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# People in Transition: Life in the Mälaren Valley from an Osteological Perspective

Anna Kjellström



## Introduction

During the period AD 750 - 1100, the Mälaren Valley was one of the most densely populated areas in what is modern day Sweden. The centuries that cover the transition from the Viking Age to the Middle Ages (approximately AD 900-1100) have conventionally been portrayed as a leap from prehistoric to historic times, even though the 'eras' themselves are artificial concepts. The religion changed from paganism to Christianity, settlement patterns altered from scattered farms to proto-towns or towns, and the socio-political organisation of chiefdoms was replaced by centrally governed royal power. These are simplified dichotomies which obscure the complexity of a non-linear transition. Some processes of social and economic change started as early as the late 8<sup>th</sup> century and others as late as the mid-12<sup>th</sup> century. The People in Transition project, financed by the Swedish Research Council, endeavoured to investigate these processes from an osteological perspective. Morphological skeletal traits and bone chemistry were used to explore patterns of demography, childhood and adult health, diet, and markers potentially related to activity. The aim

was to examine whether and how the bodies of the people who lived during this period reflect cultural alterations in lifestyle.

This paper is an overview of both published and unpublished results from the analysis of skeletons in the People in Transition project, aiming to investigate life in the Mälaren Valley in eastern central Sweden, during the period of AD 750-1100.

## Background: time and space

The project involved examining skeletons from inhumation graves from the Mälaren region. The individuals were divided into three groups roughly representing three types of societies.

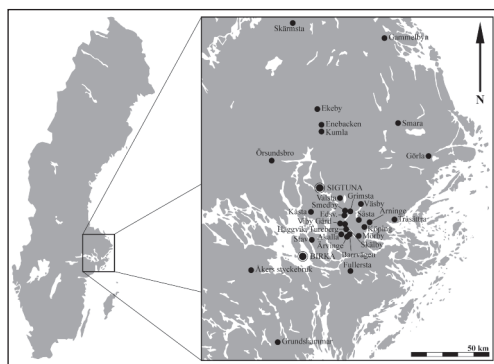


Fig. 1. Map of Sweden showing the location of the cemeteries. (Ahlin Sundman and Kjellström 2013)

1. The first group, the Birka assemblage (Fig. 1), included all the excavated and preserved skeletons from the inhumation graves of Birka on the island Björkö in Lake Mälaren. They came to represent a heterogeneous group of people in a proto-urban setting focusing on international trade (two hundred and thirty-six individuals) (Holmquist Olausson 2002; Hedenstierna-Jonson 2006). The oldest Birka graves are estimated to be from the mid-8<sup>th</sup> century and the most recent are from the end of the 10<sup>th</sup> century (Gräslund 1980).
2. The second group is more homogenous, and consists of skeletons from the inhumation graves of thirty-two rural family burial grounds belonging to farmsteads in the Mälaren Valley (one hundred and thirty-six individuals) where agriculture was the principal activity (Fig. 1). The farm cemeteries range in time from the end of the Vendel Period to the 12<sup>th</sup> century AD, with an emphasis on the period from the late 700s to 1050 (Ahlin Sundman and Kjellström 2013).
3. The third group includes skeletons (two hundred and eighty-two individuals) from the first burial phase (c. AD 970-1100) of the early medieval town Sigtuna, representing an urban milieu and a centre for both Christian and political administration (Fig. 1) (Kjellström 2005, 15; Wikström and Kjellström 2009). Only graves dated from the foundation of the town, the late 10<sup>th</sup> century to AD 1100, are included.

The dating of the three assemblages overlap and theoretically it is possible, due to the proximity of the graves in time and space, that some of the people who were buried in Birka, in the farmstead cemeteries, or in Sigtuna, actually met. That proximity makes it possible to compare the groups; the overlapping chronology helps to identify changes over time.

### Limitations and contextual problems of the study

In the initial phase of the project some contextual problems were discovered in the Birka assemblage. These comments may function as a cautionary note for future research. Nevertheless, two other source-critical aspects need to be acknowledged. Firstly, the preservation of bone in the Mälaren Valley is generally poor: for example, seventeen per cent of the total Birka skeletal material comprises loose teeth; in some areas the proportion rises to twenty-five per cent (Kjellström 2012). Secondly, it is important to recognise that only skeletons from inhumation graves were studied, therefore a large group of contemporary people who were cremated have been omitted.

The problem at Birka arises from the management of the material; the contexts of some of the finds have become mixed up. Around eleven hundred graves have been excavated at Birka (or the island of Björkö); approximately half of these were inhumations, including both rich chamber graves as well as modest coffin burials (Gräslund 1980, 4-5). Most of the graves were excavated in the 19<sup>th</sup> century by Hjalmar Stolpe (Arbman 1943). During the present analysis, it became clear that the osseous material and the contextual information given on the box or bag did not always match the data published by Arbman (Kjellström 2012); there are bags of bones tagged with grave numbers that do not exist elsewhere. In other cases, there are unburnt bones in bags from graves documented and registered according to Arbman as “cremations” and bags which include the bones of several individuals while being documented as the grave of one person.

Another interesting (and possibly controversial) find was a grave where the preserved bones do fit the original nineteenth century drawings and descriptions. This is a chamber grave furnished with fine armour and sacrificed horses. Nevertheless, three different osteological examinations all found that the individual was a woman. Whether these are not the correct bones for this grave or whether it opens up reinterpretations of weapon graves in Birka, it is too early to say.

Although not all Birka graves suffer from this uncertainty, it was decided not to associate the skeletons to specific graves. Instead, the skeletal collection is dealt with simply as “the people buried at Birka”.

### Demography: sex and age distribution

Age and gender estimations were based on morphological traits of the pelvis and the skull, in addition to measurements of the humerus and femora, using internationally recognised anthropological procedures. The methods used for the assessments are presented in Ahlin Sundman and Kjellström (2013). For the statistical calculations SPSS statistical software package version 20.0.0 was used. Tests for significance were made using likelihood-ratio chi-square tests (G-tests), or, if any crosstab cells had an expected count less than 5, using Fisher's exact test (FET).

Materials	Total N	<12 yrs n	12-20 yrs n	20-40 yrs n	>40 yrs n	Adult* n	Females n	Males n	Unknown n
Birka	246	22	6	115	22	81	47	49	150
The Mälaren valley	136	17	9	46	36	28	32	39	65
Sigtuna	282	44	41	114	43	40	71	92	119
Total	664	83	56	275	101	149	150	180	334

Table 1. Demographic composition in the three groups.

\*individuals lacking traits for age estimation, classified as 'Adults' only

The result of the osteological analysis showed that there were no differences in the distribution of men and women between the three assemblages and the distribution of sexes were balanced at each site. However, there are significant differences ( $P = <0.01$ ) in the age distribution (Table 1). (The p-

value is the calculated probability, demonstrating that the result is statistically significant). In Sigtuna 29% of the individuals were under twenty years of age. At the farmstead cemeteries 21%, and at Birka only 10%, belonged to that age group. The high number of children in Sigtuna is probably due to the fact that everybody was interred according to the Christian tradition. Additionally, the urban environment could have adversely affected young people with a higher risk of infection (Ahlin Sundström and Kjellström 2011; 2013). Although Birka was a proto-urban site with a similar potential for infection, there are many possible reasons for the low number of children and youths found there; it may reflect the site's role as a centre for trade and international exchange as it was not a typical settlement. If the unclassified adults ('Adult' in Table 1) and the youngest individuals (those below twelve years), are excluded, most of the older people (over 40 years) were found at the farmstead cemeteries in the countryside in the Mälaren Valley (FET  $P = <0.001$ ) (Table 1). This agrees with the notion that the farmsteads were family oriented; a place to return to and be cared for when approaching old age. This would contribute to why comparatively few children and older adults were found in the Birka assemblage. On the other hand, in Birka there was a significant difference (FET  $P = 0.004$ ) in age distribution between the sexes (also excluding individuals in the group "Adult"), with more men (13) in the older age group (40+) than women (9) (35% of all men versus 21% of all women). This could also be related to Birka's specialised function, and possibly to gender differences in labour: older men might be active and travelling more than older women, who may have had more domestic responsibilities than when they were younger.

### Childhood health

In order to investigate variation in health, various parameters were studied. These included the examination of *cribra orbitalia* and linear enamel hypoplasia, which were applied as indirect morphologic indicators of morbidity during youth (Walker *et al.* 2009; Littleton 2011). *Cribra orbitalia* are porous lesions of the orbital roof which may develop during childhood due to anaemia, inflammatory or haemorrhagic processes, tumours, specific dietary disorders such as rickets and scurvy, or even as an adaptive response to parasite infestation. No attempt was made to differentiate between the causes (for reviews see Stuart-Macadam 1992; Schultz 2001; Lewis 2007, 112-114). The same negative physiological processes may lead to linear enamel hypoplasia; this is a defect in the enamel in the form of linear lesions or pits, formed during the development of the teeth. The presence of changes, enamel defects and porous lesions were recorded in individuals with at least one tooth or one observable orbit, respectively.

The results of the analysis showed that there was a significant difference between assemblages; more individuals were affected at the farmsteads (LR  $X^2(2df) = 8.59$ ,  $p = 0.012$ ) (Table 2). Since the inhumation graves of the farms may display high status grave goods (Andersson 1999, 16-17) this outcome may be surprising. However, the distribution should probably not be taken as a general indicator of the health of the population at the farmsteads. The result could simply indicate that people who suffered of some kind of physical stress during childhood were less liable to leave the farm and go travelling in later life. Another interesting result was that of gender in the Birka material. The women at Birka died younger than the men, and also showed a higher frequency of *cribra orbitalia* (36.7% of women compared to 7.4% of men) (LR  $X^2(1df) = 7.52$ ,  $p = 0.011$ ) (Table 2). This could again have gender-based reasons, *i.e.* different treatment of girls and boys during younger years.

Materials	Total N*	C.o. N*	%	Females N	C.o. n	%	Males N	C.o. n	%
Birka	69	15	21.7	30	11	36.7	27	2	7.4
The Mälaren Valley	45	15	33.3	13	4	30.7	23	8	34.8
Sigtuna	104	13	12.5	32	5	15.6	48	3	6.3
Total	218	43	19.7	75	20	26.7	98	13	13.2

Table 2. Distribution of *cribra orbitalia* (C.o.) between individuals with at least one preserved orbit.

\*Includes both sexed and unsexed individuals.

No difference in the distribution of linear enamel hypoplasia was observed either between assemblages or between the sexes. Nevertheless, since the Birka material had shown some other interesting results relating to sex, a more detailed on-going study of the linear enamel hypoplasia is being conducted for this assemblage. The results are preliminary but, when focusing on canines, a tooth commonly affected, and comparing the age in months for the appearance of the first enamel lesion, it appears that girls were exposed to periods of reduced health at an earlier age than the boys (Låås and Kjellström, forthcoming). The sample is small but, as indicated by the distribution of *cribra orbitalia* in the same material, the results suggest that the girls were either treated differently to the boys or that they grew up in different environments.

### Adult health

One of the health parameters used to study adults was maxillary sinusitis (for a detailed description of methods see Ahlin Sundman Kjellström 2011; 2013). This is an inflammation of the maxillary sinuses; if chronic, this may lead to bone changes (Fig. 2). Bacterial and viral infections



Fig. 2. Signs of chronic maxillary sinusitis in an adult woman (Sigtuna, Bensinstationen ID 08012).

are the most common cause, but allergies, fungus and, importantly, poor air quality due, for example, to indoor open fires, can lead to maxillary sinusitis.

The results show a significant difference in distribution of maxillary sinusitis between assemblages. Sigtuna showed higher frequencies than the other materials (Ahlin Sundman and Kjellström 2013) very likely reflecting its urban character, with higher risks of infections and poor air in the town, in comparison with the farmsteads or Birka. Once more, there were significant differences between the sexes at Birka: the women demonstrated higher frequencies of chronic maxillary sinusitis.

Consequently, the gender differences in health, seen at Birka, are evident in both the young girls and the adult women. This strengthens the interpretation that the living conditions of women in Birka were different to those of men. Since duties connected to the household and indoor life, close to the open fire, have traditionally been assigned to women, this could explain the pattern. If so, it does not explain why there is no observable difference in health between the sexes among individuals from the farmstead cemeteries. The answer could be that the workload at a farm was not as specialised as in the proto-town. Women and men may have shared more duties in the mutual home and agrarian responsibilities may have made out-door work routine for all family members.

### Lifestyle: diet and activity related markers (tooth modification)

In addition to health studies, the stable isotopes have been analysed. In general, the diet seems to have been terrestrial, in keeping with previous results from Sigtuna (Kjellström, Storå et al. 2009). However, one of the Sigtuna cemeteries differs significantly, not only from Birka and the farmstead populations, but also from rest of the contemporaneous Sigtuna assemblage (Kjellström, Linderholm et al. forthcoming). The archaeological context of the cemetery, together with the dietary results (low in animal-protein), indicated that the buried individuals belonged to a lower social stratum.

During the ocular analysis, individuals with artificial lesions on the outer surface of the teeth were identified. Vikings with modified or “filed” teeth have previously been documented from Gotland, Öland, the southern parts of Scandinavia and England (Ahlström Arcini 2011, 87; Arcini, 2005; Littleton, 2011;). The initial analysis in this new project identified four new cases (Kjellström 2014).

These were the first examples of dental modification found in eastern central Sweden and occur in the assemblages from Birka and Bollstanäs. To test if this was solely a Viking phenomenon, skeletons from Sigtuna (the medieval town) were analysed, resulting in the identification of yet another four individuals. This suggests that the activity leading to the damage of enamel was not only present further north in Scandinavia, but that it was practiced earlier than previously believed. In addition to presenting new information about contact and exchange between sites, the great variation between the modifications of the teeth suggests either differences in activities or local specialisation. For example, it is not difficult to create these marks and the subtle modifications observed in some individuals need not have been intentional (Kjellström 2014). As with earlier finds, all the new cases are adult men and at the Viking settlements, and are found in both graves with and without grave goods, suggesting that it occurred in several social strata. Interestingly, all four men from Birka and Bollstanäs can be associated with weapons or violent acts. Two of them appear to have been ritually sacrificed and decapitated, and have been interpreted as slaves. In Sigtuna, all the new cases were identified in cemeteries not associated with church buildings. This is the same group which was identified as belonging to a lower social stratum in the diet study.

### Summary and future possibilities

The results from the People in Transition project reflect both a demographic pattern and health aspects, which appear to be specific to the character of each group of people. However, it also reflects aspects of continuity, such as diet. The sex differences observed in a variety of parameters at Birka demonstrate that the lives of the buried men and women were strongly affected by gender-based factors. The bioarchaeological results at this site coincide with an enhanced division of labour according to gender, which was also observed in the related artefacts at this site (Hedenstierna-Jonson and Kjellström, 2014). The interpretations of the results are currently tentative. There are, however, ways to further investigate theories of the demographic distribution and health situation at the sites. Firstly, the cremated bones from the funeral pyres could be osteologically analysed and carefully related to the archaeological context. Even though taphonomic factors affect the human remains in cremations to a greater extent it is still possible to obtain crude data regarding the possible sex and age group of an individual. Furthermore, stable isotope- and DNA-analysis are planned for several of the individuals from the inhumation graves in order to answer questions regarding migration and relationships between people (The Atlas of Ancient Human Genomes in Sweden, 2014). This new project could, for example, shed new light on the interactions between the centres (Birka and Sigtuna) and the nearby farmsteads. The nature of this exchange has been debated for years (Gräslund 1980, 83; Zachrisson 1998, 152-154; Roslund 2001, 201-218; Tesch 2001; Kjellström, Tesch et al. 2005).

Modified teeth are elusive. Bones and teeth develop and degenerate with some individual differences and within certain physical limitations in relation to age, workload and pathogens. However, sometimes the body responds to cultural activities which are out of the ordinary. When no clear functional explanation can be established, interpretation tends to be less straightforward. This is especially true when dealing with religious or ideological motivators, in which complex individual, socially sanctioned, ideas involving rituals, cosmetics and morals could be intertwined. It is also possible that the tooth deformation is irrelevant, being only a by-product of a particular activity.

Bioarchaeology may therefore enable new data to be gathered and new questions to be generated regarding life in the Mälaren Valley at a time of transition, enhancing those which stem from archaeological and historical sources. This may be explored further in the future.

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## ANNA KJELLSTRÖM

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