ANTHROPOLOGIE • XLVI/2–3 • pp. 135–152 • 2008

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VEDROVICE: DEMOGRAPHY AND PALAEOPATHOLOGY IN AN EARLY FARMING POPULATION

ABSTRACT: This paper presents the results of the analysis of eighty-one individuals from the Neolithic cemetery of Vedrovice. Age and sex profiles are calculated in order to allow a discussion of the demographic characteristics of the cemetery population, and palaeopathological analysis of cranial and post-cranial material has facilitated a consideration of population based expression of pathology. In terms of dental pathology, caries incidence is high at Vedrovice, although variability in expression suggests that mixed carbohydrate and protein diets were being consumed to varying degrees, and female, in particular, exhibit patterns of tooth wear indicative of tooth use in processing activities. Overall however, with occasional exceptions, the general palaeopathology and demography at this cemetery is commensurate with earlier Neolithic farming populations elsewhere in Europe.

KEY WORDS: Neolithic – Palaeoanthropology – Palaeopathology – Palaeodemography – Body stature

INTRODUCTION

The research undertaken on the skeletal populations from the Vedrovice cemetery was conducted during two research visits in 2005 (6th–10th September) and 2006 (17th to 25th July). A total of 81 individuals were studied (*Appendix 1*). The cemetery is recorded as having 110 graves within which Gronenborn (1999: 172) notes that 11 of these are "symbolic graves" i.e. grave pits without interments. In the current analysis 22 male and 35 female burials, with 22 non-adult and 2 indeterminate adult burials were recorded from the cemetery at Vedrovice. As such, the totals recorded during the 2005 and 2006 analyses comprise 81 individuals that have been used in the construction of life tables, one unborn/stillborn? child has been omitted from the calculations due to the imprecise age attributed on the basis of the fragmentary nature of the remains. In general, the preservation condition is variable, with burials ranging from the well preserved to the very fragmentary categories. Issues of preservation have been highlighted previously, e.g. Bogucki and Grygiel (1993: 415), and are reported as a problem resulting from the "poor preservation of skeletal remains in decalcified loess soil". Despite issues of preservation, the Vedrovice population is sufficiently well-preserved to facilitate detailed analysis of demography and palaeopathology.

As such, the following chapter presents the results of the age and sex determinations recovered during the research. These form the basis of the demographic analysis presented below. Alongside the ageing and sexing of these skeletal remains, analysis of dental and skeletal pathologies has been undertaken. The results of this stage of the analysis are presented and contrasted with results obtained elsewhere in Europe. In addition, a consideration of stature is presented as the skeletal remains at Vedrovice are conducive to this area of study due to the good preservation of long-bones at this site.

This study has benefited from discussions with Czech colleagues in that comparisons between observers were made in relation to the age and sex designations attributed to the more fragmentary remains at this site. In light of these discussions three non adult age estimations were modified by between 1–3 years, and two adult sex determinations were also modified. Based, however, in relation to the latter modifications it should be noted that the criteria for these changes remain somewhat subjective due to limited diagnostic morphological characteristics available for sex determination on these individuals.

Overall, the analysis indicates that the ageing of the Vedrovice population appears to be the most distinctive difference between the current study and previous calculations of population characteristics. In terms of pathology, caries incidence is high at Vedrovice, and females exhibit patterns of tooth wear indicative of tooth use in processing activities. In general the levels of pathology recorded are commensurate with early farming communities elsewhere in Europe.

METHODS

The methods employed in this study follow the standards developed for prehistoric skeletal populations (*cf*. Lillie 1998a) and recommendations outlined in Ferembach *et al.* (1980) and Buikstra and Ubelaker (1994). Ageing was undertaken using a combination of assessment criteria for hunter-gatherers and agriculturalists based on tooth wear and tooth formation patterns (after Smith 1984, 1991), whilst identification of individual [loose] teeth was based on the criteria set out in Brown (1985). Dental wear schemes are employed in the determination of adult [>20 years] age data as it has been shown that cranial suture closure is unreliable in certain prehistoric populations due to advanced closure and obliteration of sutures even at very young adult ages (Lillie 1998a). Indeed, it has been shown that suture closure can be incomplete in normal, healthy individuals (Krogman 1962: 76), and that suture closure is a very weak methodology for determining individual age in skeletal populations (Meindl, Lovejoy 1985). In addition, Hershkovitz *et al*. (1997: 395) suggest that the subjective nature of suture studies and the inherent assumptions in the methodology – that sutures close in a linear progressive process and that different ontogenic processes operate in different segments of the same suture – have no factual basis.

Whilst a reliance on dental wear stages is used in the age attribution for adults, it is acknowledged that these techniques have a tendency to under-age, and that they assume a degree of equivalence in wear across the skeletal series. In light of the clear limitations in ageing techniques, the approaches of Jackes and Meiklejohn (2008, and *cf*. Meiklejohn *et al*. 1997) have been applied alongside standard life table techniques. Non-adult age was calculated using dental development (Ubelaker 1984) and epiphyseal fusion (Bass 1987).

Sex determination was undertaken using standards outlined in Bass (1987) and Helmuth (1988), with an emphasis on the pelvis wherever possible. General skeletal pathologies were recorded using these sources alongside reference works such as: Cassidy, Cockburn *et al*., Martin *et al*., and Riddle (all 1979); for degenerative joint diseases. Standards for skeletal measurements aimed at inferring sex and stature from the skeletal remains were taken from Bass (1987) and Trotter and Gleser (1977). General indicators of systemic and dietary stressors are applied in order to facilitate determination of the degree and pattern of stress within the populations investigated (*cf*. Bowen, Birkhed 1986, Goodman, Armelagos 1985a,b, Goodman *et al*. 1984a,b, 1987, Littleton and Frohlich 1993, Meiklejohn *et al.* 1988, Smith 1991, Stuart Macadam 1989, 1992). Demographic analysis was undertaken with reference to Ubelaker (1974: 59–70), Meiklejohn *et al.* (1997), Jackes, Meiklejohn (2008), L'Abbe (2005) and Chamberlain (2006).

DEMOGRAPHY

The age and sex determinations for the Vedrovice population are outlined in *Appendix 1*. The Male/Female sex ratio is 0.63 (22 males and 35 females). This might suggest that some degree of female migration is in evidence (Chamberlain 2006: 9–10).

Despite the fact that the cemetery population is unlikely to represent a "viable" population in demographic terms (*cf*. Meiklejohn *et al.* 1997, Jackes, Meiklejohn 2008), demographic profiling of this population is presented below (*Tables 1–3*). The life tables are constructed on the basis of Ubelaker (1974: 59–70) and assume a stationary population. However, clear evidence for sample bias is highlighted by the fact that non-adult burials occur in the settlement site at Vedrovice (Crubézy *et al*. 1995).

In *Table 1*, adults have been allocated to 5 year age classes for the calculation of the life table parameters. This approach has been utilised in order to assess the results obtained against those presented in *Tables 2–3*, where adults above 20 years of age are grouped (*cf*. Jackes, Meiklejohn 2008). The allocation of adults to individual age classes is based on the 10 year age ranges applied during the ageing of these individuals. Individuals whose age ranges span classes are then allocated evenly between age brackets. Where accuracy extended beyond the 10 year age categories the individuals were evenly distributed between adult age classes.

As can be seen from the life table (*Table 1*), life expectancy at birth is 27.57 years. The non-adult pattern of deaths is higher at the 0–4.9 and 15–19.9 ends of the life table, with a drop into the 5.0–9.9 age bracket, and an increase again in the 10–14.9 category. The pattern does not match data for other Mesolithic samples, as studied by Meiklejohn *et al.* (1997), and, in addition, the drop at 5–9.9 years could be a result of sample bias and differential treatment of the dead in this age class.

Mortality rates are presented below (*Figure 1*). The data demonstrates relatively low rates of mortality throughout the <20 year age categories, with low rates continuing

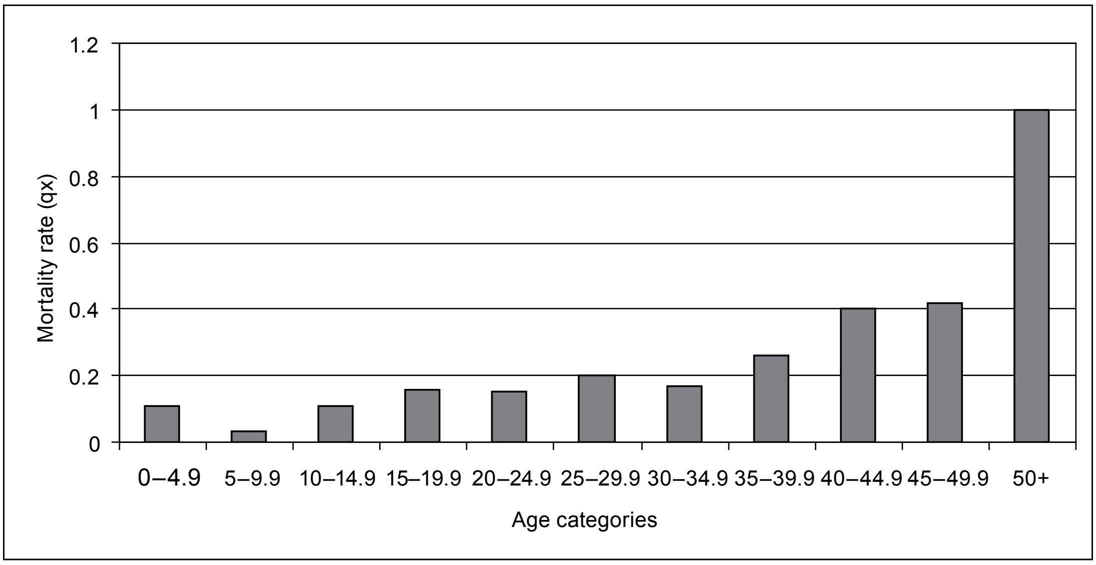

FIGURE 1. Mortality rate across standard 5 year age categories.

throughout the adult age groups up to *c*. 35 years of age when an increase in adult mortality is attested, especially after an individual reaches 35–39.9 years of age.

Crubézy *et al*. (1995: 10) analysed the Vedrovice population, including five individuals from the settlement site, in their study of 104 individuals from this location. Using these additional individuals Crubézy *et al*. (1995) originally obtained a life expectancy at birth of 42.31 for Vedrovice; which they note as being too high for the Neolithic populations being investigated. However, recalculation of the life table using their original data gives a life expectancy at birth of 31.22 years (*Table 2*), a figure that is only slightly higher than that produced by the data from the cemetery population studied here (*Table 3*), despite differences in the allocation of non-adults to age classes.

TABLE 1. Life table for 81 individuals analysed during the current study – age groupings are based on 5 year intervals. All individuals above 50 years of age are grouped together.

Age group	Dx	dx	lx	qx	Lx	Tx	ex
0–4.9	9	11.1	100	0.11	472.25	2756.53	27.57
5–9.9	2	2.47	88.9	0.03	438.33	2284.28	25.69
10–14.9	8	9.88	86.43	0.11	407.45	1845.95	21.36
15–19.9	10	12.35	76.55	0.16	351.88	1438.5	18.79
20–24.9	8	9.88	64.2	0.15	296.3	1086.62	16.93
25–29.9	9	11.1	54.32	0.2	243.85	790.32	14.55
30–34.9	6	7.41	43.22	0.17	197.58	546.47	12.64
35–39.9	7.5	9.26	35.81	0.26	155.9	348.89	9.74
40–44.9	8.5	10.49	26.55	0.4	106.53	192.99	7.27
45–49.9	5.5	6.79	16.06	0.42	63.33	86.46	5.38
50+	7.5	9.26	9.27	1	23.13	23.13	2.5
Total	81						

TABLE 2. Life table calculated using original data for 104 individuals (after Crubézy *et al*. 1995). 20+ grouping calculated on the assumption that 4×10 year age classes (20–29.9, 30–39.9, 40–49.9 and 50+) are used in the calculation. If a 50–59.9 and 60+ category are used the life expectancy at birth rises to 34.93.

Age group	Dx	dx	lx	qx	Lx	Tx	e0x
0–4.9	15	14.42	100	0.14	463.95	3121.93	31.22
5–9.9	7	6.73	85.58	0.08	411.08	2657.98	31.06
10–14.9	2	1.92	78.85	0.02	389.45	2246.90	28.50
15–19.9	3	2.88	76.93	0.04	377.45	1857.45	24.14
20+	77	74.04	74.05	1	1481.00	1480	19.99
Total	104						

TABLE 3. Life table calculated using data for 81 individuals analysed in the current study for comparison. Note that life expectancy mirrors that obtained using the data of Crubézy *et al*. 1995, but differs from the life expectancy obtained in *Table 1*. 20+ grouping calculated on the assumption that 4×10 year age classes (20–29.9, 30–39.9, 40–49.9 and 50+) are used in the calculation. If a 50–59.9 and 60+ category are used, the life expectancy at birth rises to 32.75.

Age group	Dx	dx	lx	qx	Lx	Tx	ex
0–4.9	9	11.11	100	0.11	472.23	2953.76	29.54
5–9.9	2	2.47	88.89	0.03	438.28	2481.53	27.91
10–14.9	8	9.88	86.42	0.11	407.4	2043.25	23.64
15–19.9	10	12.35	76.54	0.16	351.85	1635.85	21.37
20+	52	64.2	64.2	1	1284.00	1284.00	20.00
Total	81						

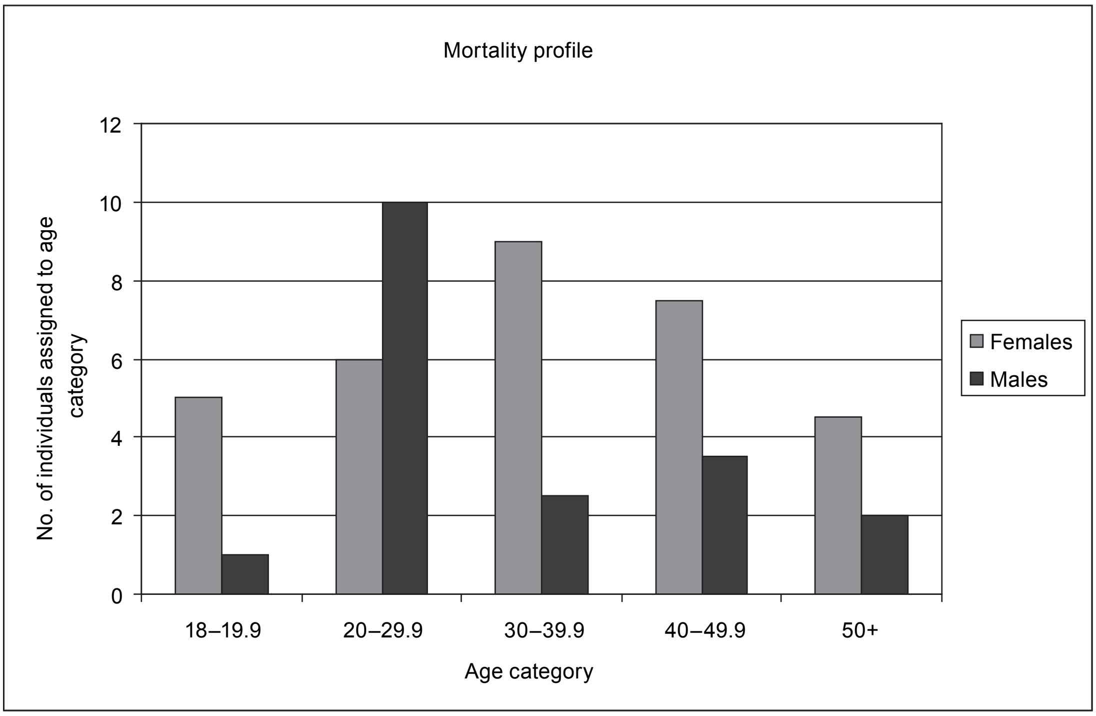

FIGURE 2. Mortality profile for the Vedrovice population. Two females and 3 males of adult age that could not be assigned to an age category are omitted from the profile. 32 females and 19 males were used in the construction of the mortality profile. Individuals that were aged across two categories were assigned equally between those categories.

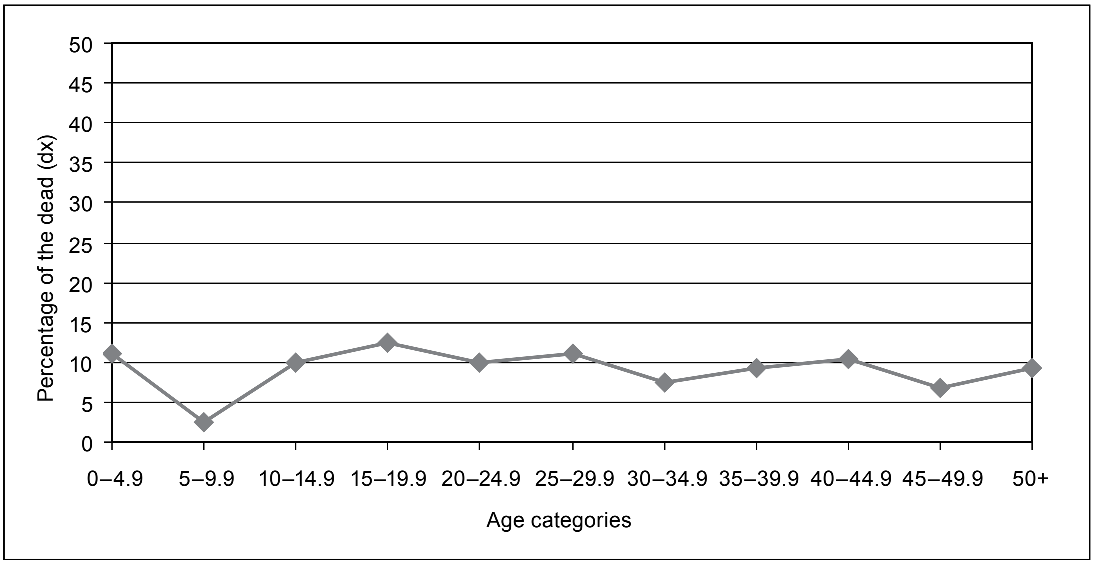

FIGURE 3. Age at death distributions across standard 5 year age categories.

As can be seen from *Table 1*, using 5 year age categories for adults produces a life expectancy estimate that is slightly lower than those obtained from *Tables 2* and *3*. Jackes and Meiklejohn (2008) argue that the use of 5 year age categories is problematic as it introduces a number of assumptions and errors into the age profile. In addition, these authors advocate a 25+ category as opposed to the 20+ category used in the current study.

Despite these observations, it is apparent from this study, alongside that of Crubézy *et al*. (1995) that non-adults are under-represented, and in the 0–4.9 age bracket a low percentage of 11.1% is recorded for the current study, compared to 14.42% when using the cemetery and settlement data combined (*cf*. Crubézy *et al*. 1995). Again, despite slight differences in the non-adult age profile, these observations accord well with the figures reported by Meiklejohn *et al.* 1997 for Skateholm [10.3] and Olenii Ostrov [14.6], but it could suggest that the 9.88% recorded for the 10–14.9 age category, and 12.35% for the 15–19.9 age category represents an over-representation of these individuals when compared to the Mesolithic evidence. This latter observation may well reflect the greater carrying capacity of farming populations when compared to those reliant on hunting and gathering subsistence strategies.

When the data for J:A ratios and MCM are compared to the plots of 59 archaeological samples presented in Meiklejohn *et al'*s work (1997: Fig. 16: 2), Vedrovice is above the regression line at 0.37 [J:A] and 0.1 [MCM]. The significance of this position remains to be determined however as the data for the Neolithic period in Europe has yet to be analysed in any detail.

As is demonstrated by *Figure 2*, the Male/Female sex ratio of 0.63 (calculated on the basis of 22 males and 35 females), highlights discrepancies in the population that are more vividly emphasised when the males and females are separated into discrete age categories. This stage of the analysis shows a clear under-representation of males versus females in all age groups, with the notable exception of the 20–29.9 category, where males outnumber females (male/female at a ratio of 0.6), i.e. a reversal of the population based trend. In the other age categories females always outnumber males, with male/female ratios of 0.2 (18–19.9), 0.27 (30–39.9), 0.47 (40–49.9 and 0.44 (50+).

As shown in *Figure 3*, the age at death distributions are generally stable across the <25 age categories, with the 5–9.9 bracket skewing the smooth distribution. However, as immigration may account for the increased representation of non-adults aged 5–9.9 (see discussion below) it is possible that the post age 10 year patterns could be equated to the occurrence of stress episodes across the 3–5 year age groups (indicated by the limited evidence for enamel hypoplasia occurrence). As such, the increase in deaths after 5 years of age could be reflecting post-stress episode evidence for compromised health status. It should be noted however that the figures for enamel hypoplasias are too low to allow for meaningful conclusions to be drawn from the available data.

PATHOLOGY

Dental Pathology

In the cranial region significant levels of dental pathology have been identified. These include general indicators of childhood stressors such as enamel hypoplasias, although these are not severe or frequent in expression at the population level. Some suggestion that these populations are in the process of a shifting dietary pathway, towards softer diets, are provided by the frequent occurrences of twisting/rotation, overcrowding, reduced third molar size and impaction/congenital absence of third molars, throughout the dental series. It should be noted however that the latter conditions could not be established through the macroscopic examination of the jaws undertaken in the current analysis.

The most prolific pathology, albeit one that appears to dominate in individuals of female biological sex, is dental caries. This pathology is visible on the dentition of 5 of the 17 males with dentitions in evidence [29.4% of the males with teeth] with the expression being 9 out of 480 teeth [1.88% of all teeth available for study]. Some inference to caries occurrence is made by the existence of abscesses and ante-mortem tooth loss which are assumed to be either the result of, or implicated in, caries involvement. For females there are 32 individuals with dentitions in evidence, 18 of these [56.25%] have caries in evidence. As with males, some inference relating to caries involvement is made on the basis of ante-mortem tooth losses and abscesses.

Of the 739 female teeth studied, 31 have direct evidence for caries involvement. This equates to 4.19% of all teeth exhibiting caries in the female portion of the cemetery. However, male dentitions are generally better preserved, with an average of 28.23 teeth per individual compared to an average of 23.1 teeth for females. It is evident that female expression of caries is not only higher at 4.19%/1.88% [F/M], but that the numbers underestimate female involvement due to a lack of preservation of the female dentitions. In general, it is apparent that caries rates are considerably underestimated due to the fact that there is frequent evidence for ante-mortem tooth loss and re-modelling of the alveolus throughout the skeletal series.

In this context, female expressions are more extreme than those in evidence for males. Only a single example of male ante-mortem tooth loss is recorded (individual 57/78), and two cases of teeth evidenced solely by the roots occur. However, in the female portion of the cemetery nine individuals exhibit ante-mortem tooth loss, and only four of these (individuals 36/76, 38/76, 68/78 and 104/81) occur without associated evidence for tooth crown destruction and teeth evidenced solely by the roots. The five female individuals with both ante-mortem tooth losses and teeth evidenced by their roots are individuals 14/75, 21/75, 22/75, 42/77 and 70/79. Of some interest in the context of dental pathology and diet is the comparison of the observations from dental pathology and buccal microwear (Nystrom 2008, Jarošová 2008).

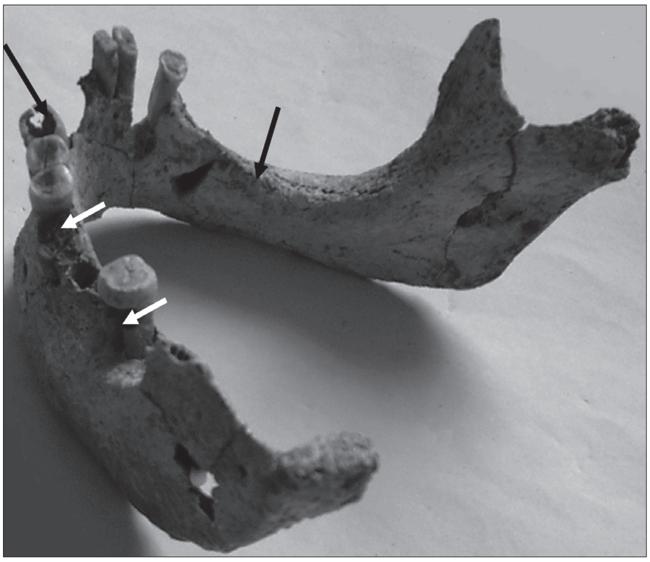

FIGURE 4. Individual 21/75 a mature female aged 30–40 years. Root caries (penetrant) are highlighted (white arrows), pre-mortem tooth losses and alveolar resorption (black arrows). The multiple dental pathologies demonstrate the fact that, in general, the females at Vedrovice exhibit greater expression of dental pathology than males.

An aged female, individual 21/75 (30–40 years) has considerable pathological change in the dentition (*Figure 4*). In this example caries involvement is recorded on the maxillary right M^3 in the proximal area at the cemento-enamel junction (CEJ). The right M^2 is not represented, but the right M^1 has caries involvement at the distal CEJ. In the mandibular region (*Figure 4*) significant ante-mortem tooth loss is in evidence in the molar regions, and the incisors, and carious lesions are in evidence on the left canine and remaining molar, which is the M_3 which has migrated forward towards the cavity left by the M_2. The mesio-buccal root of the M1 is in evidence in the socket.

Individual 22/75, a female aged 35–45, has only a single incidence of caries on the left maxillary P^3 in evidence, although as highlighted above, it should be noted that advanced alveolar resorption and tooth wear is in evidence. As the right maxillary M^1 and M^2 exhibit ante-mortem loss (alveolus fully closed), and the M^3 is attested by the roots, some carious involvement is clearly suggested. The occurrence of caries is commensurate with the evidence from the buccal microwear analysis for this individual, and a mixed diet associated with the presence of increased abrasive particles in food with some meat in the diet is inferred for this individual (Jarošová 2008).

A female aged 30–35 years of age at death (individual 38/76) exhibits considerable pathology in the dental arcade, with the right P_4 lost, ante-mortem [alveolar resorption is in evidence], and the right I_2 to canine are attested by root fragments in the mandibular arcade. The right mandibular M_2 and M_3 have carious lesions in evidence at the cemento-enamel junction. These insults occur from the buccal to lingual aspect of the teeth, on their distal portion. The rounded nature of the insult may reflect some attempt at cleaning on the part of this individual. Interproximal caries are also in evidence on the right P^3 and canine in the maxillary region. Whilst the evidence supports the assertion that this individual consumed a cariogenic diet high in carbohydrates, the buccal microwear analysis indicates that a mixed diet, with abrasive particles, was consumed by this female (Jarošová 2008).

Individual 42/77, a female aged 20–30 has heavy caries involvement in evidence, with large carious areas on the right M^2 and M^3, this is extreme in expression [level 4 – reaction through the entire tooth]. Only the distal ¼ of the M^3 is preserved. The mandibular M_1's are both lost ante-mortem, as is the maxillary left M^1, which is represented by the roots. The caries involvement would support a high carbohydrate rich diet for this individual. The buccal microwear analysis fully supports this observation, with soft vegetarian foodstuffs identified on the basis of the striation patterns in evidence (Jarošová 2008).

Individual 62/78, a female aged 30–40, has advanced carious reactions in the mouth. The right maxillary M^1 has a large carious lesion on the lingual aspect, and the left M^1 has a mesial interproximal caries in evidence of similar severity. Again, the buccal microwear analysis supports a soft mixed diet, although in this instance with possible evidence for limited meat intakes (Jarošová 2008).

An older female individual (70/79), aged 45–50 years at death, has a dentition with a considerable degree of pathology in evidence. The maxillary arcade has the right I^2, and the left I^1, I^2 and M^1 all represented by their roots. The presence of abscesses in the maxillary region (particularly at the left M^1 root) supports the observation that tooth crown losses are probably due to caries involvement and poor oral hygiene. In addition, the left P^3 has a large carious lesion (level 4) on the occlusal aspect. In the mandibular region the right M_1 and M_2 exhibit ante-mortem loss (alveolus remodelled), and whilst caries involvement may be inferred, no direct insight into the mechanism of loss is available for these teeth. The buccal microwear analysis indicates that a very abrasive, mixed hunter-gatherer food diet with meat had been consumed by this individual (Jarošová 2008).

Individual 72/79, a female aged 30–40, has trace levels of calculus over many of the teeth in evidence. The right maxillary M^2 exhibits ante-mortem loss, and there is an interproximal caries of grade 2–3 severity at the CEJ of the left M^3. In the mandibular area the M_3's are absent [either through congenital absence or non-eruption], and there is a pinhole caries on the occlusal surface of the left M_2. The mixed caries and calculus occurrence in evidence support the consumption of a mixed carbohydrate and protein diet. This is reinforced by the buccal microwear analysis which indicates a mixed diet with a noticeable proportion of meat associated with the presence of increased abrasive particles in the foodstuffs being consumed (Jarošová 2008).

Other female individuals with limited dental pathology, due to poor preservation, have been suggested as consuming soft mixed diets (e.g. 45/77).

Individual 67/78, aged 35–45 years at death, has a very fragmentary dentition, but the right M_1 exhibits a grade 3 caries on the distal interproximal aspect, and the right P_4 has some evidence for calculus deposition. Whilst limited, the available pathology conforms to the evidence from buccal microwear analysis as this suggests that a soft mixed hunter-gatherer type of diet with a noticeable proportion of vegetarian food was consumed by this individual (Jarošová 2008).

Individual 80/79 (a female aged 35–45) has some evidence for caries involvement, with the left M_3 exhibiting a large carious lesion extending from the centre line of the occlusal surface out towards the buccal aspect of the tooth crown, and the left maxillary M^1 and left mandibular I_1 evidenced by the roots, again possibly suggesting caries involvement. The buccal microwear analysis for this individual suggests that a mixed diet associated with the presence of increased abrasive particles in the food, possibly due to the grinding of seeds with quernstones, may have been consumed (Jarošová 2008).

The final four females investigated by buccal microwear analysis, 81a/79, 91/80, 100/81, and 101/81, all appear to have consumed mixed diets with a high vegetal component (Jarošová 2008). Each of these individuals exhibit differing expressions of pathology, with 81a/79 having a low functional age of 20–30 and no visible pathology, 91/80 being 18–20 and exhibiting overcrowding but no caries involvement. Individual 100/81 is aged at 20–30 years and has both calculus and caries involvement in evidence. Finally, 101/81 a mature individual aged 45–55 has grade 1 caries in evidence at the CEJ of the left mandibular M_2 and M_3. In general, the expression of dental pathology is commensurate with the inferred dietary intakes indicated by the buccal microwear analysis, suggesting that these techniques are clearly complimentary and useful indicators of diet in the Vedrovice population (Nystrom 2008, Jarošová 2008).

In addition to the significant levels of carious involvement in this population, individual 23/75, a male aged 18–20, is recorded as having rounded third molars. These may reflect incipient reduction of the dental arcade, a phenomenon that is characteristic of the shift towards "softer" diets at the agricultural transition, and is one which is associated with congenital absence (Bass 1987: 284–5, Larsen 1995: 192–3). Alternatively, reductions in tooth size have been shown to relate to nutritionally stressful environments during the stages of tooth development (*ibid*. 1995: 193). The buccal microwear analysis indicates the consumption of soft food with low quantities of abrasive particles, suggesting a vegetarian diet, or higher intakes of vegetal foodstuffs by this individual. The observation that traces of dental calculus occur in the mandibular region and on two maxillary teeth of this individual suggests that protein consumption is occurring, perhaps reflecting dietary variability in the population. Interestingly, this individual has evidence for the lesions of *cribra orbitalia* in the orbits. The lesion type (after Stuart-Macadam 1991) is graded as 3 for the right orbit and 4 for the left. Location is in the anterior-lateral portion of the right orbit and anterior-lateral to middle of the left orbit. The asymmetrical expression of the lesions conforms to the observations of Hengen (1971: 57). The predominance of the lesion in the region of the orbits in this population suggests an initial low intensity response to [amongst other factors] reductions in dietary iron intakes (Lallo *et al*. 1977, Stuart-Macadam 1989). Research by Stuart-Macadam (1992), has suggested that contrary to the established view of iron deficiency [hypoferremia] as a nutritional deficiency indicator, hypoferremia is in fact an adaptive response to disease and micro-organism invasion. As such, this pathological marker is considered to represent adaptation to environmentally specific pathogen loads, and when present in adults they reflect survival of the morbidity event (Ortner 1991, Goodman 1993).

On the basis of buccal microwear, individual 46/77, a male aged 20–25, has been inferred as having mixed food consumption associated with the presence of increased abrasive particles in the food he consumed, and with noticeable proportions of meat in his diet (Jarošová 2008). The pathologies in evidence on this dentition are commensurate with protein ingestion in that no caries are in evidence, and calculus deposition occurs on the incisors, left canine and right P_4 and M_1 in the mandibular arcade.

The buccal microwear analysis for individual 57/78, a male aged 40–50, indicates a very abrasive mixed food diet (Jarošová 2008). The dentition of this individual exhibits a range of pathologies including ante-mortem loss of the left M^1, and the right M^2 is represented by the roots. A number of the teeth have traces of calculus in evidence and the right mandibular canine has a possible LEH in evidence. There is also a pinhole caries on the occlusal surface and a proximal caries at the cemento-enamel junction of the left P^3. The maxillary canines have abscesses in evidence; the left has a large abscess while the right has an abscess at the root apex. Overall the expression of dental pathology is high for this individual.

Other male individuals with low functional ages for the dentition, 69/78 and 76/79, aged between 20–30 years, have been inferred as having mixed diets with abrasive elements, based on the buccal wear analysis (Jarošová 2008). The absence of pathology limits dietary analysis in these cases, but the buccal wear analysis allows inferences into the diets being composed of soft mixed food associated with noticeable proportions of meat. In these cases the buccal microwear analysis is considerably enhancing the interpretative ability of the palaeopathological analysis. In general, the mixed dietary pathways indicated by the palaeopathology and buccal microwear studies would be commensurate with the mixed nature of earlier LBK subsistence economies, in which cereals and domesticated animals are exploited, but also wild animals such as aurochs, red deer, wild boar, otter, fox and roe deer are hunted, with birds and fish also attested in faunal assemblages (Gronenborn 1999: 163).

Finally, none of the 19 children studied during the current investigation, and with teeth in evidence, have

FIGURE 5. Individual 68/78, a female aged 50+. Note grooving on the occlusal surface of the left incisors (arrowed). (Note: This individual is also reported in Frayer 2004).

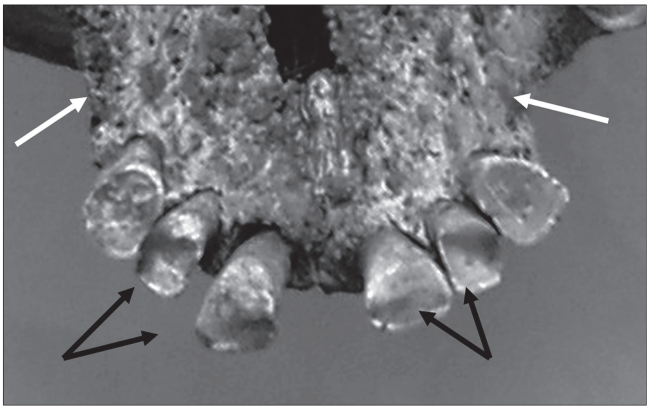

FIGURE 6. Individual 68/78, grooving on the incisors (black arrows), and tooth losses with alveolar resorption in evidence (white arrows).

any expression of caries involvement, but hypoplasias are recorded on two non-adults. The expression of hypoplasias, indicative of non-specific childhood stress episodes, is comparatively low, with only two children and three adults [2 females and 1 male] exhibiting hypoplasia formation. The numbers of hypoplasia preclude the development of meaningful population-based expressions of stress episodes. However, the two children with hypoplasias have stress episodes occurring at 3.31 years [16/75] and 3.18 and 4 years [37/76] respectively. The adult females have episodic stress at 3 years and 4.8 years [91/80] and 4.35 and 5.32 years [64/78] and the male [57/78] has a stress episode at 5 years of age. No significance can be drawn from this pattern, although the lack of defects in the first two years of life conforms to the suggestion of Goodman and Armelagos (1985a,b) that the teeth may be less susceptible to hypoplasia formation in the first two years of development.

A number of individuals in this cemetery population exhibit evidence for mechanical modification in the enamel of the anterior teeth. In this respect recent research undertaken by Frayer (2004: 94–5) is significant. This author notes that at Vedrovice 13 out of the 58 individuals he studied had evidence for notched maxillary lateral incisors or grooved maxillary central incisors. The majority of involvement is recorded as affecting females in this cemetery population.

Whilst dental attrition rates are known to vary considerably in past populations, with dietary functions being attributed as a key source of occlusal surface attrition (Molnar 1972: 513), the use of teeth as tools in prehistoric populations is also well established (*ibid*. 1972: 514–5, Alexanderson 1988: 153, Minozzi *et al*. 2008). Cases of dental mutilation are also reported in the literature (e.g. Ubelaker *et al.* 1969, Kennedy *et al.* 1981). In the current study a male (82/79) exhibits heavy wear patterning on the left maxillary incisors, which may be the result of the use of these teeth as tools. Heavy attrition occurs on the maxillary incisors of a number of young individuals (e.g. 29/76 a female aged 18–20 and individual 94/80 a female aged 18–22), and whilst no distinct grooving is in evidence the wear is again suggestive of teeth being used as tools.

Distinct grooving occurs on the maxillary central incisors of individual 46/77 a male aged 20–25, and on the maxillary incisors of individual 68/78 (*Figures 5* and *6*, below). Additional cases of maxillary incisor grooving are recorded on individuals 75/79 (female 25–35), 93a/80 (female 18–25) and 97/80 (female 30–40). There are nine individuals with exaggerated wear patterns or grooving in the maxillary region, usually on the incisors. As Frayer (2004) reports that 29 individuals from the cemeteries of Krškany and Vedrovice exhibit manipulative wear of the incisors, the numbers reported here appear broadly commensurate with these earlier observations.

Analysis of the microscopic wear patterns in evidence on the Vedrovice population has demonstrated that the most likely cause of the wear patterns in evidence is the processing of fibrous materials, such as sinew (Frayer 2004: 98).

Skeletal Pathology

Postcranial expression of pathology is limited, and consists primarily of age dependent degenerative conditions relating to osteoarthritis, with three notable exceptions. Recent research by Crubézy *et al.* (2002) has assessed the frequency of osteoarthritis and enthesopathies from both Vedrovice, and the site of Nitra-Horné Krškany, Slovakia. In their

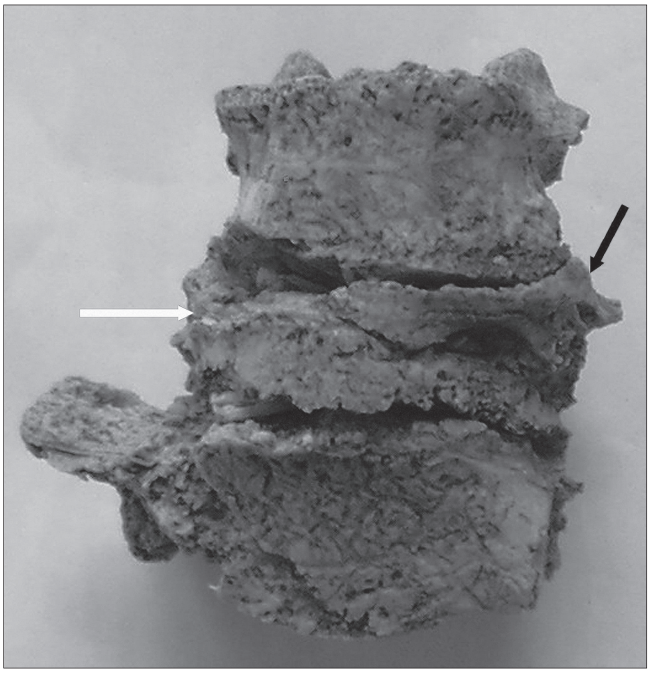

FIGURE 7. Individual 64/78; osteophytic lipping and collapse and re-modelling of vertebral bodies in lumbar region (L2, white arrow; and L3, black arrow).

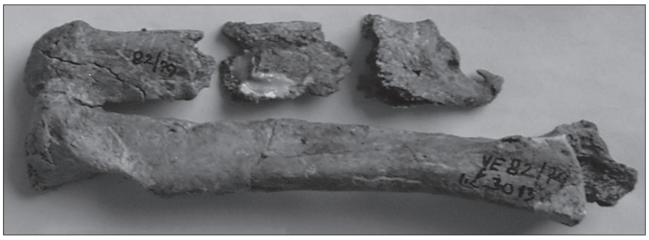

FIGURE 8. Individual 82/79; radius and ulna of the left arm. Note the fragmentary nature of the radius, which has fused to the ulna. Periosteal reactions are in evidence, reflecting infection. Crubézy (1996: 331) argues that the sharp, regular section across the ulna has to be indicative of surgical intervention.

FIGURE 9. Individual 15/75; this individual exhibits two trepanation apertures, with the surgery probably being performed in response to a compression injury (*cf*. Crubézy 1996: 331).

study Crubézy *et al.* reported that mild osteoarthritis was most common in the region of the shoulder (2002: 582–4), and that, in general, osteoarthritis occurs at low levels throughout the skeletal samples studied, with the greater severity in the shoulders being followed by the hand, hip, wrist and elbow. In the case of degenerative enthesopathies, fractures are implicated as a causal factor for a number of individuals (*ibid*. 2002: 585), but overall, the expression is low in the populations studied. In the current analysis, no quantification of postcranial pathology, in terms of osteoarthritis and enthesopathies, was undertaken due to the time limitations imposed on the sampling strategy, but incidence was noted.

As has been noted above, three individuals, nos. 64/78, 82/79 and 15/75 exhibit interesting pathologies. 64/78 is a young adult female aged ca. 18–20 years at death, who has severe fusion of the vertebra throughout the spinal region. The expression of pathology includes Schmorl's nodes, marginal lipping and fusion of vertebrae as well as collapse and re-modelling of vertebral bodies (e.g. *Figure 7*).

This individual exhibits collapse and fusion of the thoracic vertebrae, with the damage in evidence occurring between T1–T8; this damage also extends upwards into the cervical region C8 and C7. Similar extensive damage occurs in the lumbar region, between L1–L4 (*Figure 7*). In addition, pitting and osteophytes are in evidence on the right femur head. However, it should be noted that mechanical corrosion and sediment concretion hinder the recording of pathology in both the lower and upper limbs, but some eburnation and lipping is in evidence on the proximal end of the right ulna.

Individual 82/79 is a mature adult male aged ca. 50+ who has the left arm cut-off/severed ca. 110mm above the wrist (*Figure 8*), and a range of degenerative pathologies such as Schmorl's nodes and lipping of the margins of the vertebral bodies. Crubézy *et al.* (2002: 582) suggest that this amputation may have been a possible cause of osteoarthritis of the distal clavicle and glenoid cavity on this individual. The available bone suggests that fracture and infection occurred at this location, and that some modification occurred in response to this trauma. Crubézy (1996: 331) suggests that the partial amputation reported here, occurred during treatment of the original trauma.

One individual, 15/75, a male aged between 35–40 years at death exhibits evidence for trepanation (*Figure 9*). This individual has two large apertures in the region of the frontal bone. The anterior trepanation is ca. 24–26×11–15 mm [lxb] and exhibits remodelling around the margins. The posterior opening is larger in area at ca. 33mm x 14–11mm (*cf*. Dočkalová 2001: 236). In the area between the apertures there is a distinct area of reduction in the thickness of the bone to the left side of the cranium. In addition, the anterior border is somewhat irregular in shape and does not exhibit the same level of remodelling as the smaller trepanation.

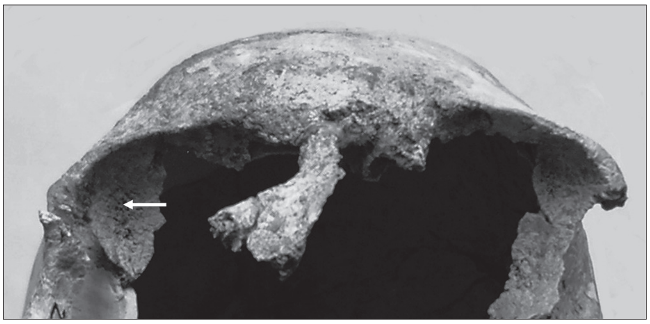

FIGURE 10. Individual 21/75 – note large and small isolated foramina and linked foramina (lesion type 3–4; after Stuart-Macadam 1991).

This could be the result of an unsuccessful procedure, or a compression injury to the vault. Crubézy (1996: 331) notes that scrape marks occur on the bone between the apertures. In addition, Crubézy also notes that the surgery occurred in response to a compression injury which sunk the bone in at least two places (1996: 331); this individual clearly survived the surgical procedure.

Other cranial pathologies identified during this study consist of *cribra orbitalia* on the roof of the orbits of 5 female and two male individuals. These 7 out of 48 individuals available for study (11 individuals were too fragmentary to allow assessment), represent 14.58% at the population level.

Individual 23/75, a young male aged 18–20, has *cribra orbitalia* in evidence, the lesion type (after Stuart-Macadam 1991) is graded as 3 for the right orbit and 4 for the left. Location is in the anterior-lateral portion of the right orbit and anterior-lateral to middle of the left orbit. The asymmetrical expression of the lesions conforms to the observations of Hengen (1971, 57). Individual 99/81, a male aged 20–30 years has both orbits with evidence for type 3 and 4 *cribra orbitalia*. This occurs in the left lateral zones 1/4 and 7 and medial zone 3 and right zones 1/2/4 and 5 (after Stuart-Macadam 1991).

The females exhibiting *cribra orbitalia* include individual 21/75 (*Figure 10*), 72/79, 83/80, and 86/80. Individual 21/75, a female aged 30–40 years, has lesions of type 3–4, visible as large and small isolated foramina and linked foramina (after Stuart-Macadam 1991), located in areas 5–8 of the roof of the orbit (middle-intermediate through to postero-medial sector – *ibid*. 1991).

Individual 72/79 is a female aged 30–40 who has evidence for *cribra orbitalia* on the left orbit at level 4 expression, which is characterised by foramina that are linked into a trabecular structure in the lateral zones of the orbit (sectors 1–4 and 7; after Stuart-Macadam 1991). An old female (83/80) aged ±60 years has porosity in the left orbit graded at 2–3, in the antero-lateral sector of the orbit (after Stuart-Macadam 1991).

Individual 86/80 an adult aged 25–35 has small foramina in the front zones of the left orbit, and finally, individual 101/81 a female aged 45–55 has scattered foramina of *cribra orbitalia* in evidence at grade 2–3. These are located in the anterior portion of the roof of the left orbit (damage to the posterior portion of the orbit prevents assessment).

STATURE ESTIMATES

Stature has been used to assess the impacts of significant shifts in subsistence strategy, such as the transition from foraging to farming, as it is generally assumed that during periods of increased dietary stress, the stature of both adults and non-adults decreases (e.g. Larsen 1995: 190–1).

Research by Meiklejohn *et al*. (1984) has reported that mean male stature during the Mesolithic is 167.7 and in the Neolithic it is 167.3, whilst the Mesolithic female stature mean is 155.6 and the Neolithic mean is 154.1. In the current analysis the Vedrovice males are in line with the Neolithic mean while females are slightly above it, being closer to the Mesolithic mean (*Table 4* and *Figure 11*).

DISCUSSION

The demographic analysis has shown that life expectancy at birth is 27.57 years, and there is clear evidence for sample bias, which is highlighted by the fact that non-adult burials occur in the settlement site at Vedrovice (Crubézy *et al*. 1995). The data presented in *Figure 1* demonstrates the fact that relatively low rates of mortality occur throughout the <20 year age categories, with a general increase in adult mortality indicated after an individual reaches 35–39.9 years of age.

Overall, the demographic data for Vedrovice are unexceptional in that there is a general risk of increasing mortality with age, and no exceptional peaks occur in risk throughout the lifespans in evidence. The drop in mortality in the 5–9.9 age group may reflect differential treatment of the dead, an observation supported by the recovery of five non-adult individuals from the settlement site (Crubézy *et al*. 1995), although the suggested immigration of a number of these individuals is problematic in this context.

TABLE 4. Stature estimates for the Vedrovice population. 16 males and 18 females are included in the analysis (*Appendix 2*).

Sex	Mean stature	Mean range	Standard deviation
Male+Female	160.82	143.31–174.94	7.84
Male	167.23	161.13–174.94	3.55
Female	155.12	143.31–163.77	5.92

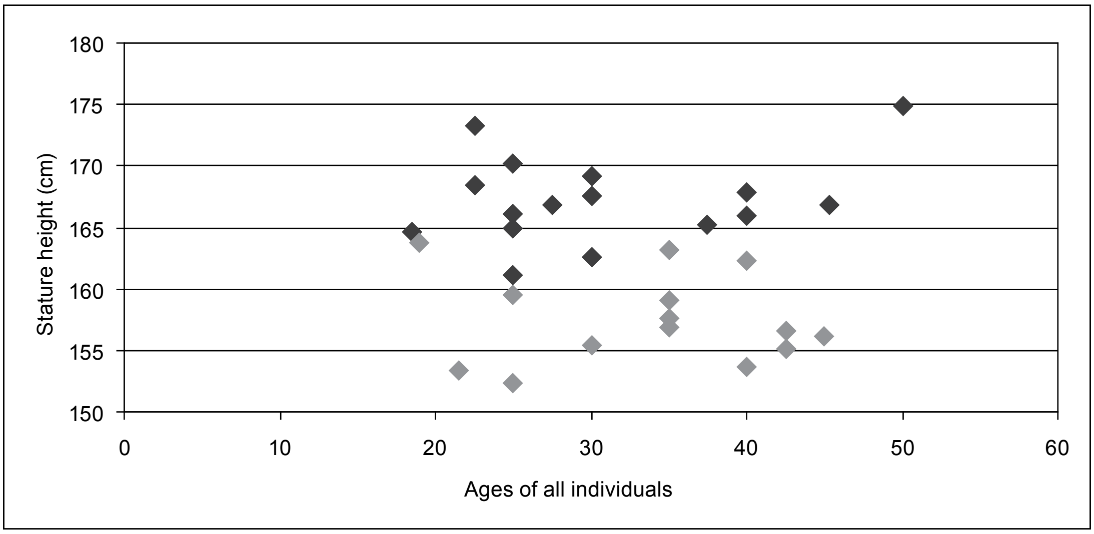

FIGURE 11. Stature estimates for the Vedrovice population. Grey diamonds – Female; Black diamonds – Male.

Further support for the suggestion that the population has a bias due to population dynamics comes from the work of Smrčka *et al*. (2005). In their study of the isotope data obtained from the settlement population these authors highlight the fact that four of the non-adult individuals are aged between 5–9.9 years of age, a factor that would elevate this under-represented group in *Table 1*. In addition, Smrčka *et al*. (2005: 322) note that two of the non-adult individuals studied exhibited strontium values that indicate non-local origins. Furthermore, an additional child, and an adult male exhibit strontium levels suggestive of migration on more than one occasion. Although not discussed by these authors, it is tempting to suggest that the male/female ratio discussed above, inferred as indicative of female migration, may be reinforced by the presence of the non-local non-adults identified from the settlement site.

Finally, recent research by Price *et al*. (2001) and Bentley *et al*. (2002), has argued that on the basis of strontium analysis of LBK individuals from the sites of Flomborn and Schwetzingen in the Rhine Valley, migration was an important factor in the spread of the LBK. In addition, it is noted that both males and females were among the migrants (Price *et al.* 2001: 601). The consideration of female/male representation in the population (*Figure 2*) demonstrates an interesting pattern, in that males are generally underrepresented in all of the age categories, with one notable exception. Overall, the male to female ratio is 0.63. The only exception to this rule occurs in the 20–29.9 category, where males outnumber females (at a ratio of 0.6), i.e. a reversal of the population based trend. The significance of this overrepresentation of young adult males in the 20–29.9 category, or alternatively, the overrepresentation of females above this age category, may relate to the observed evidence for migration, to some degree, however, this bias requires further explanation in relation to the wider socio-economic context of the Vedrovice community as a whole.

In the palaeopathological analyses the cranial region exhibits significant levels of dental pathology. These pathologies include general indicators of childhood stressors such as enamel hypoplasias, although these are not severe in expression. Some suggestion that these populations are in the process of a shifting dietary pathway is provided by the frequent occurrences of twisting/rotation, overcrowding and reduced third molar size throughout the dental series. These dental pathologies are commensurate with shifting dietary pathways, as might be expected at the transition from foraging to farming subsistence strategies.

The most prolific dental pathology, albeit one that appears to dominate in individuals of female biological sex, is caries. This pathology occurs at 1.88% expression in the male portion of the population (9 out of 480 teeth) with 5 of the 17 males studied with dentitions in evidence having caries (29.4% of the males with teeth). Some additional inference to caries is made by the existence of abscesses and ante-mortem tooth losses which are assumed to be the result of caries involvement. As such the figures quoted underestimate caries involvement.

For females there are 32 individuals with dentitions in evidence, 18 of these (56.25%) have caries in evidence, with 31 of 739 teeth carious (4.19%). As with males, some inference relating to caries involvement is made on the basis of ante-mortem tooth losses and abscesses. In total, the combined male/female sample comprises 23 individuals with caries out of 49 with dentitions available for study, resulting in a population based expression of this pathology at 46.94%, slightly higher than the figure reported by Frayer (2004: 87) who reports the total expression as 45.3%. The population based expression of caries involvement in relation to the overall number of teeth analysed is 40 out of 1,219 teeth, or 3.28%.

In general, it is apparent that caries rates are considerably underestimated due to the fact that there is frequent evidence for ante-mortem tooth loss and re-modelling of the alveolus throughout the skeletal series. Furthermore, the figures produced have been shown to underestimate female expression due to a general lack of preservation of the female dentitions. None of the 19 children with teeth in evidence have any expression of caries involvement. Caries rates have been shown to increase with the adoption of agricultural based economies (e.g. Larsen 1983, 1991).

Enamel hypoplasias are recorded on two non-adults, but overall the expression of hypoplasias, indicative of non-specific childhood stress episodes, is comparatively low. Only two children and three adults [2 females and 1 male] exhibit hypoplasia formation. As noted above, the numbers of hypoplasia preclude the development of meaningful population-based expression of stress episodes, and no significance can be drawn from the pattern in evidence.

The identification of unusual attrition patterns on the anterior teeth, particularly in females, has been recorded for this population. Larsen (2002: 131–133) has outlined the fact that teeth are used as tools, as well as for the characteristic masticatory functions, and also discusses the value of using dental microwear in studies of dietary transitions, such as the shift from foraging to farming. In the context of microwear studies Frayer (2004: 98) has noted that the grooving that has been identified in the maxillary incisors can be equated to the use of the teeth in the processing of fibrous materials, such as sinew.

In the cranial region the pathology of *cribra orbitalia* has been recorded on five female and two male individuals. At 14.58% expression at the population level this incidence is sufficient to suggest that these frequencies are commensurate with an endemic population specific occurrence. The predominance of the lesion in the region of the orbits suggests an initial low intensity response to (amongst other factors) reductions in dietary iron intakes and anaemia (Hengen 1971, Lallo *et al*. 1977, Stuart-Macadam 1989, Mensforth 1991).

Research by Stuart-Macadam (1992), has suggested that this pathology is an adaptive response to disease and micro-organism invasion, and as such, this pathological marker represents adaptation to environmentally specific pathogen loads, and when present in adults, they reflect survival of the morbidity event (Ortner 1991, Goodman 1993). The expression of this pathology would conform to a population that is in the early stages of the transition to agriculture. Larsen (1995: 199, 2002: 143) has reported that higher rates of *cribra orbitalia* are associated with sedentary farmers when contrasted with foragers (also Lallo *et al*. 1977). This increased incidence is again considered to be directly linked to the elevated pathogen loads associated with increased sedentism and population aggregation, as pathogen load is thought to be amongst the most critical factors in the development of anaemia in past populations (Kent 1986: 617, Stuart-Macadam 1992: 42).

It has been noted above that postcranial expression of pathology is limited, consisting primarily of age dependent degenerative conditions relating to osteoarthritis. However, three individuals, Nos. 64/78, 82/79 and 15/75 exhibit interesting pathologies. 64/78 is a young adult female aged ca. 18–20 years at death, who has severe fusion of the vertebrae throughout the spinal region. Individual 82/79 is a mature adult male aged ca. 50+ who has the left arm cut-off/severed ca. 110 mm above the wrist, a range of degenerative pathologies such as Schmorl's nodes and lipping of the margins of the vertebral bodies. Interestingly, individual 64/78 has the lowest stature estimate in the population at 143.31±4.45 cm, whilst individual 82/79 is the tallest person in the Vedrovice population at 174.94±3.27 cm. In addition, a male aged between 30–40 years at death (individual 15/75) exhibits evidence for trepanation. These surgical procedures have a significant incidence in the archaeological record, originating in the Mesolithic period (Lillie 1998b), with considerable evidence to support the fact that operations such as trepanation were frequently successful, and that the patient often survived the surgery (e.g. Alt *et al*. 1997, Lillie 1998b, Kaufman *et al*. 1997, Arnott *et al.* 2003).

In general, the male stature estimates are commensurate with Neolithic means (Meiklejohn *et al*. 1984), whilst female stature is above that of the Neolithic, and only slightly lower than Mesolithic means. If the general assumption, that during periods of increased dietary stress the stature of both adults and non-adults decreases, is valid (e.g. Larsen 1995: 190–1), then the population interred at Vedrovice does not conform to the general trend. This situation may exist because: either these individuals are sufficiently distant (temporally) from the initial adoption of new subsistence strategies to no longer display reduced stature, or the dietary pathway is sufficiently robust to negate any potential stressors.

CONCLUSIONS

The demographic analysis undertaken on the Vedrovice population has shown that different approaches to the construction of life tables can produce slightly different ages for life expectancy at birth (*cf*. Meiklejohn *et al.* 1997, Jackes, Meiklejohn 2008). In general, the life table data is unexceptional, and the ages generated in *Tables 1–3* range between 27.57–31.22 years. The lowest estimate was generated using a 5 year interval in the life table, an approach which has been questioned by Jackes and Meiklejohn (2008). The data presented in *Tables 2* and *3* is very similar, with a life expectancy at birth age of 31.22 generated by Crubézy *et al*. (1995) from their study of 104 individuals (*Table 2*) representing a combined sample from the settlement and cemetery at Vedrovice. *Table 3* has a life expectancy at birth of 29.54 years, slightly below the results in *Table 2*, but this is most likely to be an artefact of the lower population number (81 individuals) used in this stage of the analysis. Significant differences in relation to male/female ratios are highlighted by *Figure 2*, which demonstrates that the overall population based male/female ratio of 0.63 is reversed in the 20–29.9 age category to a female to male ratio of 0.6. The fact that females outnumber males in all of the other adult age categories in this population may well reinforce the observed isotopic evidence for immigration of females into the population; however, the male/female ratio in the 20–29.9 age category would require further explanation in the context of this evidence.

In general, the range of pathologies in evidence at Vedrovice remain commensurate with those encountered on human skeletal populations at the transition to agriculture (e.g. Alexandersen 1988, Angel 1966, Goodman *et al.* 1984a, Larsen *et al.* 1991, Lubell *et al*. 1994, Meiklejohn *et al*. 1988, Molnar, Molar 1985, y'Edynak 1978, 1989). In particular, the consistent presence of advanced carious lesions on a number of the individuals studied suggests the consumption of carbohydrates in the diet, as occurs with the consumption of cereal based subsistence strategies (Meiklejohn, Zvelebil 1991). Larsen (2002: 123) notes that caries incidence increases with the adoption of agriculture and the concomitant consumption of carbohydrates, although regional variability is in evidence (e.g. Frayer 1987). Larsen also links the differences in caries expression between males and females to gender-based differences in the preparation and consumption of food (1995: 189), a factor which could be implicated in the expression of caries and general oral pathology at Vedrovice. In addition, the fact that females are clearly exhibiting higher incidences of caries when compared to males, may reflect differential access to dietary proteins versus carbohydrates in this population. Similarly, some suggestion of differences in diet between individuals in this cemetery occurs in the incidence of flat versus angular wear patterning.

Of some interest is the observation that low levels of calculus deposition are in evidence on the dentitions of a number of individuals. The presence of calculus deposits is indicative of the consumption of dietary proteins by individuals in this population. The dental microwear analysis undertaken by by Nystrom (2008) and Jarošová (2008) reinforces this observation. The overall impression, from the dental analysis, is that whilst this population is in the early stages of agriculture, the diet is mixed, and the patterns of wear and expression of caries may suggest that both males and females are exploiting divergent diets at the intra-population level. The possibility exists that a combination of "Mesolithic" and "Neolithic" diets are being exploited by the people buried at Vedrovice. The presence of grooving on a number of the dentitions has been interpreted as resulting from the use of the teeth as tools in the processing of sinew (*cf*. Frayer 2004).

Throughout this cemetery population there is some evidence to indicate that reduction of the dental arcade is occurring, due to the absence of third molars, rotation and overcrowding. This is a phenomenon that is characteristic of the shift towards "softer" diets at the agricultural transition and which is associated with congenital absence (Bass 1987: 284–5, Larsen 1995: 192–193). Alternatively, reductions in tooth size have been shown to relate to nutritionally stressful environments during the stages of tooth development (*ibid*. 1995: 193), but this factor is not supported by the overall expression of pathology in the dentitions from Vedrovice. Interestingly, however, both of these observations remain pertinent in a population that is changing its subsistence base from hunting and gathering to farming.

The recording of *cribra orbitalia* on a number of individuals would seem to conform to frequencies that are commensurate with an endemic population specific occurrence as opposed to the incorporation of individuals from a different population base. The predominance of the lesion in the region of the orbits suggests an initial low intensity response to (amongst other factors) reductions in dietary iron intakes (Lallo *et al*. 1977, Stuart-Macadam 1989).

The population-based expression of this pathology, at 14.58%, would discount hereditary anaemias as a factor responsible for lesion development (Lallo *et al.* 1977, Klepinger 1992: 122), and support the observation that the individuals at Vedrovice are experiencing high pathogen loads associated with either infection or sedentism (or a combination of these factors). As pathogen load is thought to be amongst the most critical factors in the development of anaemia in past populations (Kent 1986: 617, Stuart-Macadam 1992: 42), the identification of potential parasite infested foodstuffs or evidence for increased sedentism and population numbers compared to other sites of similar or earlier date would be informative in assessing this expression. Larsen (1995: 199) has highlighted the fact that, in general, the *cribra orbitalia* rates increase with the transition to agriculture, although the expression of this pathology is regionally and population specific in occurrence (El-Najjar *et al*. 1976).

The fact that many of the other pathologies identified in this population appear to be age-related degenerative conditions suggests that the population is relatively healthy in terms of the physical condition of the skeleton, but that the increasing pathogen loads and dietary insults such as caries, would be commensurate with a transitional farming community. The possibility that differential access to dietary proteins and carbohydrates occurs between males and females (and between males/males and females/females) could indicate that the population buried at Vedrovice is made up of two disparate groups of people who are exploiting both traditional hunter-gatherer and farmer diets. However, this latter assertion would require corroboration with other analysis, such as isotope studies.

ACKNOWLEDGEMENTS

Dr Robert Smith assisted with the demographic analysis undertaken here, and Alena Lukes was instrumental in ensuring that my research visits were successful. I would particularly like to thank our Czech colleagues for fruitful discussions relating to the palaeodemography of the Vedrovice population. This research was funded by AHRC grant B/RG/AN18452: Biological and cultural identity of the first farmers: Multiple bioarchaeological analysis of a Central European cemetery (Vedrovice).

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APPENDIX 1. List of individuals used in the current study.

13 – F Adult	67 – F 35–45
14 – F 35–45	68 – F 50+
15 – M 35–40	69 – M 20–30 [in 20–25 bracket]
16 – Child ca. 3 years	70 – F 45–50
17 – Child ± 1 year	71 – M 35–45
18 – Child 6–8 years	72 – F 30–40
19 – M 25–30	73 – M 20–25
20 – Child 3–5 years	74 – F 50+
21 – F 30–40	75 – F 25–35
22 – F 35–45	76 – M 20–30
23 – M 18–20	77 – M 40–45
25 – M Adult	78 – Child 7–8 years
27 – Child >13 years	79 – M 25–35
28 – Child 4–5 years	80 – F 35–45
29 – F 18–20 years	81a – F 20–30
30 – Child 10–14 years	81b – Newborn
31 – Child 10–14 years	82 – M 50+
32 – Child 10–14 years	83 – F ±60
36 – F 35–50	84 – Child 10–12 years
37 – Child 11 years	86 – F 25–35
38 – F? 30–35	87 – F Adult
39 – Child 3–4 years	88 – M 20–30 [in 25+ bracket]
40 – Child ±8 years	89 – Indet Adult
42 – F? 20–30 [in 25–30 bracket]	90 – Indet Adult
43 – Child 14 years	91 – F 18–20
44 – Child 3–5 years	93a – F 18–25 [max age 20]
45 – F 35–45	93b – Child pre–natal [stillborn?]
46 – M 20–25	94 – F 18–22 [in 20–25 bracket]
48 – F 18–20	95 – M >50
50 – M Adult	96 – Child 3–5 years
51 – F 45–55	97 – F 30–40
54 – M 20–25	99 – M 20–30
55 – Child >10 years	100 – F 20–30
56 – Child <3 years	101 – F 45–55
57 – M 40–50	102 – F 40–45
59 – M 25–30	103 – F <50
61 – F 40–50	104 – F ±50
62 – F 30–40	105 – Child 16–18
63 – M 40–45	106 – Child ±15
64 – F 18–20	107 – F 18–20
66 – M 25–35	108 – M Adult

APPENDIX 2. Stature estimates.

Ref Number	Sex	Age	Age (mid)	Stature range (cm)	Stature (cm)	Stature (in)
15/75	Male	35–40	37.5	165.18±3.27	165.18	5' 4.2"
19/75	Male	25–35	30	167.55±3.27	167.55	5' 5.0"
23/75	Male	17–20	18.5	164.70±3.27	164.7	5' 4.0"
46/77	Male	20–30	25	166.13±3.27	166.13	5' 4.5"
54/78	Male	20–25	22.5	173.27±3.27	173.27	5' 6.8"
57/78	Male	40–50	45.3	166.84±3.27	166.84	5' 4.7"
59/78	Male	25–30	27.5	166.84±3.27	166.84	5' 4.7"
66/78	Male	25–35	30	162.56±3.27	162.56	5' 3.3"
69/78	Male	20–30	25	170.17±3.27	170.17	5' 5.8"
71/79	Male	35–45	40	165.89±3.27	165.89	5' 4.4"
73/79	Male	20–25	22.5	168.51±3.27	168.51	5' 5.3"
76/79	Male	20–30	25	164.94±3.27	164.94	5' 4.0"
77/79	Male	35–45	40	167.80±3.27	167.8	5' 5.0"
79/79	Male	25–35	30	169.22±3.27	169.22	5' 5.6"
82/79	Male	50+	50	174.94±3.27	174.94	5' 7.4"
88/80	Male?	20–30	25	161.13±3.27	161.13	5' 2.9"
80/79	Female	35–45	40	162.32±3.27	162.32	5' 3.2"
21/75	Female	30–40	35	157.58±3.72	157.58	5' 1.7"
22/75	Female	35–45	40	153.64±3.72	153.64	5' 0.4"
36/75	Female	35–50	42.5	155.12±3.72	155.12	5' 0.9"
48/77	Female	18–25	21.5	153.39±3.72	153.39	5' 0.3"
64/78	Female	18–22	20	143.31±4.45	143.31	4' 7.0"
72/79	Female	30–40	35	156.85±3.72	156.85	5' 1.4"
75/79	Female	25–35	30	155.37±3.72	155.37	5' 1.0"
70/79	Female	40–50	45	156.11±3.72	156.11	5' 1.2"
81a/79	Female	20–30	25	159.56±3.72	159.56	5' 2.4"
86/80	Female	25–35	30	143.76±3.72	143.76	4' 7.2"
93a/80	Female	18–25	21.5	153.39±3.72	153.39	5' 0.3"
94/80	Female	18–22	20	146.72±3.72	146.72	4' 8.0"
97/80	Female	30–40	35	159.07±3.72	159.07	5' 2.2"
100/81	Female	20–30	25	152.30±3.66	152.3	5' 0.0"
102/81	Female	40–45	42.5	156.60±3.72	156.6	5' 1.4"
45/77	Female	30–40	35	163.22±4.30	163.22	5' 3.5"
91/80	Female	18–20	19	163.77±3.72	163.77	5' 3.7"
Mean stature (M+F)					160.82	
Mean stature (M)					167.23	
Mean stature (F)					155.12	
Stand Dev (M+F)					7.84	
Stand Dev (M)					3.55	
Stand Dev (F)					5.92	