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populations evolving under high-UVR conditions have been limited. In order to address this, we report on *MC1R* coding variation in 188 individuals from Northern Island Melanesia. Diversity levels are reduced in this sample ($\pi = 0.0075$, $\theta = 0.00081$) relative to non-African populations sequenced as part of the 1000 Genomes Project (π range = 0.00056–0.00171; θ range = 0.00089–0.00323). We observe five polymorphisms, three of which are non-synonymous. Using a modified McDonald-Kreitman's test, we demonstrate that this pattern is inconsistent with a model of strong purifying selection ($p = 0.275$). Further, we do not observe extensive haplotype sharing between Melanesians and African populations from the 1000 Genomes Project, as one might expect if variation at this locus has been constrained across high UVR populations. One nonsynonymous polymorphism, rs2228479, is common in the sequenced sample (15%) but is not significantly associated with quantitatively assessed variation in skin or hair color in a larger sample of genotyped individuals, possibly due to epistatic interactions with other pigmentation loci. These results suggest that a reinterpretation of the strength of selection on *MC1R* in high UVR populations may be necessary.

Dietary trends in early medieval Croatia as evidenced by stable isotope analysis

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Little is known about the diet of early medieval Croatian populations. Written sources talking about this topic are scarce, so most of the data are available from paleodentological studies or, in rare cases, from stable isotope analyses. The main aim of this study is to reconstruct the dietary patterns of the early medieval Croats based on nitrogen and carbon stable isotopes analysis, but also to examine if there are significant differences between the sites and between the sexes.

The series includes 30 human and one animal (sheep/goat) bone sample from five EM (6th–12th c. CE) sites located on the eastern Adriatic coast. The majority of individuals had $\delta^{13}\text{C}$ values between -19.7% and -17.6% and $\delta^{15}\text{N}$ values between 8.6% and 10.5% , which is consistent with a diet based primarily on terrestrial C_3 resources with little or no marine or C_4 input. Higher $\delta^{15}\text{N}$ values in two adult individuals suggest the consumption of large amounts of high-trophic level protein, or of freshwater fish. Two other individuals, an adolescent and a 1.5–2.5 year old child, had high $\delta^{13}\text{C}$ values, indicating the consumption of either marine foods or a C_4 resource such as millet. The young child also had an elevated $\delta^{15}\text{N}$ value, so was probably consuming a C_4 or marine-based

weaning food whilst still breastfeeding. No differences were apparent between sites or between males and females in the analysed sample. These results provide us with new information on diet and lifestyle of individuals inhabiting eastern Adriatic during the Early Middle Ages.

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Male migration, family structure and children's health in a seasonal agricultural community in Veracruz, Mexico

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Family structure is widely known to be associated with children's health and wellbeing. Controlling for a range of background factors, children experiencing family stability are most likely to have healthy outcomes on most measures. The aim of this study was to determine the effect of prolonged father absence due to economic migration on the nutritional status and health of his children. Research was conducted in Ocotepéc, a small mestizo subsistence agricultural community with very low human development indices and high marginalization in Veracruz, Mexico. Families in Ocotepéc rely, to a large extent on maize milpas for its year-long staple food supply, and on relatively small government cash transfers and variable remittances to pay for agricultural inputs and other purchased goods. Although women and children typically participate in agricultural activities, crop-management decisions and strenuous heavy workloads are men's traditional responsibility. However, in nearly half the households, young men out-migrate in search of paid employment and are gone for most of the agricultural year with adverse consequences for their milpas' productivity. Data on household food security, anthropometric indices (weight-for-height, height-for-age and weight-for-age) and acute illness frequency were compared for children aged 5–12 years in female vs. male-headed households. Results show complex associations between migration-related male absence, food production and children's nutritional and health status. Higher purchasing power and relatively higher standards of living in households receiving male-earned remittances do not always compensate for the negative effects of male absence on food security in this community. Findings are discussed within a biosocial framework.

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Shining Evolutionary Light on Human Sleep: Sleep Intensity and Human Cognition

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Scientists have made substantial progress in understanding the evolution of sleep across the Tree of Life, including in primates. Remarkably, our understanding of human sleep is less complete, which is surprising given our unique mental capacity and the importance of sleep for human cognitive performance. We used new phylogeny-based methods to investigate the evolution of human sleep in comparative context, focusing on sleep duration and rapid eye movement (REM) sleep relative to other primates. Analyses revealed that humans are exceptionally short sleepers relative to other primates: human sleep duration is substantially below the 95% credible interval of predicted sleep duration, based on a Bayesian analysis that predicts sleep duration from phylogeny, body mass, activity period, endocranial volume, diet, interbirth interval, and group size (only 0.2% of the predicted distribution is less than the observed value for humans). Analyses of REM reveal that humans have a substantially higher proportion of REM sleep than expected (only 0.4% of the predicted distribution was greater than the observed human value). Combined with other findings that humans show more flexible sleep than other primates, we propose that human sleep is shorter, deeper, and more flexible than expected in a typical primate. Several factors likely served as selective pressures for more efficient and flexible sleep in humans, including increased predation in terrestrial environments and threats from intergroup conflict. Less sleep would enable longer active periods to acquire and transmit new skills and knowledge, while deeper sleep may play a critical role in consolidation of those skills.

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Intestinal parasites of wild orangutans in Gunung Palung National Park, Borneo, Indonesia

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Parasitology is increasingly employed by field primatologists to better understand the ecology and health of wild primate populations. This study examined the intestinal parasites of wild Bornean orangutans in Gunung Palung National Park. Gunung Palung is relatively pristine orangutan habitat, while many other orangutan sites consist of degraded secondary forest. As habitat disturbance and contact with humans are known to increase parasite infection

Dietary trends in early medieval Croatia as evidenced by stable isotope analysis

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Introduction

Little is known about the diet of early medieval Croatian populations. Written sources talking about this topic are scarce, so most of the data are available from paleodontological studies or, in rare cases, from biochemical analyses of early medieval skeletal remains. Considering the importance of the subject but also the paucity of more comprehensive analyses dealing with this topic the primary aim of this study is to get a better intra- and inter-population-based perspective on the dietary patterns of inhabitants of early medieval Croatia based on nitrogen and carbon stable isotopes analysis, but also to examine if there are significant differences between the studied sites and between the sexes and age groups.

Material and methods

The study is comprised of five rural sites (Dubravice, Stranče-Gorica, Konjsko polje-Livade, Omišalj-Mirine, and Vačani-Laluše) located on the eastern Adriatic coast and its hinterland (Fig. 1). These sites are dated to the early medieval (EM) period, i.e. between the 5th and 12th centuries CE, based on the radiocarbon dates, horizontal and vertical stratigraphy, and recovered artefacts (Cetinić 2011; Čaušević-Bully 2014; Gunjača 1987; Krnčević personal communication; Petrinc 2005).

The complete skeletal series includes 142 individuals. The skeletons were sexed and aged using standard macroscopic methods (Buikstra & Ubelaker 1994; Scheuer & Black 2000). All adults were allocated to either 'male' or 'female' categories. Non-adults were divided into two age groups: 'I/YC' (infants/younger children, birth-8 years), and 'OC/J' (older children/juveniles, 8-17 years) while adult individuals were assigned to a single age group. The study utilised 30 human bone samples representing slightly more than 20% of the total series: ten males, ten females and ten non-adults. One animal (sheep/goat) sample was also taken. Ribs (n=15) and long bones (n=16) were targeted as the most appropriate skeletal elements for the analysis. Collagen extraction was carried out at University College Dublin, and followed a modified Longin method (Longin 1971). Bone samples were demineralised in 0.5M HCl until soft and pliable, and then gelatinised in pH 3 water at 70°C for two days. The resulting solution was filtered using Ezee Filters and then freeze dried. Collagen samples of approximately 0.5 mg were weighed into tin capsules and analysed in duplicate at the University of Bradford Stable Isotope Laboratory. Three samples were also analysed at Queen's University Belfast in conjunction with radiocarbon dating.



Figure 1. The geographic location of the analysed sites

Results

All analysed samples yielded collagen of good macroscopic appearance, and had C:N ratios between 3.2 and 3.4 thus indicating good protein preservation (Table 1). The range of $\delta^{13}\text{C}$ was between -19.7 and -15.9‰ (\bar{x} =-18.4±0.7‰) while the $\delta^{15}\text{N}$ range was between 8.6 and 11.7‰ (\bar{x} =9.8±0.8‰) (Fig. 2).

The mean C and N values for each separate site are presented in Table 2. When C and N mean values were compared by site the only significant difference was recorded in $\delta^{15}\text{N}$ values between Dubravice and Konjsko polje ($p=0.005$, $df=11$, $t=3.5$), while all other sites exhibited almost identical values.

Sample ID	Site	Sex/age	Bone	Nitrogen	Carbon	C:N ratio
MAR01	Vacani	M, A	rib	11.6	-17.9	3.2
MAR02	Dubravice	F, A	radius	9.8	-17.6	3.2
MAR03	Dubravice	M, A	clavicle	9.6	-18.1	3.2
MAR04	Dubravice	F, A	clavicle	9.4	-18.3	3.2
MAR05	Dubravice	M, A	radius	10.0	-18.4	3.4
MAR08	Vacani	F, A	clavicle	10.0	-18.2	3.2
MAR12	Strance	S, OC/J	clavicle	9.3	-18.6	3.2
MAR13	Konjsko polje	F, A	clavicle	9.4	-18.8	3.3
MAR14	Konjsko polje	M, A	clavicle	9.1	-18.2	3.3
MAR16	Konjsko polje	M, A	clavicle	8.7	-18.7	3.2
MAR17	Konjsko polje	F, A	clavicle	8.8	-18.3	3.3
MAR22	Vacani	F, A	rib	10.1	-18.6	3.3
MAR23	Omisalj	M, A	rib	9.8	-19.0	3.2
MAR24	Omisalj	M, A	rib	9.0	-18.7	3.2
MAR25	Omisalj	M, A	rib	9.8	-18.7	3.2
MAR26A	Dubravice	S, OC/J	rib	9.0	-18.2	3.2
MAR27	Dubravice	S, I/YC	rib	10.4	-19.7	3.3
MAR28	Omisalj	S, OC/J	rib	8.5	-16.9	3.2
MAR29	Vacani	F, A	rib	10.5	-18.3	3.3
MAR30	Vacani	S, I/YC	clavicle	9.4	-18.8	3.3
MAR32	Vacani	S, I/YC	rib	9.0	-19.1	3.2
MAR33	Dubravice	S, I/YC	rib	10.4	-19.4	3.2
MAR34	Strance	S, I/YC	rib	11.7	-15.9	3.2
MAR35	Vacani	S, I/YC	rib	9.4	-18.6	3.2
MAR36	Strance	S, I/YC	rib	10.1	-18.4	3.2
MAR37	Omisalj	F, A	clavicle	10.1	-18.9	3.2
MAR39	Omisalj	F, A	rib	10.5	-19.1	3.2
K18	Konjsko polje	F, A	clavicle	8.6	-18.6	3.2
D34	Dubravice	M, A	ulna	9.7	-18.2	3.2
V10A	Vacani	M, A	clavicle	11.7	-17.7	3.2
MAR38	Vacani		capra/ovis (humerus)	6.4	-20.1	3.3

Table 1. Summary of bone collagen isotope results

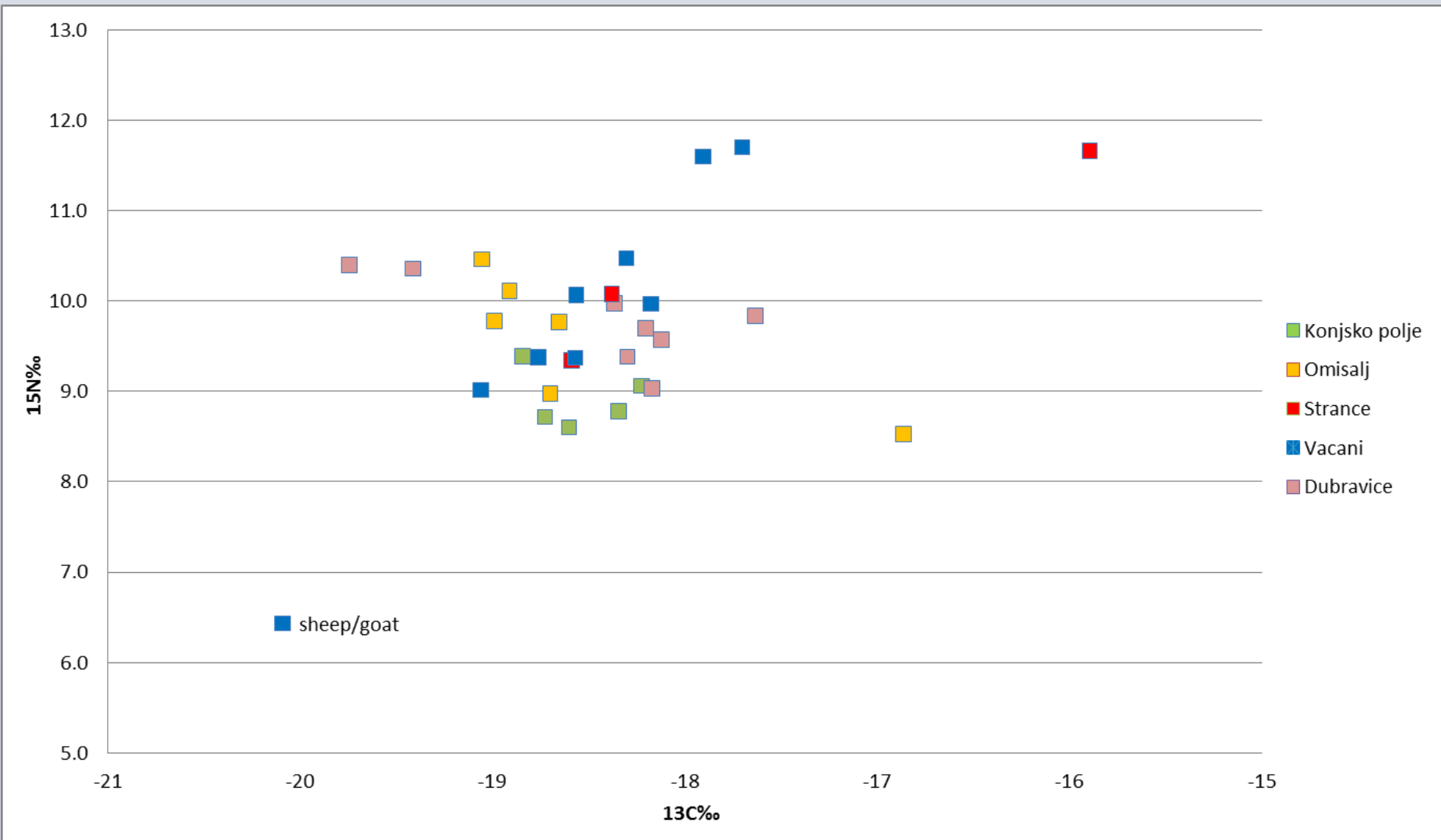


Figure 2. Collagen stable isotope values, displayed individually and by site

Site	n	Mean $\delta^{13}\text{C}$ (‰)	Mean $\delta^{15}\text{N}$ (‰)
Dubravice	8	-18.5 ± 0.7	9.8 ± 0.5
Konjsko polje	5	-18.5 ± 0.3	8.9 ± 0.3
Omisalj	6	-18.5 ± 0.8	9.6 ± 0.7
Strance	3	-17.6 ± 1.5	10.4 ± 1.2
Vacani	8	-18.4 ± 0.5	10.2 ± 1.0

Table 2. Mean collagen stable isotope values by site

The male $\delta^{13}\text{C}$ values varied between -19.0 and -17.7‰ (\bar{x} =-18.4±0.4‰) while females' ranged from -19.1 to -17.6‰ (\bar{x} =-18.5±0.4‰) (Fig. 3). Male and female $\delta^{15}\text{N}$ values were between 8.7 and 11.7‰ (\bar{x} =9.9±1.0‰), and 8.6 and 10.5‰ (\bar{x} =9.7±0.7‰), respectively. The comparison between the sexes revealed that there are no significant differences in $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values, i.e. both males and females exhibit very similar mean values.

In non-adult individuals $\delta^{13}\text{C}$ values spanned between -19.7 and -15.9‰ (\bar{x} =-18.4±1.1‰) while $\delta^{15}\text{N}$ values ranged from 8.5 to 11.7‰ (\bar{x} =9.7±0.9‰) (Fig. 4). On the other hand, $\delta^{13}\text{C}$ values in adults were between -19.1 and -17.6‰ (\bar{x} =18.4±0.4‰), and $\delta^{15}\text{N}$ spanned from 8.6 to 11.7‰ (\bar{x} =9.8±0.8‰). As seen from the presented data both C and N mean values in adults and non-adults are quite similar, and therefore no significant differences between these two categories were detected.

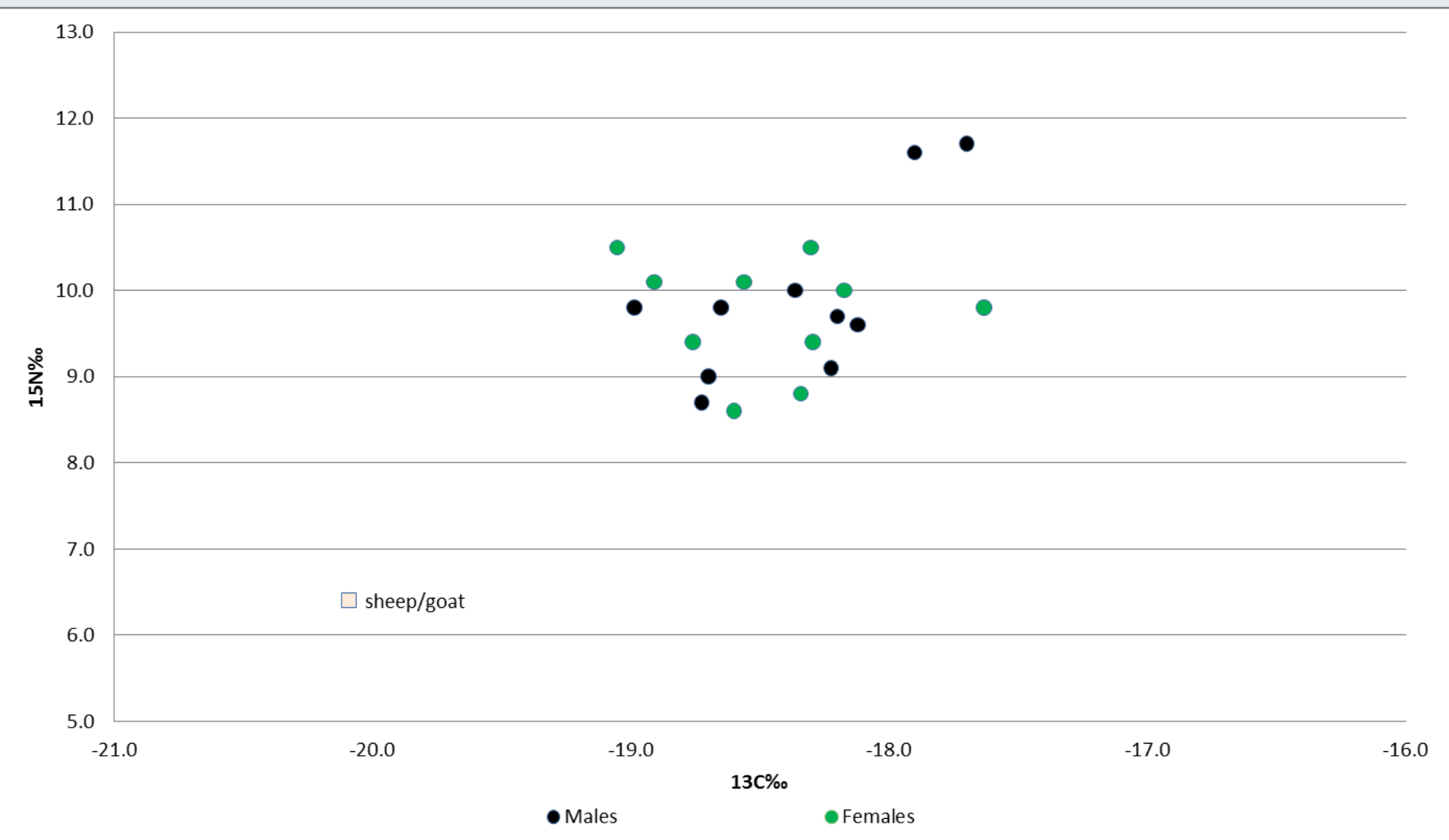


Figure 3. Carbon and nitrogen isotope ratios in adults divided by sex

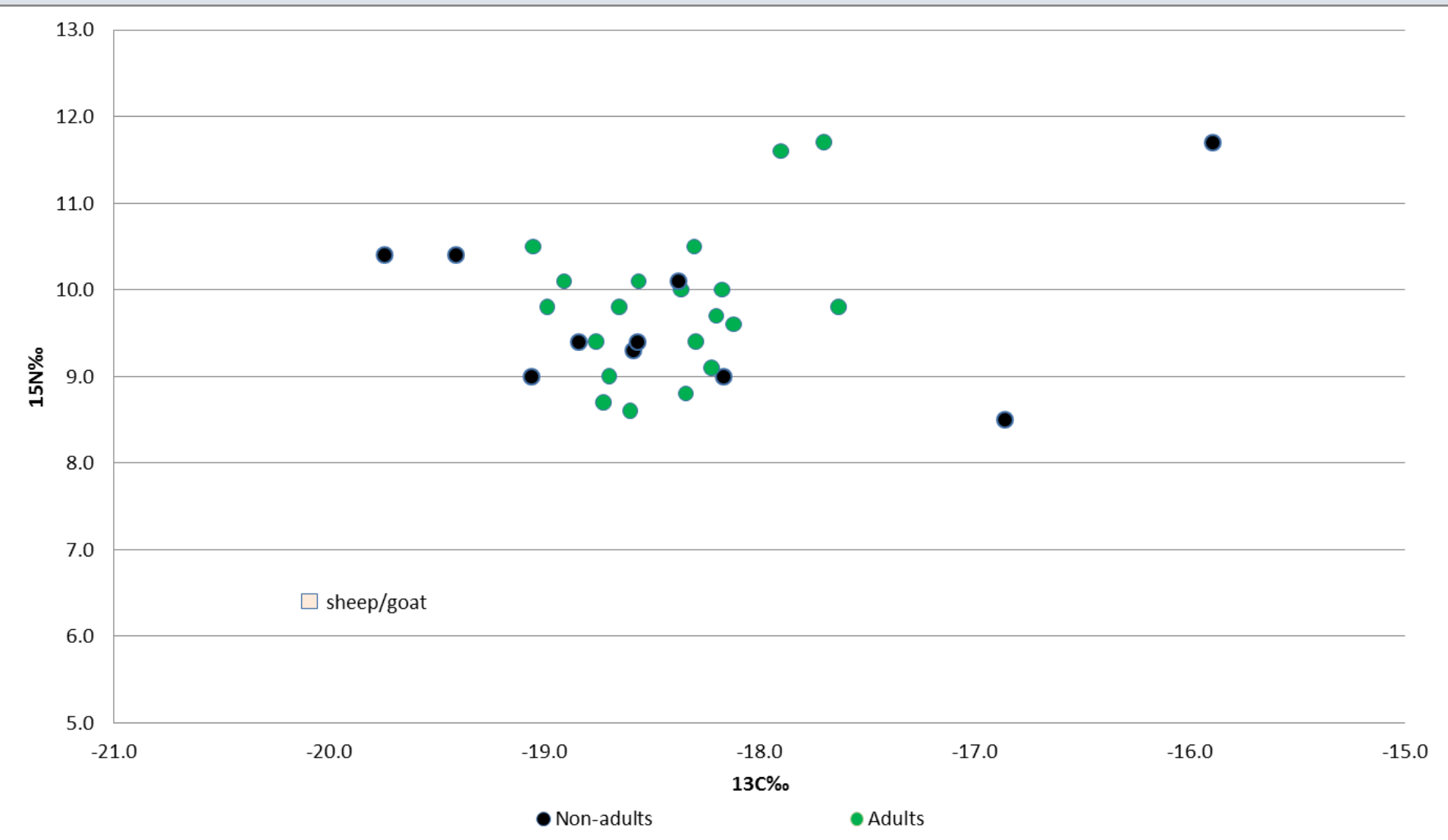


Figure 4. Carbon and nitrogen isotope ratios divided by age groups

Discussion and conclusion

The stable isotope results suggest that diet was predominantly based on terrestrial C3 resources, but with some input from C4 or possibly marine foods. Individuals at all sites appear to have relied on a similar range of dietary resources, however the lower $\delta^{15}\text{N}$ values at Konjsko polje suggest that individuals buried here had a somewhat greater intake of plant relative to animal proteins than was the norm at other sites.

Although the isotope data from most of the subadults plots within the

same range as that from the adults, the subadult $\delta^{13}\text{C}$ values are more varied and cover a wider range. This implies that diet was more varied amongst subadults than adult individuals. In particular, two subadult samples have higher $\delta^{13}\text{C}$ values than the remainder of the individuals analysed, indicating a greater intake of C4 or marine resources.

One of these subadults (MAR34, 1.5-2 years old) also has a high $\delta^{15}\text{N}$ value (11.7‰) and this most likely indicates that this individual was still breastfeeding to some degree whilst also consuming other foods. It is also possible that this individual was consuming animal proteins from higher trophic levels rather than breastmilk.

Two adult males from Vačani (MAR01 and V10A) are outliers to the rest of the adults as they have high $\delta^{15}\text{N}$ values, which are probably the consequence of a greater animal protein intake than other individuals sampled, or of consuming animal protein from higher trophic levels. These two individuals are quite interesting as they were buried in two monumental stone sarcophagi together with a large number of grave goods (the Carolingian sword, Byzantine gold coin, Byzantine glass bottle, a pair of battle knives, etc.), which strongly implies an elevated social status.

As already mentioned, written historic sources talking about the diet of EM Croatian populations are almost non-existent, therefore the only data on this topic are available from paleodontological studies and/or rare biochemical analyses. For example, a study of elemental status (metal content) from bones of the EM inhabitants of Naklice conducted by Sutlović et al. (2010) suggests that the probable main dietary components were leafy vegetables, legumes and small amounts of cereals. Furthermore, a comprehensive paleodontological study by Šlaus et al. (2010) indicates that the diet of EM Croats was significantly different in comparison to the diet of late Roman populations inhabiting the same region, i.e. it was much more dependent on carbohydrates, mostly cereals. A similar hypothesis was proposed by Lightfoot et al. (2012), based on their C and N stable isotope analyses conducted on adult individuals from four EM Croatian sites - $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values in their EM samples were statistically different from the Roman period samples indicating different diet. It seems that the diet of the EM individuals from this study included varying amounts of protein with high $\delta^{13}\text{C}$ values, presumably millet while marine protein intake was negligible (Lightfoot et al. 2012).

The comparison of the results of the present study with those from the study by Lightfoot et al. (2012) reveals that the EM Croatian $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values are almost identical, strongly suggesting a very similar, almost uniform, diet of the EM inhabitants of the eastern Adriatic coast and its hinterland with very few local peculiarities. This diet was predominantly based on terrestrial C3 resources, with a varying input from C4 (most probably millet), and with a very low intake of marine resources. It also seems that sex and age did not play a significant role in the quantity and quality of foods consumed, but apparently it was more associated with the social status of an individual as seen in the example of two adult males from Vačani.

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