithic components. The first one dates from the late EN I and includes only a small amount of TRB pottery. No radiocarbon dates of this period have resulted from the dating programme. The second component dates from the late MN A and includes a great deal of GRK pottery, flint debitage, a bone harpoon point and bones of pig, cattle, harp seal, ringed seal and grey seal. The third component dates from the early LN and includes a small amount of STR pottery and bones of grey seal. The LN date for a grey seal bone is compromised by the fact that the $\delta^{13}C$ value of the sample (Ua-16502) indicates a terrestric diet for the animal. A greenstone axe belongs either to the MN or the LN component.

Rojrhage breaks the pattern of Österholm's settlement model (1989:173-180) at two points. Firstly, in the Barshalder area coastal activities continued through the EN at Rojrhage and possibly also at the parish gravel pit 270 m to the NNE. This is evidence, not very surprisingly, of a sustained maritime component also in the EN economy of Gotland (as in the Lake Mälaren area, Segerberg 1999: 198-199). Secondly, the model of generally a single GRK site in each settlement cluster (Gullrum in the case of Hablingbo-Näs-Grötlingbo) is contradicted by the GRK sites of Rojrhage and Kattlunds (Raä 55) in Grötlingbo, none of which has been delimited spatially but which seem rather small. The second point is foreshadowed by Österholm's observations of multiple GRK sites in När-Lau, Visby and Ire-Lickershamn (1989:174, 176, 177).

Source quality at Rojrhage permits few detailed conclusions about the cultural behaviour leading to the formation of the Neolithic deposit. The simplest interpretation seems to be that the deposit formed from refuse dumped during several episodes of inhabitation through centuries. The inhabitants used and broke pottery, made simple flint tools and procured and consumed the meat of wild and tame animals. Chance preservation leaves us a single harpoon point as the only artefactual evidence of their economy, while the ecofactual evidence of the bones and the coastal location speak more eloquently.

12. References

Åhlén, Marianne. 1972. *Stenåldersboplatsen på Ardags i Ekeby, Gotland.* BA thesis. Department of Archaeology, University of Stockholm.

Åkerlund, Agneta; Bergh, Stefan; Nordbladh, Jarl & Taffinder, Jacqueline (eds). 1997. *Till Gunborg. Arkeologiska samtal.* Stockholm Archaeological Reports 33. Museum of National Antiquities & Department of Archaeology, University of Stockholm.

Andersson, Torgny. 2000. *Eke sockens förhistoria.* Eke. [150 pp]

Bägerfeldt, Lars. 1992. *En studie av neolitikum på Gotland. Problem och konsekvenser, utifrån undersökningen av en dös och neolitiska lösfynd.* Gamleby.

Bagge, Axel & Kjellmark, Knut. 1939. *Stenåldersboplatserna vid Siretorp i Blekinge.* KVHAA Monografier 26. Stockholm.

Becker, Carl Johan. 1947. Mosefundne lerkar fra yngre stenalder. *Aarbøger for nordisk oldkyndighed og historie 1947.* Copenhagen.

Becker, Carl Johan. 1990. *Nørre Sandegård. Arkæologiske undersøgelser på Bornholm 1948-1952.* Historisk-filosofiske skrifter 13. The Royal Danish Academy of Science and Letters. Copenhagen.

Brehm, Alfred Edmund. 1931. Apor, halvapor, uddatåiga och icke idisslande hovdjur. *Djurens liv,* band 1. Malmö.

Burenhult, Göran (ed.). 1997a. *Remote sensing. Applied techniques for the study of cultural resources and the localization, identification and documentation of sub-surface prehistoric remains in Swedish archaeology. Vol. 1. Osteo-anthropological, economic, environmental and technical analyses.* Theses and papers in North-European archaeology 13a. Department of Archaeology, University of Stockholm.

Burenhult, Göran. 1997b. Introduction. In Burenhult 1997a.

Burenhult, Göran (ed.). 1997c. *Ajvide och den moderna arkeologin.* Stockholm.

Burenhult, Göran (ed.). 2002. *Remote sensing. Applied techniques for the study of cultural resources and the localization, identification and documentation of sub-surface prehistoric remains in Swedish archaeology. Vol. II. Archaeological investigations, remote sensing case studies and osteo-anthropological studies.* Theses and papers in North-European archaeology 13b. Department of Archaeology, University of Stockholm.

Curry-Lindahl, Kai. 1975/82. *Däggdjur i färg – alla Europas arter.* Färgserien. Stockholm.

von den Driesch, A. & Boessneck, J. 1974. Kritische Anmerkungen zur Widerristhöhenberechnung aus Längen-massen vor- und frühgeschichtlicher Tierknochen. *Säugetierkundliche Mitteilungen* 22. München. [26 pp]

During, Ebba. 1986. *The fauna of Alvastra. An osteological analysis of animal bones from a Neolithic pile dwelling.* Ossa 12, suppl. 1. Osteological Research Laboratory, University of Stockholm. Solna.

Edenmo, Roger; Larsson, Mats; Nordqvist, Bengt & Olsson, Eva. 1997. Gropkeramikerna – fanns de? In Larsson & Olsson 1997.

Falck, Waldemar. 1971. *Ang. undersökning av golv vid Kattlunds, Grötlingbo.* Report dated 1971-12-20 at ATA (dnr 321-1907-2000), Stockholm, with a copy in the archives of Gotlands Fornsal county museum, Visby.

Hallander, Håkan. 1989. *Svenska lantraser – deras betydelse förr och nu.* Veberöd.

Hansson, Hans. 1900. En stenåldersboplats på Gotland. *Svenska Fornminnesföreningens Tidskrift* X. Stockholm.

Hansson, Harald. 1927. Excavation report dated 1927-09-27 at ATA (dnr 4043/1927), Stockholm.

Hedell, L. 1910. Benfynd från Hemmor, Gotland. Ms. at ATA.

Hedemark, Åse; Samuelsson, Christoffer & Ytterberg, Niklas. 2000. Stenåldersboplatsen vid Hemmor i ny belysning. *Gotländskt Arkiv* 72. Föreningen Gotlands fornvänner. Visby.

Holm, Jenny; Olsson, Eva & Weiler, Eva. 1997. Kontinuitet och förändring i senneolitikum. In Larsson & Olsson 1997.

Janzon, Gunborg O. 1974. *Gotlands mellanneolitiska gravar.* Studies in North-European archaeology 6. Department of Archaeology, University of Stockholm.

Jonsson, L. 1986. From wild boar to domestic pig – a reassessment of Neolithic swine of Northwestern Europe. Königsson, L.-K (ed.). *Nordic Late Quaternary Biology and Ecology.* Striae 24. Uppsala. [3 pp]

Jonsson, L. 1988. The Vertebrate Faunal Remains from the Late Atlantic Settlement Skateholm

in Scania, South Sweden. Larsson, L. (ed.). *The Skateholm Project I. Man and Environment. Interdisciplinary Studies.* Stockholm. [31 pp]

Kjellberg, A.-S. 1988. Osteologisk analys av djurbensmaterial från Stora Domerarve I-II. Ms.

Koch, Eva. 1998. *Neolithic bog pots from Zealand, Møn, Lolland and Falster.* Nordiske Fortidsminder B:16. Det Kongelige Nordiske Oldskriftselskab. Copenhagen.

KVHAA. 1974. *Kungl. Vitterhets Historie och Antikvitets Akademiens fastigheter av antikvarisk karaktär jämte övriga områden ställda under akademiens eller riksantikvarieämbetets förvaltning. Andra utökade upplagan.* Bilaga till KVHAA:s årsbok 1973. Stockholm.

Larsson, Mats. 1994. Lokale Gruppen des Frühneolithikums in Südschonen, Schweden. In Hoika, Jürgen (ed). *Beiträge zur frühneolithischen Trichterbecherkultur im westlichen Ostseegebiet. 1. Internationales Trichterbechersymposium in Schleswig vom 4. bis 7. März 1985.* Untersuchungen und Materialien zur Steinzeit in Schleswig-Holstein aus dem Archäologischen Landesmuseum der Christian-Albrechts-Universität 1. Neumünster.

Larsson, Mats. 1997. Skåne. In Kihlstedt, Britta; Larsson, Mats & Nordqvist, Bengt. Neolitiseringen i Syd-, Väst och Mellansverige – social och ideologisk förändring. In Larsson & Olsson 1997.

Larsson, Mats & Olsson, Eva (eds). 1997. *Regionalt och interregionalt. Stenåldersundersökningar i Syd- och Mellansverige.* Skrifter 23. Riksantikvarieämbetet, Arkeologiska undersökningar. Stockholm.

Lepiksaar, Johannes. 1977. Människan och husdjuren. *Fauna och flora, svensk faunistik och floristik* 72. Stiftelsen för svensk faunistik och floristik. Lund. [23 pp]

Lewthwaite, James. The art of Corse herding. Archaeological insights from recent pastoral practices on west Mediterranean islands. Clutton-Brock, Juliet & Grigson, Caroline (eds.). *Animals and archaeology 3. Early herders and their flocks.* BAR International Series 202. Oxford.

Lindgren, Christina & Nordqvist, Bengt. 1997. Lihultyxor och trindyxor. Om yxor av basiska bergarter i östra och västra Sverige under mesolitikum. In Larsson & Olsson 1997.

Lindqvist, Christian. 1997a. Betydelsen av ben- och tandfynd av rödräv, hund, svin och igelkott på Ajvide under gropkeramisk tid. In Burenhult 1997c. [3 pp]

Lindqvist, Christian. 1997b. Ansarve hage-dösen; Tvärvetenskapliga aspekter på kontext och den neolitiska förändringen på Gotland. In Åkerlund et al 1997. [18 pp]

Lindqvist, Christian. 1997c. About the importance of fine-mesh sieving, stratigraphical and spatial studies for the interpretation of the faunal remains from Ajvide, Eksta parish and other Stone Age dwelling sites on Gotland. In Burenhult 1997a. [21 pp]

Lindqvist, Christian & Possnert, Göran. 1997a. The subsistence economy and diet at Jakobs/Ajvide and Stora Förvar, Eksta Parish and other prehistoric dwelling and burial sites on Gotland in long-term perspective. In Burenhult 1997a. [62 pp]

Lindqvist, Christian & Possnert, Göran. 1997b. Om reservoareffektproblemet. In Burenhult 1997c.

Lindqvist, Christian & Possnert, Göran. 1999. The first seal hunter families on Gotland. On the Mesolithic occupation in the Stora Förvar Cave. *Current Swedish Archaeology* 7. The Swedish Archaeological Society. [23 pp]

Lindqvist, Christian & Possnert, Göran. subm. a. The Neolithic swine on Gotland: feral game or loosely herded forest pigs? *Journal of Osteoarchaeology.*

Lindqvist, Christian & Possnert, Göran. subm. b. Baltic stages, early marine adaptation and the Mesolithic-Neolithic transition on Gotland, based on bone $\delta^{13}C$ and AMS ^{14}C-data. *Journal of Archaeological Science.*

Lindqvist, Christian & Storå, Jan. 1997. Havet och sälarna. In Burenhult 1997c. [2 pp]

Malmer, Mats P. 1962. *Jungneolithische Studien.* Acta Archaeologica Lundensia, series in octavo 2. University of Lund.

Manneke, Peter. 1961. *Gotland, Grötlingbo, Suderkvie 1:14.* Report at ATA (dnr 1669/1963), Stockholm.

Matolcsi, J. 1970. Historische Erforschung der Körpergrösse des Rindes auf Grund vom ungarischen Knochen-material. *Zeitschrift für Tierzüchtung und Züchtungsbiologie* 87. Berlin. [49 pp]

Molnar, Petra. 1998. *Osteologisk analys av skelettmaterialen från Barshalder-gravfältet på Gotland. Delrapport II.* Ms. at ATA.

Munthe, Henrik Vilhelm. 1910. *Studier öfver Gottlands senkvartära historia.* Sveriges geologiska undersökning Ser. Ca, Avhandlingar och uppsatser 4. Stockholm.

Nihlén, John. 1927. *Gotlands stenåldersboplatser.* KVHAA Handlingar 36:3. Stockholm.

Olsson, Eva & Edenmo, Roger. 1997. Östra Mellansverige. In Edenmo et al. 1997.

Österholm, Inger. 1989. *Bosättningsmönstret på Gotland under stenåldern. En analys av fysisk miljö, ekonomi och social struktur.* Theses and papers in archaeology 3. Department of Archaeology, University of Stockholm.

Österholm, Inger. 1997. An analysis of the ceramics from the Ajvide site. [Augmented translation of Österholm 1989:97-117.] In Burenhult 1997a.

Österholm, Inger. 2002a (1986). The Jakobs/Ajvide site at Eksta, Gotland. In Burenhult 2002.

Österholm, Inger. 2002b (1986). The St. Domerarve site At Hablingbo. In Burenhult 2002.

Österholm, Inger. 2002c (1986). The pattern of Stone Age settlements on Gotland. In Burenhult 2002.

Petrén, Michael. 1992. *Neolitiska yxor från Gotland. Form och fördelning.* BA thesis. Department of Archaeology and Ancient History, University of Uppsala.

Possnert, Göran. 2002. Stable and radiometric carbon results from Ajvide. In Burenhult 2002.

Rundkvist, Martin. 1996a. Lägesrapport från Barshalder. *Aktuell Arkeologi V.* In Renck, Anna Maria & Stensköld, Eva (eds). Stockholm Archaeological Reports 30. Department of Archaeology, University of Stockholm.

Rundkvist, Martin. 1996b. *Go, Grötlingbo, Roes 1:36, intill Raä 54. Gårdssamling: trindyxeboplats mm.* Report dated 1996-11-25 at ATA (dnr 439-6516-1996), Stockholm, with a copy in the archives of Gotlands Fornsal county museum, Visby.

Rundkvist, Martin. 2001. *Go, Grötlingbo sn, Uddvide Samfällt + Roes 1:28 + Roes 1:31, Raä 45. Barshalder gravel pit. Rescue excavation of 27 Late Viking Period graves and a small Stone Age deposit by Gustaf Trotzig 1966.* Report dated 2001-11-21 at ATA (dnr 321-3341-2001), Stockholm, with a copy in the archives of Gotlands Fornsal county museum, Visby.

Rundkvist, Martin. 2002. *Go, Grötlingbo sn, Rojrhage 1:1, Raä 54. Barshalder cemetery. Rescue excavation of 41 Late Iron Age graves and extensive Neolithic deposits by Gustaf Trotzig 1963-1967.* Report dated 2001-11-22 at ATA (dnr 321-0612-2002), Stockholm, with a copy in the archives of Gotlands Fornsal county museum, Visby.

Rundkvist, Martin. 2003. *Barshalder 1. A cemetery in Grötlingbo and Fide parishes, Gotland, Sweden, c. AD 1-1100. Excavations and finds 1826-1971.* Stockholm Archaeological Reports 40. Department of Archaeology, University of Stockholm.

Samuelsson, Christoffer & Ytterberg, Niklas. 2002. *Arkeologisk undersökning. Hemmorboplatsen. Dalbo 1:45, 1:44, Hemmor 1:4, 1:19, Bomunds i Burgen 1:16, Raä 145, När sn, Gotland.* Rapport, Länsmuseet på Gotland. Visby.

Schnittger, Bror & Rydh, Hanna. 1940. *Grottan Stora Förvar på Stora Karlsö, undersökt av Lars Kolmodin och Hjalmar Stolpe.* KVHAA Monografier 5. Stockholm.

Segerberg, Ann. 1999. *The Bälinge bogs. Neolithic coastal settlement in Uppland, eastern middle Sweden. Bälinge mossar. Kustbor i Uppland under yngre stenåldern.* Aun 26. Department of Archaeology and Ancient History, University of Uppsala.

Sernander, Rutger. 1898. Zur Kenntniss der qvartären Säugethier-Fauna Schwedens. *Bulletin of the Geological institution of the university of Upsala* 3 (1897).

Siivonen, Lauri. 1968/76. *Nordeuropas däggdjur. Andra omarbetade upplagan.* Praktiska fälthandböcker i färg. Stockholm.

Sjøvold, Torstein. Ms. 1986. Unpublished manuscript on the calculation of height at withers in domestic animals.

Stenberger, Mårten; Dahr, Elias & Munthe, Henrik. 1943. *Das Grabfeld von Västerbjers auf Gotland.* KVHAA Monografier 30. Stockholm.

Teichert, Manfred. 1969. Osteometrische Untersuchungen zur Berechnung der Widerristhöhe bei vor- und frühgeschichtlichen Schweinen. *Kühn-Archiv* 83. Berlin. [56 pp]

Thorsberg, Kalle. 1997. Den gropkeramiska kulturens o-väsen. In Åkerlund et al. 1997.

Wallin, Paul & Martinsson-Wallin, Helene. 1996. Åter till Hemmorboplatsen – utgrävningar, analyser och reflexioner. *Gotländskt Arkiv* 68. Föreningen Gotlands fornvänner. Visby.

Vretemark, Maria. 1997. *Från ben till boskap. Kosthåll och djurhållning med utgångspunkt i medeltida benmaterial från Skara*. Skrifter från Skaraborgs länsmuseum 25. Skara.