Isotopes and individuals: diet and mobility among the medieval Bishops of Whithorn

Gundula Müldner[1], Janet Montgomery[2], Gordon Cook[3], Rob Ellam[3], Andrew Gledhill[2] & Chris Lowe[4]

Stable isotopes get personal in this analysis of burials at a medieval cathedral. Compared with the local meat-eating rank and file, those people identified as bishops consumed significantly more fish and were incomers from the east. These results, while not so surprising historically, lend much increased confidence that isotope analysis can successfully read the status and mobility of individuals in a cemetery.

Keywords: Britain, medieval, bishops, clergy, stable isotopes, diet, mobility, social rank

Method

Introduction

Isotope analyses of human skeletal tissue allow the assessment of diet and mobility at the level of individuals. These methods, on their own, are powerful tools for advancing our understanding of the past, but they are most valuable where the isotope data can be integrated with rich contextual evidence. Particularly interesting and potentially very fruitful, are those occasions where samples can be tested against known archaeological contexts and documentary evidence, or even applied to historically attested persons.

Renewed work on the archives of the 1957-67 excavations at Whithorn Cathedral Priory, Dumfries and Galloway, Scotland, recently afforded an opportunity to analyse the remains of thirteenth- and fourteenth-century bishops and clerics of Whithorn Cathedral (Lowe 2009). This was a rare chance to explore the life histories of a well-defined group of people in medieval British society, to test common assumptions about their lifestyle and to contrast them with lay individuals from the same site. We present here the results of this investigation as an example of how isotope methods can be integrated with archaeological and historical evidence in order to provide a novel perspective on the study of medieval burials.

1 *Department of Archaeology, University of Reading, Whiteknights, PO Box 227, Reading RG6 6AB, UK (Email: g.h.mueldner@reading.ac.uk)*
2 *Division of Archaeological, Geographical and Environmental Sciences, School of Life Sciences, University of Bradford, Bradford BD7 1DP, UK*
3 *Scottish Universities Environmental Research Centre, Rankine Avenue, Scottish Enterprise Technology Park, East Kilbride G75 OQF, UK*
4 *Headland Archaeology (UK) Ltd, 13 Jane Street, Edinburgh EH6 5HE, UK*

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Whithorn Cathedral Priory and town

Whithorn (*Candida Casa*) is situated on the Machars Peninsula in the historic county of Wigtownshire in south-west Scotland (Figure 1). According to tradition, it was founded by Ninian, first missionary among the Picts, in the early fifth century AD. Excavations have shown the presence of a possibly monastic settlement from at least the early sixth century and the Venerable Bede, writing in or before AD 731, reported the recent establishment of a Northumbrian bishopric at Whithorn (Bede *HE* iii,4 (Colgrave & Mynors 1979: 222-3); Hill 1997; Fraser 2002). In the eleventh and twelfth century, Whithorn expanded into one of the first urban settlements in Scotland. Until the Reformation, it was an important ecclesiastical centre, with a priory of Premonstratensian canons attached to the cathedral from *c*. AD 1177. Its sacred focus was the shrine of St Ninian, which attracted large numbers of pilgrims from the British Isles, Ireland and continental Europe. The Bishops of Whithorn presided over the province of Galloway in south-west Scotland which, in the medieval period, formed part of the archdiocese of York (Yeoman 1999; Oram in Lowe 2009).

Burial at Whithorn Cathedral Priory

A concentration of burials in the presbytery, in immediate proximity to the presumed location of the shrine of St Ninian, was revealed by excavations in the east end of the medieval cathedral under the direction of P.R. Ritchie from 1957. These burials, in the most prestigious location a medieval church afforded, were clearly of very high status. Several of the individuals were interred in stone cists, in one case a stone-built chamber, and various graves contained liturgical objects and other artefacts that identified several of the deceased as high ranking clerics (Lowe 2009; see also Gilchrist & Sloane 2005). At least three individuals were identified by name as former Bishops of Whithorn, on the basis of detailed analysis of the archaeological contexts and historical records combined with evidence from the osteological assessment and radiocarbon dating of the human remains. Others could not be matched with historical personae but are identified as priests by their accompanying artefacts. These men were presumably high ranking clerics at the cathedral chapter or the wider diocese (Lowe 2009; see Table 1).

In order to investigate aspects of the lifestyle and life-history of senior clergy at one of medieval Scotland's most prominent cathedral churches, bone and tooth samples of six of the presumed bishops and priests were submitted for isotope analysis of carbon, nitrogen, oxygen and strontium for the reconstruction of diet and mobility. These data were compared with a 'control group' of eight individuals which were selected from among other burials around the shrine, a charnel deposit, and an earlier phase open-air cemetery which was levelled in the early thirteenth century. They probably represent the remains of lay benefactors along with other individuals of unknown rank. Radiocarbon dates, obtained for all individuals in the sample, indicate that their lives covered a period of about 400 years, from the eleventh to the late fourteenth century (Lowe 2009).

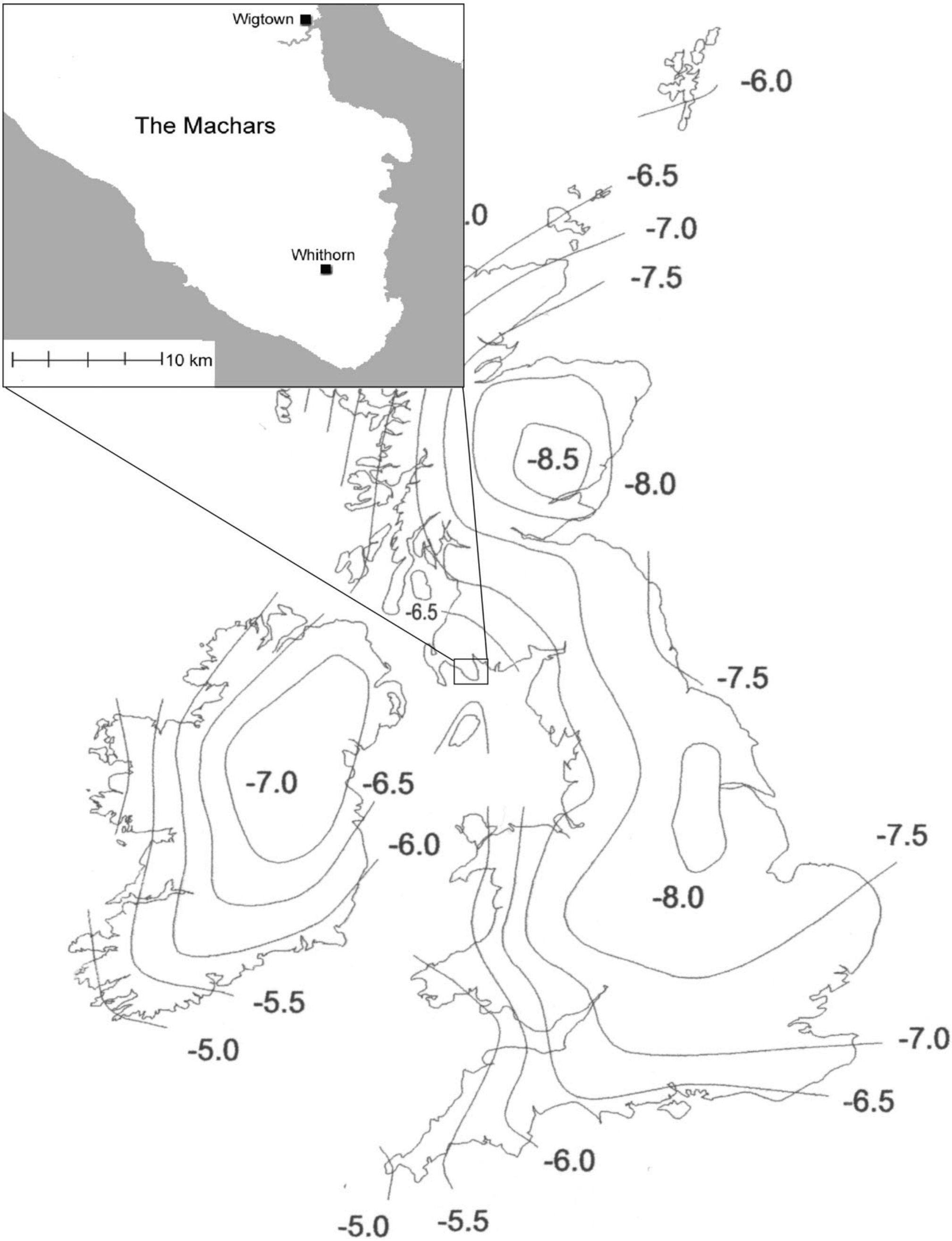

Figure 1. Location of Whithorn in south-west Scotland projected on an oxygen isotope map of Britain (adapted from Darling et al. *2003).*

Table 1. Isotope data and collagen quality indicators for humans from Whithorn. For more detailed archaeological information and individual identifications see Lowe (2009).

SK no.	Sex	Status	$\delta^{13}C$	$\delta^{15}N$	%C	%N	C/N	% Coll	Tooth	$\delta^{18}OCO_3$ (VSMOW)	$^{87}Sr/^{86}Sr$	Comments
1	M	Bishop	−19.4	13.2	44.2	16.2	3.2	9.6	P_3	27.9	0.71180	presbytery; stone cist; crozier; ring; chalice; paten
2	M	Priest	−19.2	12.0	43.6	16.3	3.2	7.3	P^3	27.0	0.71043	presbytery; stone cist; chalice; ring
3	M	Bishop	−19.3	13.5	45.3	16.8	3.2	8.1	C_1	27.6	0.71030	presbytery; stone chamber; crozier; ring
4	M	Priest	−18.9	13.3	43.8	16.3	3.2	7.5	P_4	27.8	0.71038	presbytery; chalice; paten
5	M	?Priest	−19.3	12.3	44.0	16.3	3.2	7.8	P_3	27.5	0.71037	presbytery; stone cist
8	M	?Priest	−20.0	11.5	45.6	16.9	3.2	9.8	P_3	28.3	0.70993	presbytery; stone cist; cleft palate
6	F	Lay	−19.6	11.9	44.6	16.6	3.2	6.1	–	–	–	presbytery
9	F	?Lay	−20.2	11.2	44.1	16.7	3.1	8.1	P_3	28.9	0.70959	charnel deposit
15	n.d.	?Lay	−19.4	12.0	44.1	16.5	3.2	5.6	P^4	28.5	0.70992	presbytery; adolescent
17	M	?Lay	–	–	–	–	–	–	I^2	28.8	0.70973	pre- *c*. AD 1200 cemetery
18	M	?Lay	−20.6	11.3	44.4	16.3	3.2	5.3	P_4	28.5	0.71005	pre- *c*. AD 1200 cemetery
19	F	Lay	−21.1	11.1	44.1	16.3	3.3	5.2	P_3	31.3	0.70920	pre- *c*. AD 1200 cemetery
23	M	?Lay	−21.1	11.0	41.1	14.8	3.3	3.5	M_3	28.8	0.70971	pre- *c*. AD 1200 cemetery
24	M	?Lay	−21.0	10.5	43.9	16.2	3.2	5.8	–	–	–	pre- *c*. AD 1200 cemetery

Isotope analyses of human remains

The isotopic compositions of skeletal tissues reflect those of the foods consumed by individuals over the time of tissue formation, over several decades for bone and over a period of a few years in childhood for teeth. While the isotope ratios of some elements vary mainly between different foods and are therefore useful for reconstructing diet, others are subject to change due to geographical factors and therefore offer information on whether individuals were of local or non-local origin (see Sealy 2001 and below).

Carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) stable isotope ratios in bone collagen give an indication of the main types of dietary protein consumed. In European archaeology, $\delta^{13}C$ values are mainly used to distinguish between the consumption of terrestrial and marine foods. $\delta^{15}N$ values increase systematically by trophic level and therefore serve as an indicator of plant *versus* animal protein in the diet, although they cannot distinguish between meat and dairy products from the same animals (Ambrose 1993).

Strontium ($^{87}Sr/^{86}Sr$) and oxygen ($\delta^{18}O$) isotope ratios for the reconstruction of mobility are analysed in tooth enamel, not only because this preserves an isotopic 'signature' typical for the place of residence in childhood, but also because enamel has been shown to be largely resistant against post-mortem alteration. Strontium isotope ratios in the biosphere are mostly dependent on the underlying geology, although other factors, especially strontium dissolved in rainwater and transferred over large distances, can have a significant impact on the 'local' strontium isotope signature (Bentley 2006; Montgomery *et al.* 2007). Oxygen stable isotope ratios are analysed either in enamel phosphate or carbonate. They chiefly reflect the isotopic composition of drinking water, which in turn is usually the equivalent of the local precipitation (Longinelli 1984; Bryant & Froelich 1995). The $\delta^{18}O$ of rainwater varies according to numerous climatic factors, most prominently temperature, latitude, altitude and distance from the coast (Dansgaard 1964; Bowen & Wilkinson 2002).

While there is now a growing body of medieval palaeodietary data from both Britain and the Continent (see Müldner, in press), applications of strontium and oxygen isotope analysis in post-Roman archaeology have been relatively few and have focused almost exclusively on historically attested migration events, such as the Anglo-Saxon migration or the Norse colonisation of the North Atlantic (Montgomery *et al.* 2003, 2005; Price & Gestsdóttir 2007). This study therefore represents the first time these isotopic techniques have been combined in order to investigate diet and life history in a late medieval context.

Results

The carbon and nitrogen stable isotope ratios for the human subjects (Table 1) are compared with medieval animal data from a neighbouring site (Table 2).

Diet (Figure 2)

The human data reflect a diet which was mostly based on terrestrial foods produced in a C_3-ecosystem, as would be expected for Britain. However, there is a strong positive correlation between $\delta^{13}C$ and $\delta^{15}N$ ($r^2 = 0.72$; $p < 0.001$) and the offsets between mean herbivore $\delta^{13}C$ ($-22.0 \pm 0.3‰$) and the humans with more ^{13}C enriched values are greater than is normally

Table 2. Carbon and nitrogen stable isotope data for medieval animals from Whithorn. The samples were obtained from the excavations at Fey Field, immediately west of the priory compound (McComish & Petts 2008). Note that nitrogen isotope ratios for most herbivores are high in comparison with other medieval British sites and are likely influenced by the coastal location and the vast expanses of salt marshes in the Wigtown Bay area (see Britton *et al.* 2008).

Sample	Species	$\delta^{13}C$	$\delta^{15}N$	%C	%N	C/N	%Coll.
WHA-1	cattle	−22.4	6.4	41.3	13.3	3.6	2.2
WHA-2	cattle	−22.3	9.3	42.5	14.6	3.4	3.5
WHA-4	cattle	−21.7	7.6	41.8	14.5	3.4	4.7
WHA-5	cattle	−22.1	7.4	43.3	14.7	3.4	3.8
WHA-6	cattle	−22.4	4.9	43.5	15.1	3.4	5.4
WHA-15	sheep/goat	−22.0	9.3	22.9	7.9	3.4	6.9
WHA-16	sheep/goat	−21.8	8.2	43.4	15.0	3.4	5.1
WHA-17	sheep/goat	−22.3	7.8	41.6	13.5	3.6	2.3
WHA-18	sheep/goat	−22.3	9.0	37.7	13.2	3.3	8.0
WHA-19	sheep/goat	−21.7	7.0	31.3	10.6	3.4	4.1
WHA-20	sheep/goat	−21.4	6.2	43.8	15.7	3.3	9.7
WHA-23	pig	−20.9	11.2	41.2	14.8	3.3	10.6
WHA-24	pig	−21.8	12.0	41.1	13.0	3.7	1.9
WHA-26	pig	−21.6	7.3	44.5	15.9	3.3	4.5
WHA-27	pig	−20.1	11.3	44.3	15.9	3.3	19.7

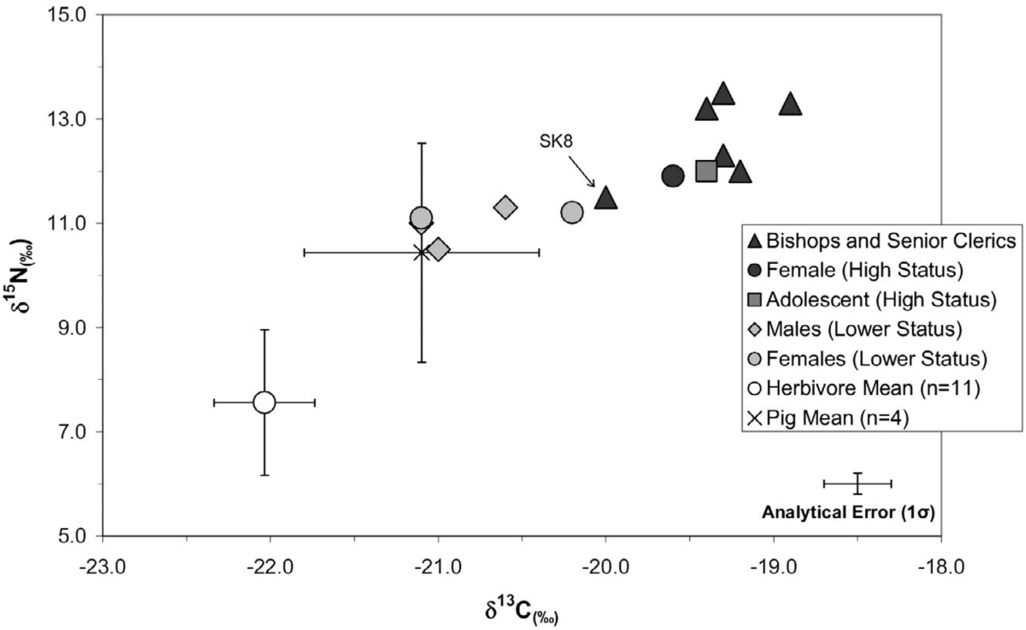

Figure 2. Carbon and nitrogen stable isotope data of high and lower status individuals from Whithorn Cathedral in comparison with average values ($\pm 1\sigma$) for Whithorn fauna.

observed for a single trophic level shift (up to 3.1‰). Data like these are characteristic of many high and later medieval sites in England and indicate the incorporation of marine foods into a predominately terrestrial diet (see Müldner & Richards 2007b). The importance of sea fish as a dietary staple in medieval Britain is well documented and fishbone recovered from the Whithorn excavations attest to its consumption at the priory (Hamilton-Dyer in Hill 1997: 601; Serjeantson & Woolgar 2006).

When the isotope data are compared with the archaeological evidence, it emerges that – with one exception (skeleton no. 8, see discussion below) – individuals from the presbytery (the senior clerics as well as one female and an adolescent (~12 years) interpreted as high status lay benefactors) display the most enriched carbon and nitrogen isotope ratios. This suggests that they consumed significantly more marine protein than their lower status counterparts, for whom a marine component in the diet is not actually detectable (independent sample t-test presbytery *vs.* other locations: $t_{(11)} = 7.13$, $p < 0.001$ for $\delta^{13}C$ and $t_{(11)} = 3.99$, $p < 0.01$ for $\delta^{15}N$).

It is possible that the dietary differences observed at Whithorn Cathedral are partly chronological. Four of the lower status individuals are from a cemetery which was built over after *c*. AD 1200; however, the radiocarbon dates place at least two of these burials at the very end of the twelfth century or later (Lowe 2009) and therefore at a time when the medieval sea fisheries are already well documented (see Barrett *et al.* 2004; Serjeantson & Woolgar 2006). Chronological change alone is therefore not a sufficient explanation for the very clear isotopic differences observed between the two groups (see Montgomery *et al.* in Lowe 2009 for further discussion).

Medieval society was very hierarchical and class distinctions were frequently expressed through differential access to food and its conspicuous consumption (Dyer 1998). Fish had a special significance as a fasting food, consumed among the upper classes in particular, whenever the church calendar required abstinence from meat as a sign of religious austerity – usually every Friday and Saturday as well as during the weeks of Lent and Advent (Woolgar 2000). Ecclesiastical and monastic superiors typically kept a separate table at which more elaborate dishes would be served, including more fish than in the ordinary messes. This is documented, for example, for the abbots of Westminster (Harvey 1995: 49).

Given this historical context, the finding that senior clerics and other high status individuals at Whithorn evidently consumed significantly more marine fish than their lower status contemporaries is not actually surprising. Nevertheless, status differences like these are rarely so clearly expressed in isotope data, which only give a very general picture of diet and more often than not blur rather than accentuate variation between individuals (see Müldner & Richards 2007a). The carbon and nitrogen isotope data from Whithorn are therefore an excellent illustration of the substantial differences in standards of living between different groups in medieval society.

Mobility (Figures 3 and 4)

The oxygen and strontium isotope evidence from Whithorn Cathedral presented here are the first such data from south-west Scotland. Consequently, no local isotopic baseline for

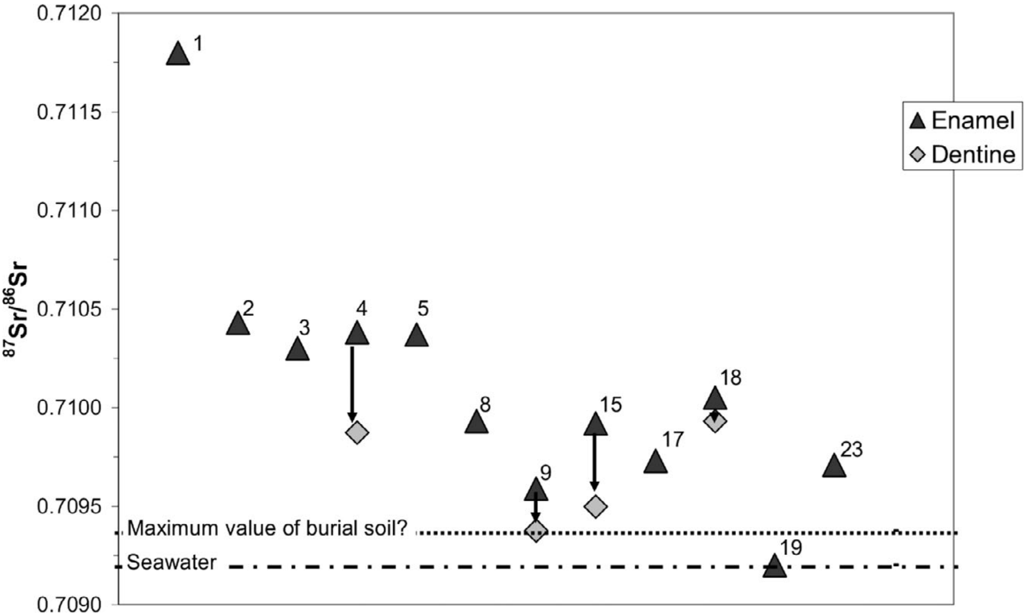

Figure 3. $^{87}Sr/^{86}Sr$ *ratios for tooth enamel and dentine samples from Whithorn. Numbers refer to skeleton numbers. Note that all dentine data converge to a common value (see text).*

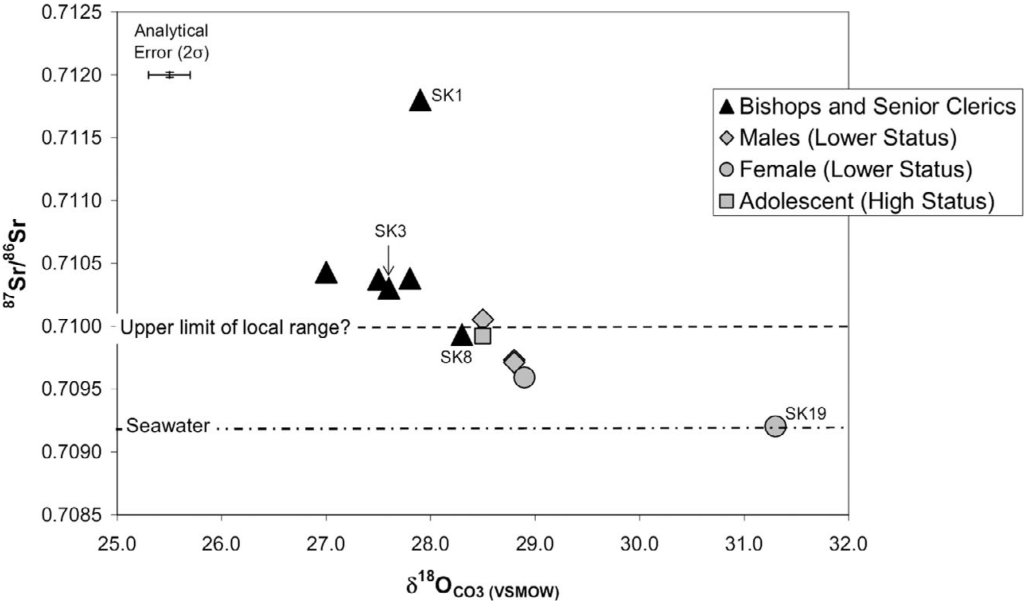

Figure 4. Dental enamel oxygen and strontium isotope data for individuals from Whithorn. Also given is the local $^{87}Sr/^{86}Sr$ *range which is expected to fall between that of modern seawater strontium and 0.7100 (see text).*

the Whithorn area is available. In order to help assess the strontium isotope range of the local biosphere, dentine of four of the human teeth was processed alongside the enamel samples (Figure 3).

The rocks that crop out in the vicinity of Whithorn are Silurian sedimentary shales and sandstones (British Geological Survey 1977, 2001) and it could be predicted that biosphere strontium should reflect the significant age of these rocks (Capo *et al.* 1998). Mineral waters hosted by Silurian and Ordovician rocks in Wales have strontium ratios ranging from 0.7117 to 0.714 (see Montgomery *et al.* 2006). Conversely, the strontium isotope ratios of enamel and dentine samples from Whithorn, with the exception of one outlier (SK1), are significantly less radiogenic and fall between the values of 0.7104 and 0.7092. All four dentine samples have lower $^{87}Sr/^{86}Sr$ than the corresponding enamel, a trend which is known to reflect the incorporation of varying quantities of strontium from the burial environment into the dentine (Figure 3; see Montgomery *et al.* 2007). The $^{87}Sr/^{86}Sr$ of the mobile strontium in the burial soil can therefore be estimated at or below 0.7094, the lowest dentine value obtained (SK9). While this is seemingly in contradiction to the higher values predicted by the geology around Whithorn, several studies on coastal and island communities in Britain have shown these to have biosphere $^{87}Sr/^{86}Sr$, which reflect their maritime location rather than the underlying bedrock. Despite the variable and often ancient rocks in places like Anglesey, Lewis, N. Uist, Skye, Orkney and Shetland, human and animal tissues from these locations exhibit a small range of strontium isotope ratios between 0.7092 and 0.7100 (Montgomery *et al.* 2003, 2007; Montgomery & Evans, unpubl. data). These data suggest that biosphere values in coastal regions are dominated by marine strontium ($^{87}Sr/^{86}Sr$ of modern seawater ~0.7092, see Capo *et al.* 1998) which may have entered the food chain from a variety of sources, not only by the consumption of marine products but also through rainwater, sea spray and crops fertilised with seaweed or grown on shell-sand. Whithorn's location about 3km from the coast as well as the trajectory of the dentine samples towards the value of seawater strontium strongly supports this also being the case here. This would suggest that the individuals with values below 0.7100 are of local origin and those with ratios exceeding 0.7100 are not.

To date, the majority of oxygen isotope data for archaeological humans from Britain have been obtained on enamel phosphate. There is very little published human data from biogenic carbonate ($\delta^{18}O_{carb}$) of any time period and therefore no directly comparable data against which to interpret the Whithorn results. Although the $\delta^{18}O_{carb}$ data presented here may therefore not be useful in absolute terms, until a greater comparative dataset is available, their relative distribution nevertheless holds important information. The oxygen stable isotope composition of modern drinking water in the UK is relatively well known through the work of Darling and colleagues (2003; Darling & Talbot 2003). It varies in a predictable manner across Britain, from more positive values along the western and southern coasts (the areas affected by the Gulf Stream) to more negative values further inland and to the east (see Figure 1). Prehistoric humans from sites in north-east England, who appear from their strontium ratios to be of local origin, have mean $\delta^{18}O_{carb}$ (VSMOW) ranging from ~25-27‰ (Montgomery & Grimes, unpubl. data). The human data from Whithorn are slightly more positive (mean value 28.1±0.6‰, outlier SK19 excluded), which would be consistent with the aforementioned east-west gradient in the oxygen isotope map of Britain.

There are two early-forming teeth in the sample, which might give slightly enriched $\delta^{18}O$ (Wright & Schwarcz 1998; see Table 1). However, these are allowed for in the interpretation presented here.

When the $\delta^{18}O_{carb}$ from Whithorn are plotted against the strontium isotope data (Figure 4), it is apparent that, with the exception of two outliers (SK1, SK19), the samples show a remarkably good correlation ($r^2 = 0.88$; $p < 0.001$), with oxygen isotope values becoming more ^{18}O depleted as $^{87}Sr/^{86}Sr$ increases. In terms of the geography of western Scotland, the negative direction of the correlation makes sense: as one moves away from the coast and further inland, the amount of marine strontium with a relatively low $^{87}Sr/^{86}Sr$ of 0.7092 in the biosphere will decrease and biosphere values will gradually reflect more and more of the much higher $^{87}SR/^{86}SR$ of the underlying bedrock. At the same time, because of the east-west gradient of drinking water $\delta^{18}O$ across the UK, human oxygen isotope ratios will become increasingly negative. The oxygen and strontium isotope data from Whithorn are therefore consistent with a mixed group of individuals, some of whom spent their childhood in or close to Whithorn itself, and others who moved there from further inland.

As with the dietary evidence, when these data are correlated with the archaeological status groups, a remarkably clear pattern emerges. If we accept that 0.7092-0.7100 is a reasonable estimate for the local $^{87}Sr/^{86}Sr$ range (see above), then it seems that none of the high ranking clerics grew up in the Whithorn area, with the exception again of SK8. Instead, their isotope values suggest childhoods further east or north and at greater distance from the coast. Although strontium and oxygen in skeletal tissues are ultimately derived from the food and drink consumed by individuals, this variation cannot simply be the result of the dietary differences discussed above. It is those individuals whose carbon and nitrogen data indicate the *least*, if any, consumption of marine protein that exhibit the most 'marine' strontium values. SK1 is a clear outlier in that his $^{87}Sr/^{86}Sr$ (0.7118) shows little influence of marine strontium. It is indicative of origins in a region of Cambrian or Lower Palaeozoic rocks, such as Devonian sandstones and Silurian or Ordovician sedimentary rocks (Evans & Tatham 2004; Bentley 2006; Montgomery *et al.* 2006, 2007). These dominate the geology of southern Scotland up to the Southern Uplands Fault but also crop out further north, especially along the Highland Boundary Fault (British Geological Survey 1977).

The $^{87}Sr/^{86}Sr$ ratios of the lay and lower status individuals are consistent with childhoods spent in the Whithorn area. Their $\delta^{18}O_{carb}$ cover a very small range and therefore also suggest a common origin. An exception is SK19. Her tooth enamel is significantly more ^{18}O enriched than the others, suggesting geographical origins somewhere considerably warmer and at lower latitude than Whithorn. Her $^{87}Sr/^{86}Sr$ is consistent with a coastal location but it is also characteristic of biospheres hosted by most sedimentary rocks dating from the Mesozoic, which occur extensively across England and southern Scotland. As a consequence, it is unfortunately not a particularly diagnostic ratio (Montgomery *et al.* 2003, 2007). While the oxygen isotope data appear inconsistent with origins in the UK, an alternative explanation may be that her main source of childhood drinking water was subjected to constant and considerable evaporation. Darling *et al.* (2003) observed such a mechanism in small lochs in the Shetland Isles which were exposed to strong and persistent wind and gave the most ^{18}O enriched freshwater values in the UK. Unfortunately, there is currently no published oxygen isotope evidence from inhabitants of places such as Shetland to assess whether this enrichment is also seen in the human data. While the presence of an individual from this far afield in medieval south-west Scotland may seem surprising, it is worth remembering that the shrine of St Ninian was a prominent place of pilgrimage which attracted many visitors from Britain and abroad (Yeoman 1999: 39).

Identifying the Bishops

The roles of high ranking clerics in the medieval church were not purely spiritual, they held senior administrative posts and often had important political functions in the secular life of the realm (Southern 1990). Galloway was a relatively independent border province whose regional powers were frequently in conflict with the Scottish crown (Barrell 2000). This struggle for authority was repeatedly reflected in disputes over successors to the Whithorn bishopric who were usually senior clerics at prominent Scottish monasteries or clerks in the households of the king or the leading families of Galloway (Oram in Lowe 2009). The isotopic evidence which suggests that other senior positions in the Whithorn cathedral chapter were not held by locals therefore not only illustrates the supra-regional importance of Whithorn as an ecclesiastical centre, it might also indicate that similar outside interests were at play in the appointment of the higher clergy.

The isotope data for most of the clerics are very similar to each other and may well indicate childhoods spent in Galloway, but further away from the coast. SK3, for example, has been identified as Bishop Walter (AD 1209-1235) (Lowe 2009). Prior to becoming a bishop, Walter served as a household clerk for Alan, Lord of Galloway, whose main powerbase lay in the uplands of northern Galloway (Barrell 2000: 21). The isotope data would not contradict the suggestion that Walter also grew up in this area, although the family had connections throughout the British Isles and there is no reason to assume that he was necessarily a local man (see Oram in Lowe 2009).

SK1, the individual with the most radiogenic $^{87}Sr/^{86}Sr$, can be identified as Henry, formerly abbot of Holyrood Abbey in Edinburgh, who served as Bishop of Whithorn AD 1253-1293 (Lowe 2009). Nothing is known about Henry's childhood origins. Given the complexity of Scotland's geology and without suitable baseline data, it is difficult to say whether his strontium isotope ratio would be consistent with a childhood in the Edinburgh area. On the whole, 0.7118 appears too radiogenic to easily fit the Carboniferous rocks that dominate this region; however, in the absence of published strontium data from archaeological skeletons excavated from Carboniferous lithologies we cannot demonstrate this conclusively. In general, Henry's $^{87}Sr/^{86}Sr$ is more suggestive of Devonian sandstones and the Ordovician/Silurian geology of the Southern Uplands (British Geological Survey 1977; Montgomery *et al.* 2006).

Given the administrative connection of Whithorn with the archbishopric of York, it might be suggested that clerics at the Whithorn cathedral chapter also moved there from northern England. Such a possibility cannot be excluded on the grounds of the isotope evidence: most of the clerics would certainly be consistent with the sedimentary Triassic and Jurassic bedrock of North Yorkshire. Only SK1 has a $^{87}Sr/^{86}Sr$ that is highly unlikely to derive from such regions but is characteristic of older Palaeozoic rocks such as those of Carboniferous or Devonian age which are found in northern and western Britain (Montgomery *et al.* 2005, 2006).

The hare-lipped 'priest'

The isotope data from Whithorn clearly separate high and low status burials as well as clerics and presumed lay individuals with one exception: SK8, who had been grouped with the clerics on archaeological grounds consistently plotted with the lay and lower status individuals, suggesting that he spent his childhood in the Whithorn area and did not consume a superior diet later in life.

Unlike the other clerics, SK8 actually had no insignia with him that identified him as a priest, although metal staining on the pelvis had suggested to the archaeologists that ecclesiastical artefacts may have been removed from the grave prior to the 1950s excavations. More unusually, osteological analysis revealed that SK8 was afflicted by a cleft palate, a congenital defect creating an aperture between the mouth and nasal cavity (Henderson in Lowe 2009). This diagnosis raises the question whether he could have conceivably been a priest, as an infamous passage from Leviticus 21 decreed that no man *'with a blemish'* could enter priesthood. Although candidates could attain special dispensation, it seems the prohibition was enforced for higher offices (Metzler 2006: 40-41). This renders it unlikely that he was a senior cleric, especially because SK8's condition almost certainly would have resulted in a speech impediment which would have made it difficult to carry out some of the duties of a priest (see also Lowe 2009). His prominent burial location and interment in a stone cist nevertheless clearly demonstrate SK8 as a man of importance, although his diet also appears to set him apart from the other high-status lay individuals in the presbytery. These differences are not necessarily explained by his medical condition. Although newborns with a cleft lip or palate cannot easily breastfeed and may also take longer than other children to make the transition to solid foods, most of them eventually adapt and learn to eat normally (Biavati 2006). Perhaps the great renown of the shrine of St Ninian as a place of miraculous healing provides the most suitable explanation for SK8's presence in the presbytery (Hill 1997: 19-20).

Conclusions

The isotope data from Whithorn Cathedral separated individuals clearly along the lines drawn by the archaeological evidence: in terms of diet into a high status group buried in the presbytery and lower status individuals buried elsewhere; in terms of mobility into probable lay-people with a predominately local upbringing and a group of senior clerics who had moved to Whithorn from further inland. The only individual breaking this pattern in both instances proved on closer investigation to be a very unusual burial for which there was other evidence to challenge the classification.

It is rare to see this degree of correlation of archaeological with isotopic evidence, as well as of multi-isotopic data from several independent isotopic systems with each other. Although the number of samples analysed may be small, the observed differences are very clear and therefore more than likely robust. If nothing else, they provide (yet another) piece of evidence that isotope analyses indeed reliably reflect diet and mobility at an *individual* level.

For applications of isotope analysis in medieval archaeology these results are significant. It has been demonstrated that a well-defined status group consumed an isotopically distinct diet, and one particularly appropriate for senior clerics: it incorporated more fish which had spiritual significance as a fasting food. Comparison of Whithorn with a large dataset from the Gilbertine priory at Fishergate in York suggests that what was apparently a high status diet in coastal south-west Scotland in terms of the amount of fish consumed was only about average in medieval York (Montgomery *et al.* in Lowe 2009). Further analyses could therefore not only investigate key questions regarding the relationship between diet and social stratification in the Middle Ages, they might also address issues of regional variation in diet throughout the UK (see Mays 1997).

Isotope studies on mobility in the high and later Middle Ages are still very much in their infancy. The data from Whithorn provide evidence for status-dependent mobility but also offer a glimpse into the diverse origins of individuals buried at a major centre of pilgrimage. Future studies may expand on this, with an added objective of assessing the level of background mobility in what was nominally a 'non-migration period'. Overall, this case study of the Bishops of Whithorn has shown that the stark divisions within medieval society lend themselves very well to investigation by isotopic techniques.

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Technical Appendix

Bone collagen was extracted using a modified Longin method (Brown *et al.* 1988), following the protocol described in Müldner & Richards (2007b). Carbon and nitrogen stable isotope measurements were undertaken by continuous-flow isotope ratio mass spectrometry. Analytical error determined from repeat measurements of internal and international standards was 0.2 (1σ) or better.

Core enamel samples were obtained following the procedure given in Montgomery (2002). Oxygen stable isotope determinations of biogenic carbonate were made by conventional phosphoric acid method (McCrea 1950) and dual-inlet mass spectrometry. Analytical error (2σ) was better than 0.2‰. Enamel and dentine samples for strontium isotope analysis were prepared in the clean laboratories at SUERC according to the method described in Vandeginste *et al.* (2009), and analysed on a VG Sector 54-30 mass spectrometer. The total procedural blank was <500 pg. Instrumental mass fractionation was corrected to $^{86}Sr/^{88}Sr = 0.1196$ using an exponential fractionation law. Data were collected as 12 blocks of 10 ratios. NIST SRM-987 gave $^{87}Sr/^{86}Sr = 0.710255 \pm 0.000022$ (n = 15) during the course of this work.

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