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BASELINE ^{87}SR/^{86}SR VALUES IN SOUTHERN FINLAND AND ISOTOPIC PROVENIENCING OF THE CEMETERY AT RAVATTULA RISTIMÄKI

Abstract

The data on ^{87}Sr/^{86}Sr ratios of biologically available strontium in the environment, widely used in ancient population mobility studies, is scarce and scattered for most of the north-eastern Baltic Sea Region. This study includes new information on strontium isotope baselines in southern Finland. Archaeological samples of small mammals, mostly hare (*Lepus timidus* or *europaeus*) skeletal remains, were collected from southern Finland and measured for ^{87}Sr/^{86}Sr. Our goal is to develop a baseline for the local strontium isotope background level for comparison with archaeological human tooth enamel for information on past mobility. In general, the strontium isotopic baseline values in the region correlate with soil and bedrock geology, characterized by values of 0.730 or greater. As a case study, we present the analysis of individuals from the Ristimäki ('Cross Hill') inhumation cemetery and churchyard in Ravattula village, Kaarina municipality, southwestern Finland. The cemetery dates to Late Iron Age and Early Medieval times (12th–13th centuries) and contains the remains of the earliest known church in the country. The isotopic values from twelve graves indicate that the deceased were of local origin with the exception of two burials.

Keywords: Isotopic proveniencing, population mobility, strontium baseline, Crusade Period, Early Medieval, Finland, Ravattula Ristimäki

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INTRODUCTION

Strontium isotope analysis is a widely used method for reconstructing human mobility in the past and has been employed successfully across much of northern Europe (e.g., Sjögren et al. 2009; Price et al. 2011; 2018; Price 2013; Eriksson et al. 2016; Peschel et al. 2017). The method is relatively straightforward and robust (Price et al. 2002; Bentley 2006) and requires some prior knowledge of background levels of the strontium isotope ratio, ^{87}Sr/^{86}Sr.

However, there is relatively little strontium isotopic analysis undertaken or published in archaeology as yet in Finland (e.g., Bläuer et al. 2013; Moisio 2015; Sikora et al. 2019; Lahtinen et al. 2021) and the eastern Baltic (Oras et al. 2016; Price et al. 2016; 2020). The absence of baseline information hinders reconstructing ancient mobility in this region. Here we report ^{87}Sr/^{86}Sr results for 18 hare (*Lepus timidus* or *europaeus*) bones, three modern hare incisors, and one rodent incisor, European water vole (*Arvicola amphibius),* from archaeological sites across southern Finland to begin to establish a bioavailable strontium isotope baseline in the region. As an example of archaeological applications of strontium isotope analysis, we present a case study of the AD 12th–13th century inhumation cemetery at Kaarina Ravattula Ristimäki.

The paper covers the principles and methods of Sr isotopic proveniencing and discusses the importance of baseline information for strontium isotope studies. To understand the baseline in context we provide a brief summary of the geology of Finland. Next, we consider the isotopic proveniencing that has been done in Finland before a discussion of our own samples and results from the southern part of the country. Thereafter a case study from the Ravattula Ristimäki inhumation cemetery, particularly the analysis of 12 individuals from the site i.e., the provenience of these early Christian individuals, is introduced as an example of the potential of Sr isotope analysis for establishing ancient human mobility.

PRINCIPLES OF SR ISOTOPIC PROVENIENCING

The principles of isotopic proveniencing are straightforward and based on (1) human tooth enamel, which forms in childhood and remains largely unaltered through life and, in most conditions, after death, and (2) isotopic ratios that vary geographically and are incorporated into tooth enamel (Ericson 1985; Price et al. 1994; Budd et al. 2000). If the isotopic ratio in tooth enamel differs from the local value at the place of burial, then the buried individual can usually be identified as non-local. Some secondary sources like modern fertilisers, sea spray, rainwater, or atmospheric dust can alter the naturally occurring isotopic ratios (see Price et al. 2015 for details). Oxygen, lead, and strontium have been used in such studies (Evans et al. 2006; Chenery et al. 2012; Sharp et al. 2016). Most success has come with strontium. Strontium isotopes in general terms vary with geology and enter human tissue through the food chain.

^{87}Sr is formed over time by the radioactive decay of rubidium (^{87}Rb, $t_{1/2} \sim 4.88 \times 10^{10}$ years, Long 1998) and comprises approximately 7.04% of total strontium in nature. Other stable isotopes of strontium are non-radiogenic and according to the Commission on Isotopic Abundances and Weights (www.ciaaw.org) include ^{84}Sr (~ 0.56%), ^{86}Sr (~ 9.86%), and ^{88}Sr (~ 82.58%). Because natural materials have variable strontium concentrations, strontium isotope compositions are expressed as ratios to normalize variation in absolute ^{87}Sr abundances. Variation in strontium isotope composition in natural materials is conventionally expressed as ^{87}Sr/^{86}Sr.

^{87}Sr/^{86}Sr isotopic baselines can be derived from different substances: water, geological minerals, or skeletal tissues of living or archaeological organisms (Bentley 2006; Frei & Frei 2011; 2013; Maurer et al. 2012; Willmes et al. 2014). However, estimating strontium isotope baseline directly from water or geological material is not direct, because these sources do not directly reflect strontium isotopic values of living organisms, i.e., bioavailable strontium in human tissues incorporated via food chain. Hence biological samples, ideally small animal (e.g., rodents) samples with limited home-ranges, are very suitable for creating local bioavailable strontium isotope baselines for the study of ancient human migration (Price et al. 2002). As our objective was to provide an initial dataset of bioavailable strontium isotopes in southern Finland, we targeted animal skeletal remains as primary analytical material.

As noted above, isotopic ratios of bioavailable strontium are those that are actually available in the food chain, but these may vary from the actual geological background for a number of reasons. Factors include differential weathering of minerals in rock, atmospheric dust, and the deposition of aeolian, alluvial, or glacial sediments on top of bedrock geology (Bentley 2006). Hence, complex geological areas may have several different sources of ^{87}Sr/^{86}Sr contributing to human diets. Furthermore, coastal populations are impacted by additional phenomena. Strontium isotope ratios may vary within water bodies, including within the Baltic Sea (Andersson et al. 1992; Glykou et al. 2018), and it has been also highlighted that the consumption of marine foods effects isotopic ratios measured in human remains (Montgomery 2010; Fornander et al. 2015; Lahtinen et al. 2021). Different isotopic ratios may also be introduced by salt spray and rainfall in coastal areas. Also, secondary contaminations like modern fertilizers and field liming must be considered (Price et al. 2015; Thomsen & Andreasen 2019).

To avoid contamination from modern fertilizers and non-local food sources, but also to ascertain the measurement of local strontium isotope ratios, archaeological animal skeletal remains, preferably of small home-range terrestrial mammals, are preferred for identifying local $^{87}Sr/^{86}Sr$ ratios (Price et al. 2002; Bentley et al. 2004; Lambert 2019). Standardization of procedures to collect such baseline information has been proposed previously (e.g., Maurer et al. 2012; Grimstead et al. 2017).

It should be noted that certain caution has to be exercised when interpreting human isotopic results from the Ristimäki case study, because due to poorer enamel preservation it cannot be entirely excluded that isotopic signals from surrounding sediments might have contributed/contaminated the measurements to some extent (cf. e.g., Budd et al. 2000; Hoppe et al. 2003; Trickett et al. 2003) even through standard sample preparation including mechanical cleaning and chemical sample preparation was applied to the material. These are the general cautionary notes that need to be taken into account when working with Finnish archaeological material.

A brief geology of Finland

The geology of Finland incorporates very different geological formations from different ages (e.g. Huhma et al. 2011; Fig. 4). The bedrock of Finland belongs to the older part of the Fennoscandian Shield and was formed by a succession of orogenies during the Precambrian. Common rock types are orthogneiss, granite, metavolcanics and metasedimentary rocks covered by later Quaternary glacial till deposits.

There are three primary domains of bedrock from the Precambrian (3600–570 Ma) supereon from north to south Finland (Simonen 1980; Nironen 1997; 2017). It formed into its present state about 3000 to 1400 million years ago. The bedrock of Finland belongs to the old Precambrian bedrock region of Northern and Eastern Europe, the Fennosarmatia cratonic area. The oldest rocks in Finland are located in the Archean (3600–2500 Ma) bedrock areas of Eastern and Northern Finland. The Early Proterozoic bedrock of northern Finland has been deposited on top of the Archean basement. It primarily consists of volcanic and sedimentary rocks formed in two phases (2500–2250 and 2250–2200 Ma). A large Karelian schist formation in Eastern Finland consists of 2500–1900 million metamorphized volcanic rocks. The third primary formation of the Proterozoic period is the Svecofennic schist areas, which consisted of sediments and volcanic rocks deposited around 1900 million years ago. The present-day bedrock in southern and central Finland was formed during the orogeny of the Svecofennids. Anorogenic rocks, rapakivi batholiths, and stocks were emplaced in southern Finland about 1650 to 1540 Ma.

The ice sheets that covered Finland repeatedly during the Quaternary came from the Scandinavian Mountains and left a deep layer of ground moraine on most of the surface. The most recent, i.e., Weichselian period, processes eroded the vast majority of older surface deposits. Relative to the rest of Finland, the southern coastal areas have a thin and patchy cover of till. Finland first became ice-free along the southeastern coast, shortly before the Younger Dryas, 12 700 years BP. The ice cover all but left Finland by 10 100 years BP.

Strontium isotope baseline data from Finland

The Finnish Geological Survey has compiled information on strontium isotope ratios in bedrock along with many other chemical values in its Rock Geochemical Database. Kaislaniemi (2011) reporting both measured and modelled strontium isotope values described a range of modelled values for $^{87}Sr/^{86}Sr$ between 0.7135 and 0.7637 (non-weighted values), with a weighted

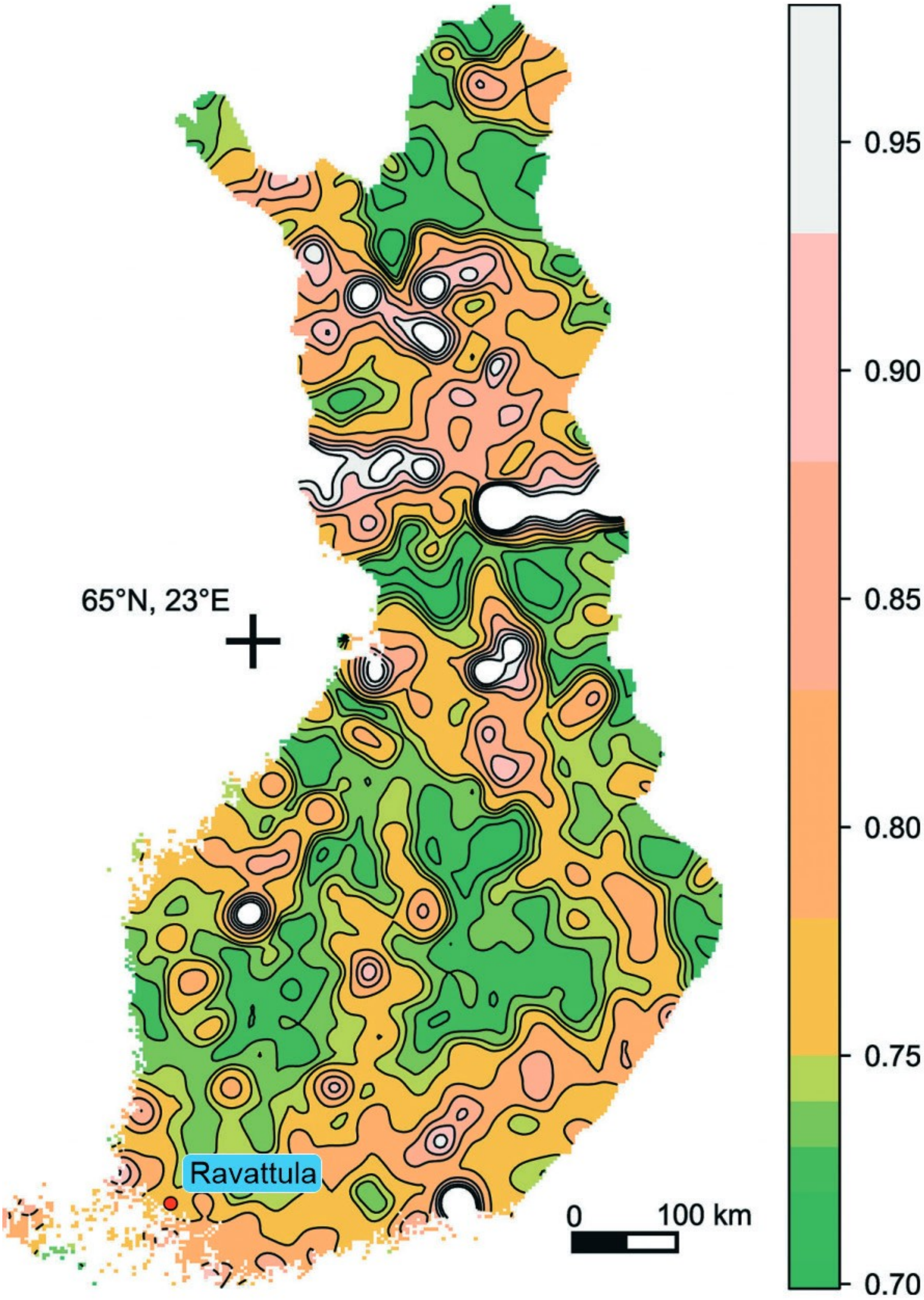

Figure 1. Bedrock 87Sr/86Sr (smoothed estimation) in Finland (modified from Kaislaniemi 2011, Fig. 3).

average of 0.7293 for all of Finland. He noted that no systematic difference between Archean and younger rocks can be seen in the estimated isotope ratios. A map of bedrock $^{87}Sr/^{86}Sr$ across Finland (Kaislaniemi 2011) (Fig. 1) provides some information on the range of values that characterize the very old rocks of this country.

There is very little information at present on bioavailable $^{87}Sr/^{86}Sr$ values in Finland. Åberg et al. (1990; Åberg 1995; see also Åberg & Wickman 1987) reported values between 0.71–0.80 from lakes, rivers, soil, and trees in Finland and Sweden. The average $^{87}Sr/^{86}Sr$ ratio in the rivers on the Precambrian shield of Fennoscandia is estimated to be 0.730 (Löfvendahl et al. 1990). Negrel et al. (2003) report values between 0.720 and 0.735 in samples from a lake in southwest Finland. Water $^{87}Sr/^{86}Sr$ values within the range of 0.71836 ± 0.00003 and 0.75189 ± 0.00008 (with variations in different sampling units and sampling areas) have been also reported in southwest Finland (Kortelainen & Karhu 2009). In general, $^{87}Sr/^{86}Sr$ values around 0.730 and higher would appear to be common in Finland.

Only a few archaeological strontium isotope ratios have been published from prehistoric Finland. From western Finland analyses have been made on an unburnt Bronze Age cattle tooth from burial cairn in Selkäkangas in the municipality of Nakkila (Satakunta region). The averaged Sr isotope value for two samples from the same tooth was ca. 0.730 (NAK0 0.73007 (±0.000015, 2SE), NAK2.5 0.73039 (±0.000015, 2SE), and although deviating results, considered consistent with the expected range of $^{87}Sr/^{86}Sr$ for the region, estimated from bedrock age and rock contents of Rb and Sr (Bläuer et al. 2013: 13–7). Another analysis was made on a human dental sample from grave 7 in the Turku Maaria Kärsämäki cemetery in southwestern Finland, region Finland Proper (Moisio 2015). This was an inhumation grave dated to the 6th or 7th century AD. The $^{87}Sr/^{86}Sr$ value for this sample was 0.7292 and was related to the $^{87}Sr/^{86}Sr$ ratios from northern Finland and Norrland or Svealand in Sweden, rather than values from southern Finland. Quite recent is the study of Levänluhta in Isokyrö (Ostrobothnia region) water burial site from 5th to 8th centuries AD reported in Sikora et al. 2019 where the modern fauna baseline results vary between 0.7238 and 0.7384. The latest addition is the paper by Lahtinen et al. (2021) on Iin Hamina site located in Ii municipality, northern part of the country (Northern Ostrobothnia). From these previously reported datasets of either archaeological or modern origin we see certain variation of local bioavailable strontium ratios, which poses its own challenges for establishing local reference baselines and interpreting the archaeological measurement results.

MATERIALS AND METHODS

$^{87}Sr/^{86}Sr$ baseline material

Our focus in this study of bioavailable $^{87}Sr/^{86}Sr$ in Finland was on the southern part of the country (Fig. 5). Since the Bronze Age, most of the archaeologically visible population has been concentrated in this area, and it is thus most relevant for studying past population movements.

However, the preservation of organic material such as bones and plant fibers is poor in Finland due to the acidity of soils (Arponen 2008; Hurcombe 2014: 93) and archaeological bone material is unevenly distributed creating a challenge for sample coverage (c.f. Pálsdóttir et al. 2019). For this study, hare (*Lepus timidus* or *europaeus*) was selected as the main target species. It is regularly present in low numbers in archaeological assemblages from the Mesolithic period onwards and it is assumed to represent locally hunted animals even in urban deposits.

We obtained bone samples from 18 hares from twelve archaeological sites dating from Mesolithic to the Post-Medieval period (Appendix 1) covering eight major regions in Southern Finland (Finland Proper, Satakunta, Tavastia Proper, Päijänne Tavastia, Pirkanmaa, Uusimaa, Kymenlaakso, and South Karelia). The dataset included both burnt and unburnt material. For unburnt remains, the overall state of preservation was good. In addition, three modern well preserved, fresh and unburnt hare incisors (enamels) and one rodent incisor discovered during the excavations were measured from the case study area of Kaarina Ravattula in Finland Proper to obtain modern reference data. These 22 small animal samples with limited geographical distribution areas are presumed to be local to the place where they were collected (within the

Figure 2. Orthophoto with elevation model of the Ravattula area and its surroundings. (Image: Juha Ruohonen.)

range of max 1 km^2) and thus provide a measure of local bioavailable $^{87}Sr/^{86}Sr$. Although bone material incorporates and reflects the $^{87}Sr/^{86}Sr$ values from the surrounding environment (Budd et al. 2000), this is not problematic for our purposes, because we relied on small animals like hare and rodents with narrow geographical home-range and hence the baseline data obtained either from bone or enamel material is expected to reflect the same limited geographical isotopic signal. Similar strontium baseline mapping strategies have been used widely before (e.g., Sjögren et al. 2009; Frei & Price 2012; Oras et al. 2016; Price et al. 2018). Furthermore, previously published results from animal remains from south-west Finland (Bläuer et al. 2013; Sikora et al. 2019) were also included for a more comprehensive picture of the bioavailable strontium baseline in Finland (see Appendix 1 and Fig. 4).

Case study material: Kaarina Ravattula Ristimäki cemetery

The Ristimäki (‘Cross Hill’) inhumation cemetery in the village of Ravattula, municipality of Kaarina in southwestern Finland (Finland Proper), is located approximately 4 km from the city of Turku and near the River Aurajoki, which flows to the Baltic Sea 8 km from the site. The site is on a small and low moraine hillock — diameter roughly 75 by 45 meters — surrounded by clay fields, situated approximately 250 m from the historical village of Ravattula (Fig. 2). As part of a comprehensive study of this site by the Department of Archaeology at the University of Turku (e.g., Ruohonen 2017; 2019), the stone foundation of the small wooden church, a large cemetery and the remains of a wall surrounding the churchyard were partly excavated in 2010–2016.

The church with its narrow choir is the earliest known ecclesiastical structure in Finland, built in the second half of the 12th century and used well into the first half of the 13th century

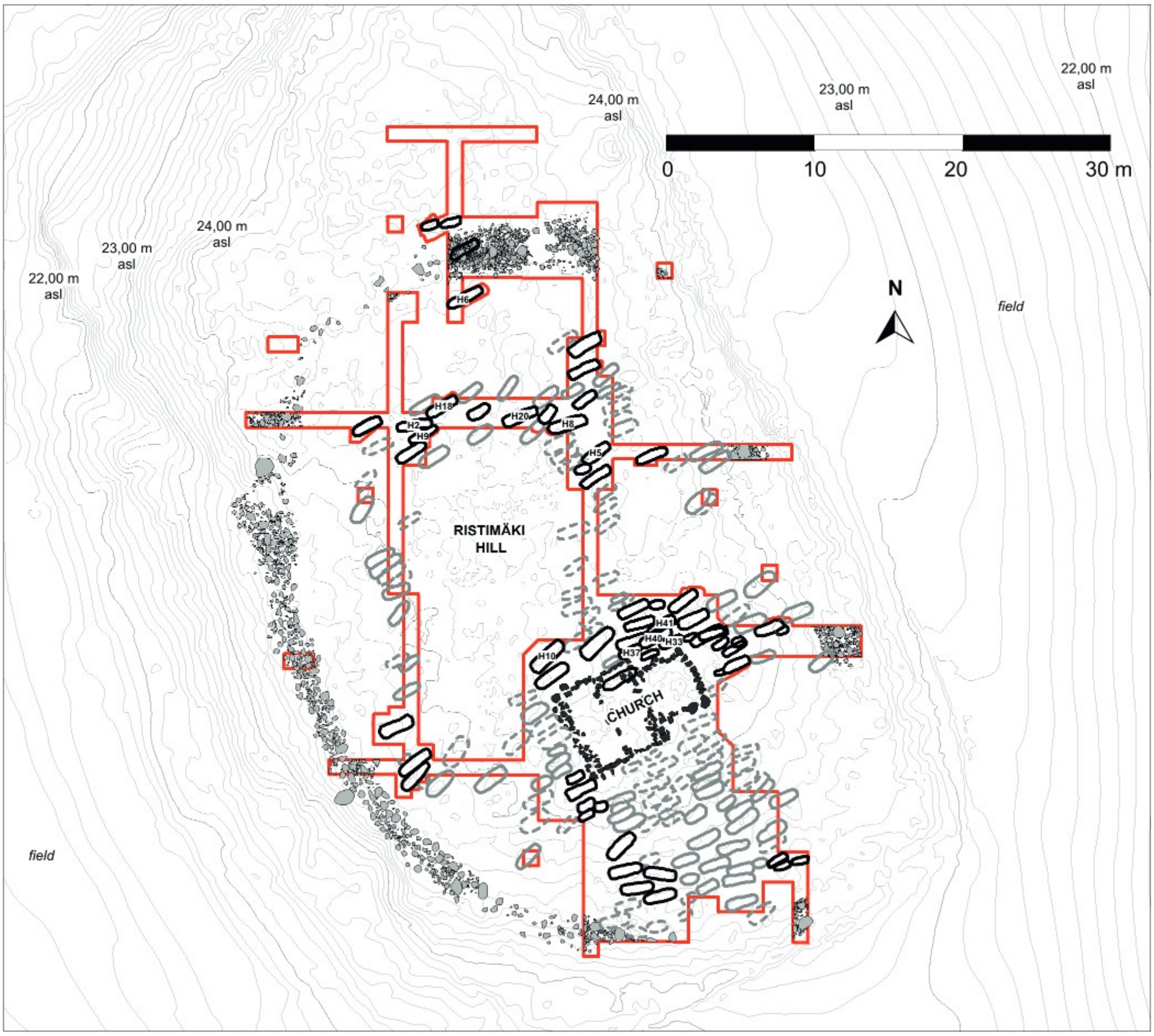

Figure 3. The cemetery at Ristimäki hill in Ravattula in Kaarina. Excavated areas are marked with red lines. Individuals analysed in this study are marked with a letter H and grave number. (Map: J. Ruohonen and S. Tuomenoja.)

by surrounding villages (Ruohonen 2017). This period is of great interest in Finland because it sheds light on missionary activity and the Christianization process in the area. There are several medieval villages near the Ravattula church, on both sides of the Aurajoki river. It can be assumed that the graves in Ristimäki belong to the local rural communities. The total number of inhumations is estimated at 300–400 but only 61 have been archaeologically excavated so far (Fig. 3). The latest burials probably originate from the middle of the 13th century as the cemetery likely came into use at the beginning of the 12th century, several decades before the church was built (Ruohonen 2019). In Ristimäki, all burials are classified as totally Christian or at least deeply Christian-influenced based on the presence of church remains, inhumations instead of cremations, the east-west orientation of grave pits, and the almost total lack of tools and weapons as grave goods. A few individuals were buried in full dress including metal items such as penannular brooches made of silver or bronze, knives, knife sheaths and ornaments made of bronze spirals. However, the absolute chronology of the graves without grave goods is difficult to determine due to a lack of datable material.

Because of the local soil conditions, the human remains were not well preserved and most often there was only tooth enamel or a colored soil layer left from the remains of the decomposition of the dead. Due to poor organic preservation gender and age estimations could only rely on the grave goods. The fragmentary state of the teeth made the closer identification of tooth type or wear complicated. Based on the preservation of suitable dental material (see below) we were able to analyse a total of 13 samples from 12 individuals (see details in Appendices 2–3).

Methods

The samples were collected from all the excavated graves where tooth enamel was preserved in a good enough condition. Sample selection was based on identifiable teeth, preferring premolars or first molars as these incorporate strontium isotope signals from the early childhood. The material was overall fragmentary and brittle, grayish matt in colour, and with the crowns fragmented into smaller pieces weighing from a couple of milligrams to max 220 mg with very variable measurements. Whole crowns were available for only two individuals (graves H10 and H37) and dentine was generally missing. Samples were taken from the largest fragments of teeth and whenever possible from the upper part of the crown.

For conducting the analysis whole teeth and bones in case of animal samples, and largest tooth fragments for human samples were picked for sampling. These were rinsed in MilliQ deionized water in an ultrasonic bath to remove any exogenous dirt from the surrounding sediments. Thereafter they were cleaned on both surfaces with a dental drill equipped with a carbide burr (to remove any visible dirt or contamination). For the fragile and brittle human enamel, the lowest speed and extra careful drilling was employed to avoid any additional fragmentation of the sampled material. In case of teeth, a sample was taken from the tooth crown enamel using a dental drill equipped with a circular saw. For bone samples a small chip of bone was removed using dental drill with a circular saw. The enamel or bone samples were ground to powder, weighed, and placed in a labeled plastic vial.

Measurement of strontium isotopes was conducted at the Geochronology and Isotope Geochemistry Lab at the University of North Carolina-Chapel Hill under the direction of Paul Fullagar and Ryan Mills. Samples were dissolved in nitric acid and the strontium fraction purified by ion selective chromatography (Eichrom Sr resin), prior to analysis by TIMS (thermal ionization mass spectrometry) on a VG Sector 54 mass spectrometer run in dynamic mode. Internal precision in the laboratory is consistently around 0.0007% standard error (or $1\sigma=0.00006$ in the ratio of a particular sample). Long-term, repeated measurements of SRM-987 are around 0.710260 – an acceptable difference from the recognized value of 0.710250 – and raw sample values from individual runs are standardized to the recognized value of SRM-987.

RESULTS AND DISCUSSION

Information on the samples collected and strontium isotope ratios is presented in Appendix 1. A ranked bar graph of these values is presented in figure 4. The mean ± 1 s.d. for the 22 measured baseline animal samples (hare bones and incisors and one rodent) was 0.7323 ± 0.0088, with a considerable range between 0.7143 and 0.7484. However, the lowest values are represented with two measurements, while all the other baseline data ratios were above 0.7230. The two lowest values (0.7143, 0.7182) are from coastal areas and may be associated with marine deposits which should have lower $^{87}Sr/^{86}Sr$ values (Price & Gestsdóttir 2006). A map of baseline sample locations and $^{87}Sr/^{86}Sr$ values is shown in figure 5. In general terms and with few exceptions $^{87}Sr/^{86}Sr$ baseline values around 0.7300 characterize our study region covering south-west Finland. Values even higher might be expected with the older rocks and till in the northern parts of the country.

We managed to map out some general tendencies of bioavailable strontium isotopic ranges in south and south-west Finland and significantly detail previously reported modelled bioavailable strontium signals in the region (Hoogewerff et al. 2019). However, considerable variation among the closely located averaged values as well as for some of the baseline datasets from the same location are evident (see Appendix 1, Fig. 5). On the one hand these are expected, as the geological formations differ and Finland is one of those regions with very complex and variable geology. On the other hand, deviations

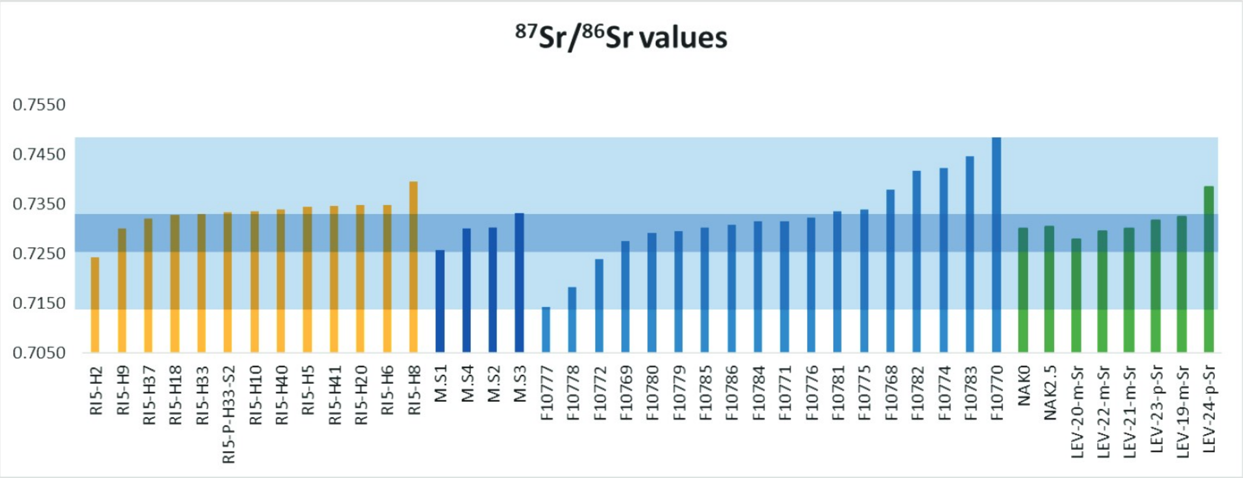

Figure 4. Bar graph of ranked ^{87}Sr/^{86}Sr values. Yellow - Ristimäki human samples; dark blue - Ristimäki animal samples; light blue - other animal samples from southern Finland analysed in this study; green – animal samples from previous publications reported in Appendix 2 (Bläuer et al. 2013; Sikora et al. 2019). Blue shaded areas mark the expected range of bioavailable strontium values in the study area (lighter) and in the close surroundings of Ristimäki (darker).

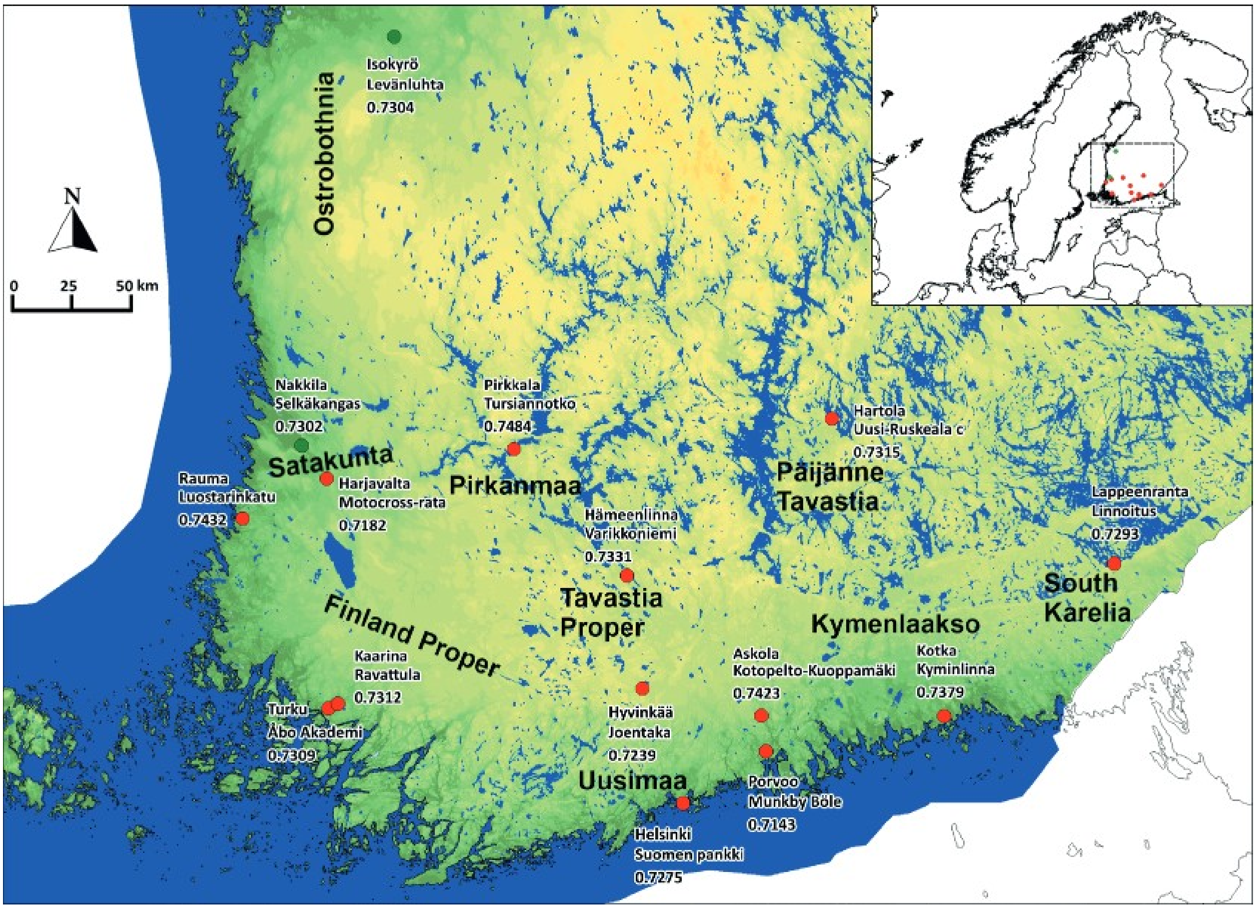

Figure 5. Location and averaged 87Sr/86Sr values for archaeological animal samples analysed for this study (red dots; Appendix 1) and from previous publications (green dots; based on data reported in Bläuer et al. 2013, Sikora et al. 2019).

within the measurements of single site samples highlight the multifaceted nature and various potential contributors to strontium isotope ranges in living organisms. The dataset provided here has wide implications for starting to understand general tendencies and distributions of bioavailable strontium isotopic baseline in our study region, but can be further adjusted with new datasets, also covering different sample types.

The isotopic analysis of the Ristimäki human remains produced 13 strontium isotope ratios from 12 graves. They had a mean value of 0.7332 with a range from 0.7243 to 0.7395. The dark blue shaded area in the bar graph (Fig. 4) marks the expected terrestrial bioavailable strontium isotope ratios at Ravattula village. Samples from three modern hares from the Ravattula village, from the surrounding fields of the Ristimäki hill, were used as a reference data, as well as one rodent from the excavation area. These four samples show a range from 0.7257 to 0.7331, with a mean of 0.7298, with one deviating result – sample M.S1 with value 0.7257. As we are dealing with a sample of a modern hare, who feed on local plant material, including from cultivated fields, it is possible that this deviating value might be influenced by modern agricultural practices such as field liming (Thomsen & Andreasen 2019). With this sample the average strontium value is 0.7298, without this outlier the samples averaged to 0.7312. The latter corresponds closely to strontium isotopic ratios from the cemetery.

The values from the inhumation graves are very similar to each other in the case of ten individuals. They had a mean value of 0.7334 with a range from 0.7300 to 0.7344. Among the samples of inhumations, at least 10 of 12 individuals would appear to be local or at least not outside the Aurajoki river valley area.

The other values from the Aurajoki river valley area are only slightly lower than the average from Ravattula. For example, the three medieval hares from the town of Turku (Turku Åbo Akademi) had a mean value of 0.7309 with a range from 0.7307 to 0.7315. Distance from this site to the Ravattula village is 4.2 km. According to Löfvendahl et al. (1990, table 2) the $^{87}Sr/^{86}Sr$ ratio of water of the Aurajoki river is 0.73202. The river and our measured terrestrial strontium values fit with each other well and seems to create a rather good representation of local bioavailable strontium signal for the region. Additionally, we can expect that food sourcing from Aurajoki River by local populations should not have had a significant impact on measured strontium isotope values.

If the isotopic ratio in tooth enamel differs from the local value at the place of burial, then the deceased can be identified as non-local. The graph suggests that there were also non-local individuals buried at the Ristimäki cemetery. There is one individual with $^{87}Sr/^{86}Sr$ values above (8/2015, 0.7395) and one with values below (2/2015, 0.7243) the baseline range. However, a certain caution must be taken into account with the latter individual, as the result does not differ too much from one of our deviating modern hare sample (M.S1, 0.7257). In principle, if this baseline sample were to be considered as reliable representation of local bioavailable strontium baseline values, the individual might be local as well. Yet, only further addition of reference samples could help to solve this issue. Furthermore, as the close-by Turku Åbo Akademi baseline samples also represent higher values, the baseline >0.7300 seems more reliable for this area. It also must be acknowledged that without a more elaborate strontium isotopic baseline data covering the whole Aurajoki River valley and mapping possible isotopic variations in this area, it is difficult to estimate whether these two individuals might originate from other regions of the Aurajoki River valley or further away, but they do differ from the majority of measurements we obtained at the surroundings of Ristimäki site and closer-by Turku Åbo Akademi baseline results. Based on the ornaments and garment remains found from the graves both were women (Appendix 3). The characteristics of burials, for example dress details found in these graves, were similar to others known from Ristimäki site. The only exception is that these deceased were buried in treetrunk coffins (coffins hollowed out of a single log) instead of more common plank coffins. Even though there were other treetrunk coffins in the site, there were no dental remains from these to be analysed. It should be noted however, that the use of such a coffin might be the result of practical reasons only.

The economy of the Late Iron Age and medieval rural villages like Ravattula in southwestern

Finland was based on farming and animal husbandry (Vuorinen 2009; Haggrén 2016). Connections to nearby villages were close especially in the same river valley area. More distant mobility of people within this kind of agrarian community was not particularly significant, as is now also seen in $^{87}Sr/^{86}Sr$ values. For example, the geographical area from which the spouse was chosen was small. Usually, the marriage field was limited to one's own village, surrounding nearby area, or, at its widest, to the parish (e.g., Heikinmäki 1981: 23–6). However, the lower and higher values of two individuals in our sample set do indicate connections outside the nearby villages, potentially also beyond the Aurajoki river valley itself. As an alternative possibility for the female with lower strontium isotopic value, it is also probable that we might evidence larger input from the Baltic Sea based diet (i.e., lowering her strontium isotope signal, e.g., Lahtinen et al. 2021). Additionally, as the exact type of the molar (M1, M2, or M3) was not identifiable for this individual due to fragmentary state of the teeth, we might also face later childhood dietary and hence strontium signal here as well.

CONCLUSIONS

The results from our preliminary baseline study of southern Finland suggest that much of the region is characterized by $^{87}Sr/^{86}Sr$ values of 0.730 or greater. The west coast of the area is the exception to this, where somewhat lower values are seen due to marine deposits and possibly from sea spray (Price et al. 2018). In general, this pattern correlates well with the geology of the country.

In terms of the cemetery of Ravattula Ristimäki in Kaarina, most of the individuals have values of 0.730 and above. Modern samples from the same area are within the same range. From the analysed dental material only two individuals (16.7%) differ from the general population and that would be the lowest and highest values, burials 2/2015 and 8/2015. These burials are likely non-local individuals or display deviating dietary input with larger incorporation of marine food sources. Yet, their treatment in the cemetery was similar to that of the general population meaning that at death they were clearly regarded as the members of local community.

Our study is intended as an introduction to the isotopic proveniencing of ancient human remains in Finland by providing an initial step involving the identification of baseline values. We look forward to the continuation of such investigations in Finland and the rest of northernmost Europe.

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REFERENCES

Åberg, G. 1995. The use of natural strontium isotopes as tracers in environmental studies. *Water, Air, and Soil Pollution* 79: 309–22.

Åberg, G. & Wickman, F. E. 1987. Variations $^{87}Sr/^{86}Sr$ in water from streams discharging into the Bothnian Bay, Baltic Sea. *Nord Hydrol*ogy 18: 33–42.

Åberg, G., Jacks, G., Wickman, T. & Hamilton, P. J. 1990. Strontium isotopes in trees as an indicator for calcium availability. *Catena* 17: 1–11.

Andersson, P. S., Wasserburg, G. J. & Ingri, J. 1992. The sources and transport of Sr and Nd isotopes in the Baltic Sea. *Earth and Planetary Science Letters* 113, Issue 4, 459–72. https://doi.org/10.1016/0012-821X(92)90124-E.

Arponen, A. 2008. Arkeologisen materiaalin konservointi. In P. Halinen, V. Immonen, M. Lavento, T. Mikkola, A. Siiriäinen & P. Uino (eds) *Johdatus arkeologiaan:* 225–35. Helsinki: Gaudeamus.

Bentley, R. A., Price, T. D. & Stephan, E. 2004. Determining the 'local' 87Sr/86Sr range for archaeological skeletons: A case study from Neolithic Europe. *Journal of Archaeological Science* 31: 365–75.

Bentley, R. A. 2006. Strontium isotopes from the earth to the archaeological skeleton: A review. *Journal of Archaeological Method and Theory* 13:135–87. 10.1007/s10816-006-9009-x.

Bläuer, A., Korkeakoski-Väisänen, K., Arppe, L. & Kantanen, J. 2013. Bronze Age cattle teeth and cremations from a monumental burial cairn in Selkäkangas, Finland: New radiocarbon-dates and isotopic analysis. *Estonian Journal of Archaeology* 17/1: 3–23.

Budd P., Montgomery J., Evans J. & Barreir B. 2000. Human tooth enamel as a record of the comparative lead exposure of prehistoric and modern people. *Science of The Total Environment* 263: 1–10.

Chenery, C. A., Pashley, V., Lamb, A. L., Sloane, H. J. & Evans, J. A. 2012. The oxygen isotope relationship between the phosphate and structural carbonate fractions of human bioapatite. *Rapid Commun Mass Spectrom* 26: 309–19.

Commission on Isotopic Abundances and Weights <www.ciaaw.org> Read 11 November 2021.

Ericson J. E. 1985. Strontium isotope characterization in the study of prehistoric human ecology. *Journal of Human Evolution* 14: 503–14.

Eriksson, G., Frei, K. M., Howcroft, R., Gummesson, S., Molin, F., Lidén, K., Frei, R. & Hallgren, F. 2016. Diet and mobility among Mesolithic hunter-gatherers in Motala (Sweden): The isotope perspective. *Journal of Archaeological Science: Reports* 10.1016/j.jasrep.2016.05.052.

Evans, J. A., Chenery, C. A. & Fitzpatrick, A. P. 2006. Bronze Age childhood migration of individuals near Stonehenge, revealed by strontium and oxygen isotope tooth enamel analysis. *Archaeometry* 48: 309–21.

Fornander, E., Lidén, K., Eriksson, G. & Andersson, P. 2015. Identifying mobility in populations with mixed marine/terrestrial diets: Strontium isotope analysis of skeletal material from a passage grave in Resmo, Öland, Sweden. In P. Suchowska-Ducke, S. S. Reiter & H. Vandkilde (eds) *Forging Identities. The Mobility of Culture in Bronze Age Europe*: Volume 1: 183–91. Oxford: British Archaeological Reports.

Frei, K. M. & Frei, R. 2011. The geographic distribution of strontium isotopes in Danish surface waters: A base for provenance studies in archaeology, hydrology and agriculture. *Applied Geochemistry* 26: 326–49.

Frei, K. M. & Price, T. D. 2012. Strontium isotopes and human mobility in prehistoric Denmark. *Archaeological and Anthropological Sciences* 2012/4:103–114.

Frei, R. & Frei K. M. 2013. The geographic distribution of Sr isotopes from surface waters and soil extracts over the island of Bornholm (Denmark): A base for provenance studies in archaeology and agriculture. *Applied Geochemistry* 38:147–60.

Glykou, A., Eriksson, G., Storå, J., Schmitt, M., Kooijman, E. & Lidén, K. 2018. Intra- and inter-tooth variation in strontium isotope ratios from prehistoric seals by laser ablation. *Rapid Communications in Mass Spectrometry* 32: 1215–24.

Grimstead, D. N., Nugent, S. & Whipple, J. 2017. Why a standardization of strontium isotope baseline environmental data is needed and recommendations for methodology. *Advances in Archaeological Practice* 5: 184–95.

Haggrén, G. 2016. Keskiajan arkeologia. In G. Haggrén, P. Halinen, M. Lavento, S. Raninen & A. Wessman (eds) *Muinaisuutemme jäljet. Suomen esi- ja varhaishistoria kivikaudelta keskiajalle*: 369–556. Helsinki: Gaudeamus Oy.

Heikinmäki, M.-L. 1981. *Suomalaiset häätavat. Talonpoikaiset avioliiton solmintaperinteet*. Helsinki: Otava.

Hoogewerff, J. A., Reimann, C., Ueckermann, H., Frei, R., Frei, K. M., Aswegen, T., Stirling, C. et al. 2019. Bioavailable 87Sr/86Sr in European soils: A baseline for provenancing studies. *Science of The Total Environment* 672: 1033–44.

Hoppe, K. A., Koch, P. L. & Furutani, T. T. 2003. Assessing the preservation of biogenic strontium in fossil bones and tooth enamel. *International Journal of Osteoarchaeology* 13: 20–8.

Huhma, H., O'Brien, H., Lahaye, Y. & Mänttäri, I. 2011. Isotope geology and Fennoscandian lithosphere evolution. In K. Nenonen & P. A. Nurmi (eds) *Geoscience for Society*. 125th Anniversary Volume. Geological Survey of Finland, Special Paper 49: 35–48.

Hurcombe, L. 2014. *Perishable Material Culture in Prehistory: Investigating the Missing Majority*. London & New York: Routledge.

Kaislaniemi, L. 2011. Estimating the distribution of strontium isotope ratios (^{87}Sr/^{86}Sr) in the Precambrian of Finland. *Bulletin of the Geological Society of Finland* 83: 95–113.

Kortelainen, N. & Karhu, J. 2009. Geochemical and isotopic evolution of high-pH groundwater in a carbonate-bearing glacigenic aquifer, SW Finland. *Hydrology research* 40(1): 19–31.

Lahtinen, M., Arppe, L. & Nowell, G. 2021. Source of strontium in archaeological mobility studies: Marine diet contribution to the isotopic composition. *Archaeological and Anthropological Sciences* (2021) 13:1. https://doi.org/10.1007/s12520-020-01240-w.

Lambert, S. F. X. 2019. Identifying strontium baselines and large game animal trade at Fremont sites through strontium isotope (87Sr/86Sr) analysis. *Journal of Archaeological Science: Reports* 27: 101936.

Long, L. E. 1998. Rubidium-strontium method. *Geochemistry. Encyclopedia of Earth Science.* Dordrecht: Springer. https://doi.org/10.1007/1-4020-4496-8_279.

Löfvendahl, R., Åberg, G. & Hamilton, P. J. 1990. Strontium in rivers of the Baltic Basin. *Aquatic Sciences* 52: 315–29.

Maurer, A. F., Galer, S. J., Knipper, C., Beierlein, L., Nunn, E. V., Peters, D., Tütken, T., Alt, K. W. & Schöne B. R. 2012. Bioavailable ^{87}Sr/^{86}Sr in different environmental samples: Effects of anthropogenic contamination and implications for isoscapes in past migration studies. *Science of the Total Environment* 433: 216–29. doi: 10.1016/j.scitotenv.2012.06.046. Epub 2012 Jul 13.

Moisio, J. 2015. *Migrations and the Middle Ground in the Coastal Region of Finland Proper during the Roman Iron Age.* Master's thesis, Archaeology, School of History, Culture and Arts Studies, University of Turku.

Montgomery J. 2010. Passports from the past: Investigating human dispersals using strontium isotope analysis of tooth enamel. *Annals of Human Biology* 37(3): 325–46. https://doi.org/10.3109/03014461003649297.

Negrel, P., Casanova, J., Blomqvist, R., Kaija, J. & Frape, S. 2003. Strontium isotopic characterization of the Palmottu hydrosystem (Finland): Water–rock interaction and geochemistry of groundwaters. *Geofluids* 3: 161–75.

Nironen, M. 1997. The Svecofennian Orogen: A tectonic model. *Precambrian Research* 86: 21–44.

Nironen, M. 2017. Guide to the Geological Map of Finland – Bedrock 1:1 000 000. *Geological Survey of Finland, Special Paper* 60: 41–76. Espoo: Geological Survey of Finland.

Oras, E., Lang, V., Rannamäe, E., Varul, L., Konsa, M., Limbo-Simovart, J., Vedru, G., Laneman, M., Malve, M. & Price, T. D. 2016. Tracing prehistoric migration: Isotope analysis of Bronze and Pre-Roman Iron Age coastal burials in Estonia. *Estonian Journal of Archaeology* 20: 3–32.

Pálsdóttir, A. H., Bläuer, A., Rannamäe, E., Boessenkool, S. & Hallsson, J. H. 2019. Not a limitless resource: Ethics and guidelines for destructive sampling of archaeofaunal remains. *Royal Society Open Science* 6: 191059. https://doi.org/10.1098/rsos.191059.

Peschel, E. M., Carlsson, D., Bethard, J. & Beaudry, M. C. 2017. Who resided in Ridanäs? A study of mobility on a Viking Age trading port in Gotland, Sweden. *Journal of Archaeological Science: Reports* 13: 175–84.

Price, T. D., Grupe, G. & Schröter, P. 1994. Reconstruction of migration patterns in the Bell Beaker period by stable strontium isotope analysis. *Applied Geochemistry* 9(4): 413–7.

Price, T. D. 2013. Human mobility at Uppåkra: A preliminary report on isotopic proveniencing. In B. Hårdh & L. Larsson (eds) *Studies at Uppåkra, An Iron Age City in Scania, Sweden*: 157–69. Lund: Institute of Archaeology.

Price, T. D., Burton, J. H. & Bentley, R. 2002. Characterization of biologically available strontium isotope ratios for the study of prehistoric migration. *Archaeometry* 44: 117–35. https://doi.org/10.1111/1475-4754.00047.

Price, T. D. & Gestsdóttir, H. 2006. The first settlers of Iceland: An isotopic approach to colonization. *Antiquity* 80(307): 130–44.

Price, T. D., Frei, K. M., Dobat, A., Lynnerup, N. & Bennike, P. 2011. Who was in Harold Bluetooth's army? Strontium isotope investigation of the cemetery at the Viking Age fortress at Trelleborg, Denmark. *Antiquity* 85: 476–89.

Price, T. D., Meiggs, D., Weber, M.-J. & Pike-Tay, A. 2015. The migration of late Pleistocene reindeer: isotopic evidence from northern Europe. *Archaeological and Anthropological Sciences* 2015/9: 371–94.

Price, T. D., Peets, J., Allmäe, R., Maldre, L. & Oras, E. 2016. Isotopic provenancing of the Salme ship burials in Pre-Viking Age Estonia. *Antiquity* 90: 1022–37.

Price, T. D., Arcini, C., Drenzel, L., Kalmring, S. & Gustin, I. 2018. Isotopes and human burials at Viking Age Birka and the Mälaren region, East Central Sweden. *Journal of Anthropological Archaeology* 49: 19–38.

Price, T. D., Peets, J., Allmae, R., Maldre, L. & Price, N. 2020. Human remains, context, and place of origin for the Salme, Estonia, boat burials. *Journal of Anthropological Archaeology* 58: 101149.

Ruohonen, J. 2017. Ristimäki in Ravattula: On the remains of the oldest known church in Finland. In J. Harjula, S. Hukantaival, V. Immonen, A. Randla & Tanja Ratilainen (eds) *Sacred Monuments and Practices in the Baltic Sea Region: New Visits to Old Churches*: 46–60. Newcastle upon Tyne: Cambridge Scholars Publishing.

Ruohonen, J. 2019. Identifying a stone structure in the medieval church at Ravattula in Finland: Reflections on free-standing crosses in Northern Europe. *Zeitschrift für Archäologie des Mittelalters* 46: 113–35.

Sharp Z. D., Gibbons J. A., Maltsev O., Atudorei V., Pack A., Sengupta S., Shock E. L. & Knauth L. P. 2016. A calibration of the triple oxygen isotope fractionation in the SiO2–H2O system and applications to natural samples. *Geochimica et Cosmochimica Acta* 186: 105–19.

Sikora, M., Pitulko, V., Sousa, V., Allentoft, M., Vinner, L., Rasmussen, S., ...Willerslev, E. 2019. The population history of northeastern Siberia since the Pleistocene. *Nature* 570: 182–8.

Simonen, A. 1980. *The Precambrian in Finland*. Geological Survey of Finland, Bulletin 304. Espoo: Geologinen tutkimuslaitos.

Sjögren, K.-G., Price, T. D. & Ahlström, T. 2009. Megaliths and mobility in south-western Sweden: Investigating relations between a local society and its neighbours using strontium isotopes. *Journal of Anthropological Archaeology* 28: 85–101.

Thomsen, E. & Andreasen, R. 2019. Agricultural lime disturbs natural strontium isotope variations: Implications for provenance and migration studies. *Science Advances* 5(3). DOI: 10.1126/sciadv.aav8083.

Trickett, M. A., Budd, P., Montgomery, J. & Evans, J. 2003. An assessment of solubility profiling as a decontamination procedure for the 87Sr/86 Sr analysis of archaeological human skeletal tissue. *Applied Geochemistry* 18: 653–8.

Willmes, M., McMorrow, L., Kinsley, L., Armstrong, R., Aubert, M., Eggins, S., Falguères, C., Maureille, B., Moffat, I. & Grün, R. 2014. The IRHUM (Isotopic Reconstruction of Human Migration) database: Bioavailable strontium isotope ratios for geochemical fingerprinting in France. *Earth System Science Data* 6: 117–22.

Vuorinen, J.-M. 2009. *Rakennukset ja rakentajat Raision Ihalassa rautakauden lopulla ja varhaisella keskiajalla*. Annales Universitatis Turkuensis C 281. Turku: University of Turku.

APPENDICES

Appendix 1. Animal skeletal remains ^{87}Sr/^{86}Sr isotope results used for baseline. Site-specific outliers (STDEV >0.002) marked in italics. Data from previously published material: NAK – Nakkila Selkäkangas (Bläuer et al. 2013); LEV – Isokyrö Levänluhta (Sikora et al. 2019). UB - unburnt

Sample Nr	Site	Region	Dating	Museum code	Species	Element	Preservation	weight (g)	^{87}Sr/^{86}Sr
F10768	Kotka Kyminlinna	Kymenlaakso	Post-medieval	KM2005062:400	Hare	Ulna	UB	1.6	0.737897
F10769	Helsinki Suomen pankki	Uusimaa	Post-medieval	KM2000002:2133	Hare	Humerus	UB	3.2	0.727502
F10770	Pirkkala Tursiannotko	Pirkanmaa	Late Iron Age	KM 39785:1244	Hare	Talus	UB	0.3	0.748376
F10771	Hartola Uusi-Ruskeala c	Päijänne Tavastia	Post-medieval	KM 37985:66	Hare	Femur	UB	1.3	0.731517
F10772	Hyvinkää Joentaka	Uusimaa	Stone Age	KM 33456:576	Hare	Mt II	Burnt	0.1	0.723917
F10774	Askola Kotopelto-Kuoppamäki	Uusimaa	Stone Age	KM35021:311	Hare	Humerus	Burnt	0.3	0.742274
F10775	Hämeenlinna Varikkoniemi	Tavastia Proper	Late Iron Age	KM26058: 3174	Hare	Talus	UB	0.2	0.733910
F10776	Hämeenlinna Varikkoniemi	Tavastia Proper	Late Iron Age	KM 26058:3223	Hare	Talus	UB	0.2	0.732204
F10777	Porvoo Munkby Böle	Uusimaa	Stone Age	KM19799: 2229	Hare	Radius	Burnt	0.1	0.714305
F10778	Harjavalta Motocross-rata	Satakunta	Stone Age	KM 20493: 190	Hare	Talus	Burnt	0.3	0.718216
F10779	Lappeenranta Linnoitus	South Karelia	Post-medieval	KM87120 C6/4	Hare	Tibia	UB	1.9	0.729492
F10780	Lappeenranta Linnoitus	South Karelia	Post-medieval	KM87120 C7/3	Hare	Radius	UB	1.7	0.729102
F10781	Rauma Luostarinkatu	Satakunta	Medieval	KM41321:215	Hare	Humerus	UB	1.3	0.733471
F10782	Rauma Luostarinkatu	Satakunta	Medieval	KM41321:215	Hare	Humerus	UB	1.2	0.741731
F10783	Rauma Luostarinkatu	Satakunta	Medieval	KM41321:215	Hare	Humerus	UB	1.3	0.744673

Sample Nr	Site	Region	Dating	Museum code	Species	Element	Preservation	weight (g)	^{87}Sr/^{86}Sr
F10784	Turku Åbo Akademi	Finland Proper	Medieval	TMM21816:159	Hare	Tibia	UB	3.2	0.731466
F10785	Turku Åbo Akademi	Finland Proper	Medieval	TMM21816:159	Hare	Tibia	UB	1.6	0.730355
F10786	Turku Åbo Akademi	Finland Proper	Medieval	TMM21816:159	Hare	Tibia	UB	2.3	0.730747
M.S4	Kaarina Ravattula Ristimäki	Finland Proper	Modern	TYA 914:707	Rodent	Incisor	UB	6.7	0.730182
M.S3	Kaarina Ravattula	Finland Proper	Modern	NA	Hare	Incisor	UB	10.6	0.733132
M.S2	Kaarina Ravattula	Finland Proper	Modern	NA	Hare	Incisor	UB	7.2	0.730316
M.S1	Kaarina Ravattula	Finland Proper	Modern	NA	Hare	Incisor	UB	9.9	0.725662
NAK0	Nakkila Selkäkangas	Satakunta	Bronze Age	TYA 169: 7	Cattle	Molar	UB	NA	0.73007
NAK2.5	Nakkila Selkäkangas	Satakunta	Bronze Age	TYA 169: 7	Cattle	Molar	UB	NA	0.73039
LEV-19-m-Sr	Isokyrö Levänluhta	Ostrobothnia	Modern	NA	Rodent	Teeth & jaw	UB	NA	0.732432
LEV-20-m-Sr	Isokyrö Levänluhta	Ostrobothnia	Modern	NA	Rodent	Teeth & jaw	UB	NA	0.72794
LEV-21-m-Sr	Isokyrö Levänluhta	Ostrobothnia	Modern	NA	Rodent	Teeth & jaw	UB	NA	0.730113
LEV-22-m-Sr	Isokyrö Levänluhta	Ostrobothnia	Modern	NA	Rodent	Teeth & jaw	UB	NA	0.729584
LEV-23-p-Sr	Isokyrö Levänluhta	Ostrobothnia	Modern	NA	Rodent	Teeth & jaw	UB	NA	0.731776
LEV-24-p-Sr	Isokyrö Levänluhta	Ostrobothnia	Modern	NA	Rodent	Teeth & jaw	UB	NA	0.738395

Appendix 2: Kaarina Ravattula Ristimäki human enamel ^{87}Sr/^{86}Sr results. M – molar, PM - premolar.

Sample ID	Burial ID	87Sr/86Sr	Tooth analysed	Maxilla/mandibular	Weight (mg)
RI5-H2	2/2015	0.724258	M	mx	8.2
RI5-H5	5/2014	0.734367	PM1	md	9.7
RI5-H6	6/2015	0.734833	M?		8.9
RI5-H8	8/2015	0.739532	M		8.8
RI5-H9	9/2015	0.730077	PM		8.7

Sample ID	Burial ID	87Sr/86Sr	Tooth analysed	Maxilla/mandibular	Weight (mg)
RI5-H10	10/2015	0.733587	PM1	mx?	5.4
RI5-H18	18/2016	0.732846	PM		7.8
RI5-H20	20/2016	0.734737	PM1	mx	10.2
RI5-H33	33/2016	0.733017	M		8.4
RI5-P-H33-S2	33/2016 (2nd sample)	0.733284	M		7.1
RI5-H37	37/2016	0.732106	PM		8.5
RI5-H40	40/2016	0.733906	PM1	mx	10.1
RI5-H41	41/2016	0.734555	unidentified		9.2

Appendix 3: Studied burials at the Kaarina Ravattula Ristimäki cemetery.

Burial no.	Burial ID	Age	Gender	Coffin type	Grave goods	Location in the cemetery
2	2/2015	Adult	F	treetrunk	buried in dress	north side
5	5/2014	Adultus	F	plank coffin	buried in dress	north side
6	6/2015	Adult	F	plank coffin	buried in dress	north side
8	8/2015	Adult	F	treetrunk	buried in dress	north side
9	9/2015	Adultus	?	plank coffin	buried in dress?	north side
10	10/2015	Adultus?	F?	plank coffin	buried in dress?	north side
18	18/2016	Adultus	F	plank coffin	buried in dress	north side
20	20/2016	Adult	F	plank coffin	buried in dress	north side
33	33/2016	Infans	F?	plank coffin	buried in dress	next to the church
37	37/2016	Juvenilis	F	plank coffin	buried in dress	next to the church
40	40/2016	Adult	?	plank coffin	NA	next to the church
41	41/2016	Adult	F	plank coffin	buried in dress	next to the church