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A FISHY TALE ABOUT A SHEEP AND A DOG – ISOTOPE STUDIES AND MEDIEVAL SÁMI MOBILITY AND HUSBANDRY IN INNER FINNMARK, NORTHERN NORWAY

Abstract

Datings of sheep and dog bone samples from a so-called ‘Sámi circular offering site’ at Bealjalgnai in Karasjok Municipality, Finnmark, Norway, show that they were deposited in the Middle Ages. They are among the earliest dated bones from such structures, and the sheep is the oldest known example from this part of inland Finnmark. Isotope analyses show that the dog lived primarily on aquatic foodstuffs, with a substantial marine intake. The sheep’s nitrogen and carbon values indicate that it had eaten protein from animals quite high up in the food chain, mainly from freshwater and terrestrial sources, though with a certain intake of marine fodder as well. Two methods were employed to establish the amount of different nutrients eaten by these individuals and the potential marine and freshwater reservoir effects on their datings. Despite several potential sources of error, the results raise intriguing questions about mobility patterns and husbandry among medieval inland North Sámi groups. The cultural historical context of the finds is discussed, suggesting some possible scenarios that may have led to the surprising isotope analysis results.

Keywords: circular offering sites, diet, isotope analyses, Middle Ages, mobility, North Norway, Sámi archaeology, traps

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INTRODUCTION

In relation to a PhD-project concerning the so-called ‘Sámi circular offering sites’ (Spangen 2016), animal bone finds from such structures were sampled for radiocarbon dating and isotope analyses (Fjellström 2015a; 2015b). The primary objective was to date the use of these structures, but further isotope analyses were performed to explore what information this method might yield on the origins and cultural context of the deposited animals, comparing the results from several similar sites in differ-

ent areas. Two samples, one from a dog bone and the other from a sheep bone found at the Bealjalgnai site in Karasjok Municipality, inner Finnmark, northern Norway, proved to be particularly interesting. Their nitrogen, carbon and sulphur values indicate that the dog fed on aquatic foods including a substantial marine intake, while the sheep must have fed on a significant proportion of freshwater and terrestrial food, as well as a certain amount of marine nutrients. The latter may be explained by known cultural traditions for livestock feeding in northern Norway. The marine food intake,

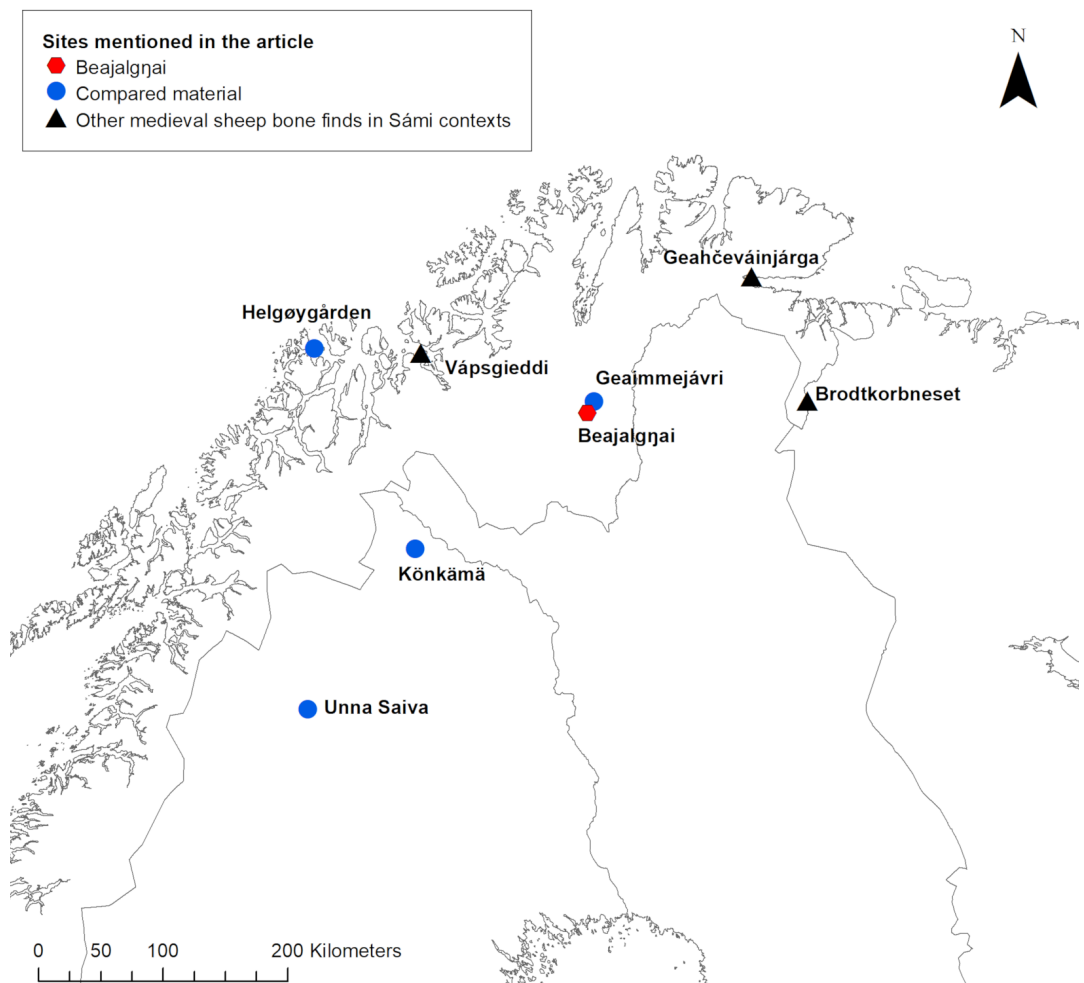


Fig. 1. Map with place names mentioned in the text. Illustration: M. Spangen; background map: The Norwegian Mapping Service.

however, especially the considerable amount eaten by the dog, and the early dating of the sheep to the 14th–15th century, are both surprising results in this inland context.

In this article, we will compare the finds to the previously established knowledge about medieval Sámi culture and subsistence in Finnmark, mainly concerning mobility patterns and sheep husbandry, and discuss the possibilities and limitations of stable isotope analyses in this context. The results of the isotope analyses may indicate that the medieval Sámi in the area moved over longer distances than previously thought, while

the presence of sheep shifts our view of the inland Sámi subsistence in the Middle Ages. There is reason for caution using stable isotope analyses to explore such issues, as multiple uncertainties may affect the results and interpretations. Sample representivity and the current lack of local comparative material pose challenges in reaching plausible conclusions, as do unknown factors concerning nutrition sources, and how these may have been made available. The present study still demonstrates the potential of isotope studies to add to our knowledge about medieval Sámi culture and society. The results open

up some interesting possibilities and debates that should be explored further in future studies.

SITE DESCRIPTION AND FINDS

The animal bones analysed in the present study were found at the Bealjalgnai site, which is situated along the river Iešjohka, one of the larger waterways in inner Finnmark. This is a distinctly inland locality about 100 km from the nearest Atlantic coastline (Fig. 1). The site incorporates a dry-stone wall structure placed in the lower part of a scree sloping down towards the river from a small hilltop (Fig. 2). Large stone enclosures like this do not have demarcated entrances. They are made by removing stones from the inner floor, creating vertically straight inner walls, while the outer part of the walls are outward sloping until they align with the surrounding rocky terrain. The inner diameter of the Bealjalgnai structure is c 5 m and the height of the extant outer wall measures up to 130 cm from the surrounding ground level. The structure features an angular inner shape typical of so-called ‘Sámi circular offering sites’ (Spangen 2016; 2017), and remains of wood indicate another recurring feature: a wooden fence on top of the stone walls (cf. Vorren 1985: 75). It should be noted that this description is only valid for some of the monuments included in the category of ‘circular offering sites’, as the label has been employed rather liberally during the last few decades. It currently covers a range of stone circles and other structures that are probably remains of diverse cul-

tural activities from different time periods rather than one specific practice. The large kind of structure described above, however, constitutes a more coherent subtype that appear to have been built according to defined criteria and for a common use. This type is found mainly in inner fjords and inland Finnmark, with one other certain occurrence in northern Troms (Spangen 2016; 2017).

The general interpretation of the described structures as medieval or early modern Sámi offering sites rests on somewhat uncertain premises and may stem from later reinterpretations that were consolidated by a mid-19th-century scholarly hypothesis (Spangen 2013; 2016; 2017). The archaeological evidence, osteological find material and topographical locations of these structures, along with a range of comparable descriptions in historical and ethnographic sources, indicate that they were initially built and used as traps for wolves and other fur-bearing predators (Spangen 2016; 2017). However, it appears that the enigmatic structures were later made subject to local reconceptualisations as ritual sites, as illustrated by the early-20th-century local tradition among sedentary Sámi in Karasjok, who are said to describe the Bealjalgnai site as an old offering site (Nissen 1928: 184).

The stone structure at Bealjalgnai is mentioned in the overview of Sámi offering sites in Norway compiled by researcher Just Qvigstad in 1926 (Qvigstad 1926). Upon a visit in 1908, the local official and historian Kristian Nissen describes finding the cranium of a wolverine in

the middle of the stone circle (Nissen 1928: 185). The site was later investigated by ethnographer Ørnulf Vorren, who studied this sort of structure extensively, partly with excavations, in the latter half of the 20th century (e.g. Vorren 1956; 1985; Vorren & Eriksen



Fig. 2. The stone structure at Bealjalgnai, Karasjok, Finnmark, northern Norway. Photo: M. Spangen.

1993). He does not describe the specific bone finds made at Beajalgnai in his publications, and his field diary only reports that digging inside the stone circle produced bones from various animals from the 'lower cultural layer' (cf. Vorren n.d.). During a review and restructuring of his private archives in 2012–3, a collection of bones from the site were found together with some sketches indicating the finds' position relative to the structures on the site, which also include a shooting blind and two meat caches built into the scree. Osteologist Anna-Kaisa Salmi, University of Oulu, did a preliminary identification based on photos and determined the collection to include bones of canids, reindeer and sheep/goat. Four bones were selected for sampling and further analysed and identified by Professor Jan Storå at Stockholm University. These included dog, arctic fox, reindeer and sheep (see below).

In the following we will leave the debate about whether the structure was utilised as an offering site or a wolf trap in the Middle Ages, as this is thoroughly discussed elsewhere (Spangén 2016; 2017). Rather, we shall focus on the radiocarbon datings of the mentioned dog and sheep bones, their isotope signatures and the wider cultural-historical context of the presence and subsistence of these animals in medieval inland Finnmark.

THE ISOTOPE ANALYSES

Isotope analysis of collagen from archaeological skeletal material provides information about the intake of protein an individual has had during its

lifetime. Proteins are found in all kinds of vegetable and animal products (eggs, meat, fish, intestines, dairy products, etc.) and therefore give an essential picture of an individual's dietary intake. Bone material gives an indication of an individual's diet during the last 7–30 years of its life (Hedges et al. 2007), depending on the bone element. Teeth are representative for the individual's diet during different stages of its childhood, according to the age at which the teeth are formed, which varies somewhat depending on the species. It is possible to differentiate marine versus terrestrial food sources and freshwater sources with the means of the animal's carbon and nitrogen values ($\delta^{13}\text{C}$ and $\delta^{15}\text{N}$). The sulphur isotope $\delta^{34}\text{S}$ is used to study mobility patterns, as $\delta^{34}\text{S}$ represents the local geological background of the protein intake, whether consisting of vegetation, fish or animals.

There can be substantial differences in values from one time period to another, so it is important, when possible, to have animal references from the same time and geographical area as the site studied. The values retrieved from various samples are compared to established standards (PDB, AIR and VCDT) (Krouse 1980: 436; Richards et al. 2003; Sealy 2005: 270). Isotopes follow different rates of fractionation, and the relative values of, for instance, $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ are also important to understand the dietary intake. The $\delta^{13}\text{C}$ value of bone collagen, relative to the dietary protein, experiences an enrichment of +1‰ as trophic level increases (DeNiro & Epstein 1978). The $\delta^{15}\text{N}$ value is enriched by c 3–5‰ for each step

Sample	Site	Species	Element	Collagen (%)	$\delta^{13}\text{C}$ (‰)	$\delta^{15}\text{N}$ (‰)	$\delta^{34}\text{S}$ (‰)
BEA 1	Beajalgnai	<i>Vulpes lagopus</i>	Mandibula sin (<i>corpus</i>)	1.6	-	-	-
BEA 2	Beajalgnai	<i>Canis familiaris</i>	Ulna (<i>olecranon</i>)	3.5	-14.6	16.4	14.7
BEA 3	Beajalgnai	<i>Ovis/Capra</i>	Mandibula sin (<i>corpus</i>)	1.0	-18.6	11.3	-
BEA 4	Beajalgnai	<i>Rangifer tarandus</i>	Mandibula sin (<i>corpus</i>)	2.1	-	-	-
Mean value					-16.6	13.9	14.7
Standard deviation					2.8	3.5	-

Table 1. Stable carbon, nitrogen and sulphur values and the ^{14}C dating for all individuals from Beajalgnai

up the food chain (Minagawa & Wada 1984; Bocherens & Drucker 2003). The $\delta^{34}\text{S}$ values from bone collagen tend to be similar to the sulphur isotopic composition of the diet (Richards et al. 2003; Faure & Mensing 2005; Fornander et al. 2008), however, the values in single individuals depend on a range of factors. Nehlich demonstrates a certain difference in trophic shifts between fauna ($0.5\pm 2.4\%$) and human individuals ($0.8\pm 2.5\%$), though with a relatively high standard deviation (Nehlich 2015). A recent study instead argues for a depleting value of $-1.5\pm 0.8\%$ (Webb et al. 2017). These uncertainties have to be taken into account when using $\delta^{34}\text{S}$ values for studying mobility. Large differences in values between individuals will still be a plausible sign that they have resided in different environments.

In the Bealjalgnai study, four bone samples representing four different individuals were analysed, including mandibles from a reindeer (*Rangifer tarandus*), a sheep (*Ovis*) and an arctic fox (*Vulpes lagopus*), as well as an ulna from a dog (*Canis familiaris*). Bone powder was extracted from the corpus of the mandibular samples and the olecranon of the ulna. Collagen was extracted from the powder (according to Brown et al. 1988), and analysed in a mass spectrometer for carbon, nitrogen and sulphur isotopes at the Stable Isotope Laboratory at Stockholm University. Quality markers used to identify well-preserved collagen are the exchange of collagen ($>1\%$), the concentrations of carbon (15.3–47.0%), nitrogen (5.5–17.3%) and sulphur (0.15–0.35%), as well as the C/N (2.9–3.6)

and C/S (300–900) ratios (DeNiro 1985; Ambrose 1990; van Klinken 1999; Nehlich & Richards 2009). The results are shown in Table 1.

Although samples were taken from rather compact bone areas, the quality of the collagen was poor, which prompted a secondary collagen extraction. The relative lack of preserved collagen could be due to a range of different biological or mechanical processes, for instance direct exposure to weather after deposition or chemical weathering of the bone in acid soils (White & Hannus 1983). Cooking prior to deposition also causes organic deterioration and poor preservation of collagen (Collins et al. 2002). The later alternative is less likely in this case, since two of the animals were canids that would not be normally cooked and consumed, whether in a ritual or a profane context. Despite the relatively poor preservation, isotope values used in this study are valid according to the stated quality criteria for interpretation and discussion concerning dietary habits and reservoir effects on the radiocarbon datings.

When studying archaeological past diet and mobility it is necessary to establish a dietary baseline for comparison of the isotope values. The more local and time accurate the better. However, due to a lack of analysed medieval zooarchaeological material from the area in question, we refer here to previously published isotope studies of different species (i.e. cod, reindeer, sheep/goat, and brown bear) from a wider area of northern Fennoscandia (Barrett et al. 2011; Fjellström 2011; Salmi et al. 2015). This baseline runs from the most terrestrial at -21.9%

%C	%N	%S	C/N	C/S	Lab-index	BP	±	calAD (2σ)	calAD (2σ), corrected for MRE
-	-	-	-	-	Ua-48763	390	32	1440–1632	-
39.1	14.0	0.23	3.3	454	Ua-48764	804	35	1210–1280	1387–1487
31.7	10.2	-	3.6	-	Ua-48765	600	37	1305–1410	1404–1517
-	-	-	-	-	Ua-48766	390	35	1439–1632	-

with mean values and standard deviation (after Fjellström 2015b); MRE – marine reservoir effect.

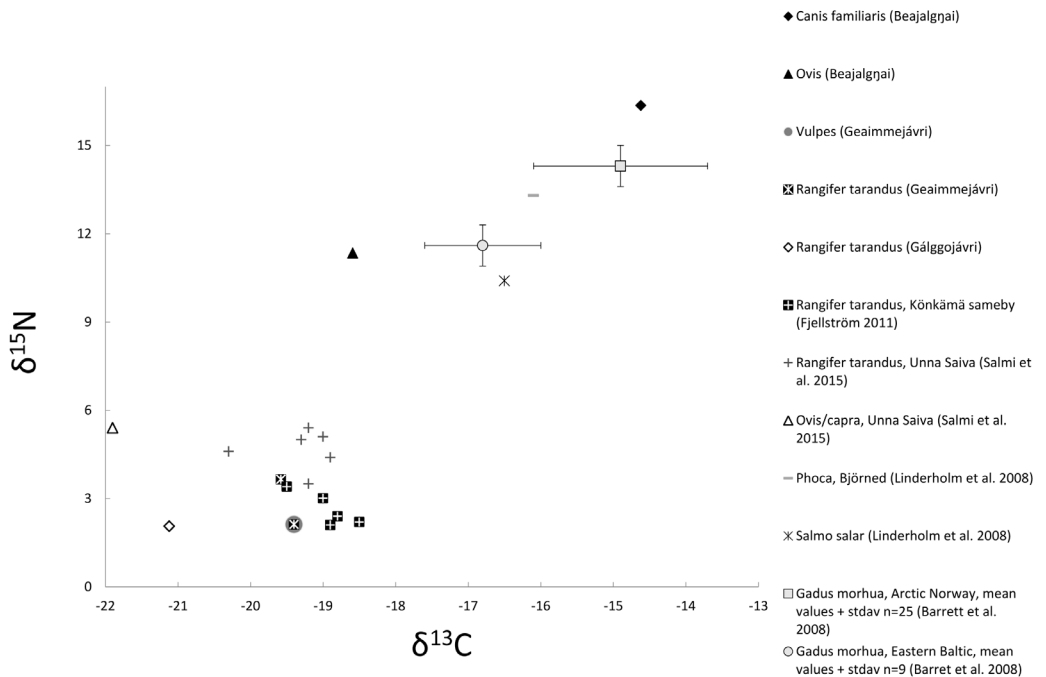


Fig. 3. Stable carbon and nitrogen values for the sheep/goat and the dog from Beajalgnai compared to isotope values of reindeer, a sheep/goat, a seal and salmon from Geaimmejávri, Gálggójávri, Könkämä sameby, Unna Saiva, Björned, and the Bothnian Sea. Illustration: M. Fjellström.

(a sheep/goat from the Unna Saiva Sámi offering site in inland northern Sweden) to the most marine at -12.4‰ (a cod from the medieval farm Helgøygården in northern Norway, representing the Atlantic coast).

Only two samples, from the dog and the sheep, contained collagen of good enough quality for measuring carbon and nitrogen values ($\delta^{13}\text{C}$, $\delta^{15}\text{N}$). The carbon isotope values measured in these two bones varied between -18.6‰ and -14.6‰ with a mean value and standard deviation of $-16.6 \pm 2.8\text{‰}$, while the nitrogen values varied between 11.3‰ and 16.4‰ with a mean value and standard deviation of $13.9 \pm 3.6\text{‰}$. The values for the dog clearly indicate that it fed mainly on non-terrestrial fodder, as evidenced by both high carbon (-14.6‰) and high nitrogen (16.4‰) values (Fig. 3). The sheep must have had a mixed diet with a carbon value of -18.6‰ and a relatively high nitrogen value for a sheep of 11.3‰ . This suggests an intake of protein from animals fairly high up in the food chain. As the sample was taken from an adult individual,

the increased levels cannot be due to suckling (Fjellström 2015b).

For this study, we tested the applicability of statistical analyses to estimate the ratio of various dietary intakes, using the Bayesian program Food Reconstruction Using Isotopic Transferred Signals (FRUITS). The method measures signals of dietary proxies in a consumer, considering different food sources (Fernandes et al. 2014). In the Fennoscandian inland context discussed here, we assume that nutrients originate from three different main natural environments: freshwater, marine and terrestrial species, whereof the marine nutrients could come from either the Atlantic coast or the Bothnian Bay. The analysis is therefore based on previous studies of isotope values in food sources from all these contexts (Berglund et al. 2001; Barrett et al. 2008; Linderholm et al. 2008; Fjellström 2011; unpublished data; Salmi et al. 2015; Dury et al. in press). The results indicate that approximately half of the dog's food intake was from freshwater sources, while the other half was from marine

sources. Only a very small percentage seems to come from terrestrial sources. The marine intake seems to be divided between an Atlantic and a Baltic origin. For the sheep, the FRUITS analysis indicates a distinct predominance of freshwater nutrients, as well as a substantial intake of terrestrial foods. The marine intake is less pronounced. An obvious challenge with FRUITS analyses is the question of how representative the faunal reference material and assumed food sources are for the individual studied. Nonetheless, taking into account food sources that are archaeologically or historically documented and cross referencing with available stable isotope results, FRUITS can be a helpful statistical tool to assess past diet.

Unfortunately, only the bone remains of the dog had enough collagen left to be analysed for sulphur, with results showing a value of 14.7‰ (Fig. 4). Few other local sulphur values are available. Thus, the dog was compared with sulphur values from five modern reindeer from the Könkämä Sámi village in northern Sweden (Fjellström 2011), some 180 km to the south-west of Bealjalgnai, six medieval reindeer from

Unna Saiva, somewhat further south-west of Könkämä (Salmi et al. 2015), as well as medieval reindeer bones from a similar stone enclosure by lake Geaimmejávri in the Karasjok mountains (Fjellström 2015a), only c 10 km from the structure at Bealjalgnai. Other research show that isotope values in contemporary individuals of the same species may differ considerably even between sites that are only 10 km apart (Sayle et al. 2016). Nevertheless, it is worth noting that the reindeer bone values from all three contexts closely resemble each other, while the dog bone has a distinctly different value. This substantiates that the dog was fed with proteins from another geographical area than the inland site of Bealjalgnai, where the bones were eventually deposited.

DATINGS AND RESERVOIR EFFECTS

Initially, the sheep was dated to 600±37 BP (calAD 1305–1410; Ua-48765) and the dog to 804±35 BP (calAD 1210–1280; Ua-48764) (Spangen 2016). However, radiocarbon datings of human and animal individuals with a

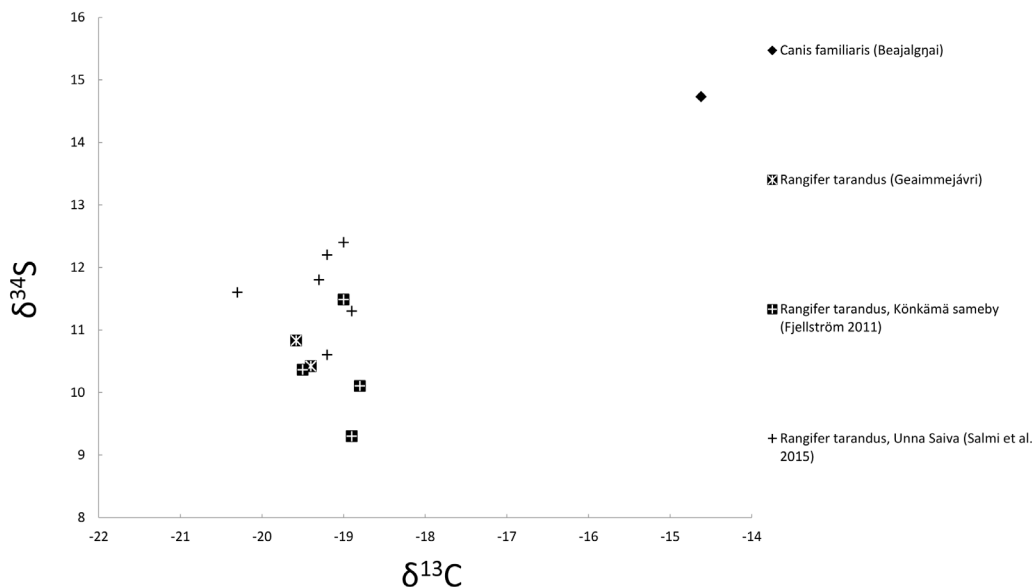


Fig. 4. Stable carbon and sulphur values for the dog from Bealjalgnai compared to isotope values of reindeer from Geaimmejávri, Könkämä sameby and Unna Saiva. Illustration: M. Fjellström.

pronounced marine diet may be affected by a marine reservoir effect of several hundred years (Stuiver & Braziunas 1993; Ascough et al. 2006; Mangerud et al. 2006). This is not necessarily the case for all marine species or for the individuals dated within this study, as the reservoir effect depends on the specific sources of marine proteins, which are difficult to determine in this inland context. A cautious evaluation still has to take into account that the age of the bones could be hundreds of years younger than the latest date indicated in the calibration results described above. Consequently, a new calibration has been made for this study based on an estimate of the animals' marine intake and using OxCal v. 4.3 (Bronk Ramsey 2009; Reimer et al. 2013).

Due to the previously mentioned uncertainties of the FRUITS analysis, the marine input was calculated according to the dietary baseline described above. As mentioned, there are issues with this method as well. The validity of the baseline depends on the assumption that material from a wider area and from several species are relevant to compare with the sampled material from Beajalgnai. It also assumes that the individuals sampled elsewhere are in fact representative for the area where their bone remains were found. At the moment, however, this is the most precise baseline that can be established. The results of the comparison with the baseline indicate a c 76% intake of marine proteins for the dog, which amounts to an estimated reservoir effect of 192 calibrated years, dating it to calAD 1387–1487 (2σ , i.e. 94.5% probability). Compared to the established baseline, the sheep may have had a marine intake of c 35%, resulting in an estimated marine reservoir effect of 103 years, thus dating it to calAD 1404–1517 (2σ).

The FRUITS analysis, on the other hand, indicated a smaller marine intake but also demonstrated a possibility that the sheep had a substantial intake of freshwater nutrients, in which case its dating could be influenced by a freshwater reservoir effect as well (Philippsen 2013). Further studies of local conditions and values in Finnmark would be desirable (cf. Lougheed et al. 2013), but a recent study assessing the freshwater reservoir effect for archaeological individuals in the northern Swedish mountains compared with modern samples from northern Troms in Norway shows very little or no such

effect (Dury et al. in press). This would suggest that a freshwater reservoir effect is not a major concern in inland Finnmark either.

As noted, we lack data about the exact type and amount of marine nutrients, which would be necessary to assess the marine reservoir effect on these specific bone samples accurately. Nevertheless, and even with the relatively small sample size and thus limited representativity, we would argue that the calibrated dating of the dog and the sheep to more or less the same medieval time period is plausible. The datings of two other animal bones from the Beajalgnai site, one from arctic fox and one from reindeer, to calAD 1440–1640 (Spangen 2016: 171–2; see also Table 1) substantiates that a contemporary or slightly older date is not unlikely for either the dog or the sheep. As described above, the bones of the arctic fox and reindeer were not preserved well enough to submit them to further isotope analyses. Considering the inland context it is unlikely that a species like arctic fox would have had a substantial intake of marine fodder. It is therefore assumed that its dating is not subject to a marine reservoir effect that would alter the calibrated date to any significant extent. Thus, we find it plausible that the dog and the sheep were deposited at the Beajalgnai site sometime in the late 14th or 15th century, and possibly even as late as the early 16th century, though the uncertainties relating to the estimates of their marine intake render this an approximation.

EARLY SÁMI SHEEP HUSBANDRY AND FEEDING PRACTICES IN MEDIEVAL FINNMARK

The presence of a sheep in Karasjok in the late 14th to early 16th century suggests an inland husbandry that challenges previous assumptions that medieval Sámi sheep husbandry in northernmost Norway was a coastal phenomenon. The latter supposition follows from the few sheep bone finds from medieval Sámi contexts in Finnmark and Troms counties, which are predominantly associated with coastal habitation sites. One example is the site of Geahčeváinjárga, on the peninsula of Angsnes in the inner part of the Varanger Fjord, eastern Finnmark. Here, several finds of sheep bones were made in an excavated *goahhti* turf hut (Gæččevajjar'ga 244B; cf. Odner

1992). Neither the hut itself, the bone finds nor the hearth have been radiocarbon dated. Some researchers have assumed a dating of the turf hut that corresponds with an AD 1400–1420/30 coin from Reval (Estonia) found nearby (Odner 2001), but a previous excavation of the midden outside the house yielded animal bones that where radiocarbon dated to 800 ± 70 BP (T-6544; Odner 1992: 171; Hambleton & Rowley-Conwy 1997). This dating was recalibrated for the present publication to calAD 1040–1297 (OxCal 4.2; Bronk Ramsey 2009; 2σ). Considering the results of the present study, the dated bone may be subject to the marine reservoir effect. Hence it could possibly date to the 15th century after all, but for different evidential reasons than argued in previous publications. The presence and extent of a reservoir effect would have to be confirmed through new multi-isotope studies of the bone. In any case, it represents an early presence of sheep on Sámi habitation sites.

Sheep bones were also found in a medieval Sámi *goahti* turf hut at Vuoppášgjeddi (Vapsgedden) on the island Spildra in the Kvænangen Fjord, northern Troms. These bones were indirectly dated by sampling birch charcoal found between the animal bones in a clearly intentional deposit against the back wall inside the house. The charcoal is radiocarbon dated to 375 ± 45 BP, calibrated in the original study to calAD 1450–1630 (T-11718; Grydland 1996: 35–6 and Appendix 4), coinciding well with the datings from Beajalgnai. Another deposit by the door consisted of an almost complete skeleton from a lamb of six to nine months, which was probably slaughtered in the autumn and that may indicate summer habitation (Grydland 1996: 30–3, 35–6; 2001: 37, 40–2).

Sheep bones in Sámi scree graves in Finnmark are of uncertain dates, but at least some of these are likely to be from the Middle Ages (Kleppe 1974: 113; Schanche 2000: 198–203). These graves also have a mainly coastal association. On Spildra, burnt bones from all parts of a sheep have also been found in a hearth dated to AD 895–1215. The find was interpreted as the remains of rituals (Schanche 2000: 150, 330). The hearth is one of six placed in a row on a pebble beach ridge, which is interesting considering the early dating of sheep bones from two sites with row-organised hearths in the Pasvik River

valley in eastern Finnmark. The latter is a distinctly inland region on the present border with Russia. Fragments of sheep bones were found in several of the hearths, of which one bone from hearth 3 at Brodtkorbneset was radiocarbon dated to calAD 990–1155 (Hedman et al. 2015: 14–5). Two samples of pine charcoal from the same hearth, from a branch and the outer layers of a trunk, were dated to calAD 1035–1280 (Hedman et al. 2015: Table 7). The dates testify to a much earlier inland Sámi husbandry in these eastern Sámi areas than previously assumed. The study in question suggests that the sheep at the Pasvik sites were in fact kept by Sámi who used the row-organised living space during autumn and winter, when they went hunting in the area. They probably also herded small reindeer flocks that would benefit from the good winter pastures around the site (Hedman et al. 2015). Sheep are not easily moved in deep snow, but later ethnographic sources about eastern Sámi from the same area document that sheep were kept and moved around on sleds in wintertime (Nickul 1948: 67; cf. Hedman & Olsen 2009: 16). Ethnographic records indicate that the Sámi groups in question may have spent spring and summer along the coast (Tanner 1929). Hence, it could be relevant to consider a marine reservoir effect on the dating of these sheep bones as well.

The sheep bone from Beajalgnai in Karasjok, some 150 km west of the sites in Pasvik, may suggest that, at least by the 15th century, sheep husbandry was not only a local occurrence in eastern Sámi areas but an integrated part of inland Sámi subsistence in northern Fennoscandia. Finds of sheep/goat bones dating to 664 ± 37 BP, calAD 1270–1400, on the Sámi offering site of Unna Saiva in Gällivare, northern Sweden, may be evidence of the same. The sample had a clear terrestrial isotope signature (Salmi et al. 2015). However, it can be argued that there are several possible explanations for the presence of sheep in these two contexts, especially since they are not directly related to habitation. There are historical records of Sámi further south buying domesticates from farmers on the coast especially for use as offerings (e.g. Rheen 1983[1671]: 59). This could perhaps have been the case with animals used as bait for predator traps too, as the structure in Beajalgnai is interpreted to be by the present authors. However, a more pronounced

protein intake of freshwater fish than marine nutrients suggests that the sheep in this case was, in fact, kept in an inland area – at least during winter when feeding was most necessary.

That medieval sheep fed on animal protein is a known phenomenon: along the coast in northern Norway, the limited access to hay has resulted in sheep and other livestock regularly being fed during winter with a mix of seaweed, lumpfish, fish heads and other food leftovers, as well as moss and hay. The mixture was boiled in large cauldrons and called *løypning* in Norwegian and *liepmasat* in North Sámi¹. This feeding practice persisted into the 20th century. Available historical and ethnographic sources do not mention a similar practice in the inland, but it is reasonable to think that sheep here may have been fed in a comparable way in the past.

Another possible explanation for the intake of animal proteins is that sheep were kept in similar situations as the domestic reindeer described in ethnographic sources about the eastern Sámi. These reindeer were kept close to the living areas, and would be attracted by sources of salt and fat. They could occasionally be found eating salted fish, licking fatty hides, and licking or gnawing wood utensils and bowls that had contained food (Itkonen 1948: 86). The amount of proteins high up in the food chain in the sheep's diet still suggests that it must have had more regular access to such food sources.

As described, the exact intake of marine nutrients is difficult to estimate based on the data currently available, but both estimation methods used in this study indicate a certain but less pronounced portion of marine proteins in the sheep's diet. Feeding on migrating salmon, which are abundant in the Iešjohka river in summertime, could give a certain marine signature. However, this does not coincide with the season when feeding with *løypning/liepmasat* is necessary, because the largest amount of salmon going up this waterway occurs between June and August, when grass and other herbs are relatively abundant.

Furthermore, these alternatives seem less likely when taking into account the dog's distinct marine food intake. While marine foods like dried cod may well have been available in inland Finnmark at the time, it would be surprising if animals were fed predominantly with such

non-local food. Assuming some connection between the dog, the sheep and the Sámi groups in the area around Beajalgnai, the marine intake of the dog could indicate that even the sheep did in fact stay in coastal areas for parts of its life. Here it may have consumed several types of food that could result in the marine signature. Plants in coastal areas can be subjected to an effect of sea-spray, which could lead animal individuals grazing on them to have similar sulphur isotopic values to a seawater-based diet (Wadleigh et al. 1994). This is also the case for animals that feed on seaweed (Schulting et al. 2017). The marine intake could of course also be due to intentional feeding of the sheep on the coast with *løypning/liepmasat* made from marine sources when other feeding options proved scant, for instance in early spring. Irrespective of the exact source of the marine intake, it is important to acknowledge that the marine isotope values may be the result of a physical proximity to the ocean in parts of the sheep's life.

SÁMI MEDIEVAL MOBILITY AND TRANSHUMANCE?

While the traces of some marine nutrients in the sheep bone may have several possible explanations, the values in the dog bone indicate an amount of marine food that is peculiar for the inland find location. As mentioned above, it seems unlikely that animals in this area would be fed with non-local fish, even if this was available. Rather, it appears that the dog lived some of its life along the coasts. The FRUITS analysis may even suggest an alternate intake of food from the Atlantic Ocean and the Baltic Sea. As with the sheep, this could be explained by the dog being bought on the coast and brought to the inland, possibly specifically for deposition in the particular context at Beajalgnai. In the present authors' opinion, the dog was used as bait in a wolf trap (cf. Spangen 2016), while the traditional interpretation would be that the animal was placed there as an offering (cf. e.g. Nissen 1928; Voren 1985). If the dog was purchased, its diverse dietary intake may suggest trading partners that travelled extensively and possibly from coast to coast. The so-called *birkarl* merchants of northern Sweden and the Bothnian Bay are obvious candidates. The *birkarls* dominated the trade in

furs with the inland Sámi in the area, but they also traded extensively in dried fish from the Atlantic coast, at least from the 14th century onwards, as well as other goods (Hansen & Olsen 2014: 153–5, Bergman & Edlund 2016). This may have included live animals to some extent. Another possibility is that the inland Sámi travelled to and traded at the coast themselves, as attested in historical sources about certain coastal market places, of which some are known to go back at least to the 16th century (Hansen 1984; 1990).

A third option is that the isotope values in the dog are the result of following its Sámi owners to coastal settlement sites on a seasonal basis. This would suggest more extensive mobility than generally assumed for the inland Sámi in Finnmark in the time period in question. The historically known seasonal moves from the inland to the coast have been associated with the development of more extensive reindeer herding in the 18th century. A previous reconstruction of the *siida* territories of the pre-reindeer herding Sámi in Finnmark, based on an assumed livelihood of hunting, gathering and fishing, presents relatively confined *siida* areas defined by the watersheds of the larger river valleys and their associated resources. In this model, the inland *siidas* do not stretch out to the coastline (e.g. Vorren 1978; 1979). The present study could imply that Sámi groups in inner Finnmark regularly moved between the inland and the coast.

Assuming the sheep's isotope values are evidence of it being kept and fed in Karasjok in wintertime corresponds well with the recent interpretation of the 'circular offering sites' as wolf traps related to Sámi winter habitation sites. The distribution of these large structures is geographically mutually exclusive to known summer habitation sites on the coast (Spangen 2016: 206). The latter are identified through remains of *goahhti* turf huts in the fjords and stone spiral labyrinths by deep water fishing sites on the outer coast (Odner 1961; Olsen 2002; Hansen & Olsen 2014: 59–60).

In principle, this mobility pattern is also in accordance with 16th-century sources that describe how the Sámi in Finnmark moved four times a year. In spring they were said to live by the seaside, presumably in the inner fjords. In summer they lived in the outer part of the fjords, in

autumn they lived 'by the seaside' again, while in winter they would live in the 'mountain forests', where there was freshwater and rivers, and hunt reindeer, and other animals, birds, and so on (Storm 1895: 232). The source does not say whether these mountain forests could include areas as far away from the fjords as Karasjok, and it is unclear if the information only applies to Sámi groups encountered along the coast. Studies of tax records testify to movements between the inland and the coast in the late 16th century, but seasonal movements are difficult to trace in this historical material (Hansen 2013: 84–5).

While the bone finds from the Beajalgñai site may point in the direction of long-distance seasonal moves, we cannot say for certain whether the animals were only moved once from the coast to the inland, or if this was a recurring event, since the isotope analyses were performed on bone samples that reflect the total dietary intake over several years. For studies of seasonal moves, it would be beneficial to do strontium analyses of the enamel of teeth, preferably using so-called laser ablation, which can show dietary change through the year.

FUTURE STUDIES

The results of the limited study presented here raise some interesting possibilities and questions. At the moment, however, the lack of local comparative material limits the possible conclusions. It is necessary to gather more samples, preferably from both animal species and contemporary human osteological material, as well as geological background reference values, to establish a more accurate dietary baseline and to provide more precise input for FRUITS analyses.

Studies of Sámi subsistence and mobility patterns based on isotope analyses are currently subject to many uncertainties. They still have the potential to clarify Sámi regional territorial use in the Middle Ages, which has otherwise been difficult to reconstruct in northernmost Norway. Historical sources can only account for the geographical territorial situation back to c 1700, by which time the increased Scandinavian and Russian fiscal, legal, religious and administrative involvement in these areas, as well as changes in the Sámi economic basis, had already had sub-

stantial impact on the local Sámi territorial use (e.g. Vorren 1978; 1979; Olsen 1987; Hansen 2006; Hansen & Olsen 2014; Hood 2015). Despite the limited sample size in the present study, it contributes to a growing body of published comparative material that can provide the foundation for interesting future studies of medieval Sámi societies in the north.

Integrating isotope analyses into more archaeological studies in northern Fennoscandia can also provide more accurate of $\delta^{13}\text{C}$ measurements and thus more precise marine and freshwater reservoir effect estimates for radiocarbon datings. As demonstrated in this article, this is not only relevant for carnivores or species living in water but even for herbivores in inland areas, which are usually assumed to be less affected by such dietary issues.

CONCLUSION

Radiocarbon dating and stable isotope analyses of bone remains from a dog and a sheep found at Beajalgnai in Karasjok, Finnmark, have proven a medieval dating, and that the animals were fed with substantial amounts of aquatic nutrients. The marine intake suggests they are likely to have stayed in coastal areas for parts of their lives. The results combined with other sources about the cultural historical context may indicate earlier sheep husbandry in this part of inner Finnmark than previously thought, and a possible coast-inland mobility pattern. The sample is small and there are several uncertainties related to the dietary baseline and statistical method used, due to the general lack of local comparative material. The study still demonstrates the potential use of isotope analyses to trace individual movements, human-animal relationships and related social and historical developments. Further isotope analyses of bone finds from inland and coastal areas would provide much needed comparative material and contribute to discussions about Sámi husbandry, mobility and territoriality in medieval northern Norway. Such studies would also improve the estimates of marine and freshwater reservoir effects in, and thus the accuracy of, radiocarbon datings of both human and animal bones from northernmost Fennoscandia.

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NOTES

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