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ABSTRACT

Pre-Hispanic human remains from Salvatierra, Llanos de Mojos, Bolivia

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Studies on pre-Hispanic populations in the Amazon region are rare and mostly focus on the remains of the earliest humans in the region. There is currently a complete lack of relevant studies for the southwest of Amazonia. In this paper we present the results of a comprehensive multi-disciplinary study on the skeletal remains of 125 individuals from the pre-Hispanic Casarabe culture settlement Salvatierra. The Casarabe culture flourished between 500–1400 AD in the southeast of the Llanos de Mojos, which make up a large part of the Amazon lowlands of Bolivia. The study, conducted in 2007 and 2008, involved classic osteological examinations, as well as analyses of ancient DNA, isotopes, and trace elements.

KEYWORDS

Amazonian archaeology, bio-anthropology, anthropometry, human remains, treponematosis, Casarabe culture, Bolivia

Pre-Hispanic human remains from Salvatierra, Llanos de Mojos, Bolivia

Introduction

¹ The anthropological material discussed originates from excavations in the Casarabe culture settlement Salvatierra between 2004 and 2006. These excavations were carried out as part of the “Proyecto Lomas de Casarabe”, a collaborative research project of the Commission for Archaeology of Non-European Cultures (KAAK) of the German Archaeological Institute (DAI) and the Bolivian monument authority (DINAR, Dirección Nacional de Arqueología del Viceministerio de Cultura).

² The Salvatierra settlement is located about 1.5 km southwest of the village Casarabe, the only major settlement in the area today. The Casarabe culture, named after this place, flourished between 500–1400 AD in the southeastern part of the Llanos de Mojos, an extensive savannah that covers a major part of the Amazon lowlands of Bolivia (Fig. 1). With 147 hectares and a center with monumental earthen architecture, the Salvatierra site belongs to the category of secondary centers within a 4-tier hierarchy of Casarabe sites (Prümers et al. 2022).

³ The excavations have mainly focused on the central area of the settlement, which is located on an artificial terrace approx. 2 m high (Fig. 2). On this terrace a pyramidal structure approx. 5 m high was constructed, as well as lower platform buildings. The excavation units, with a total area of 440 m², were located in this core area of the settlement. In some cases they could be dug down to the sterile ground, in others the work had to be stopped at a depth of 4 m for safety reasons. Skeletal remains were found – with the expected exception that proves the rule – in all excavation sections. They belong to 125 individuals. If one assumes that the entire core area of the site, covering 3.44 hectares, has a comparable grave density, there were probably more than 9500 individuals buried in the area, of which the skeletal remains on which this study is based represent only a very small, random selection.

⁴ Of 20 individuals, only very few skeletal remains that had already been relocated in pre-Hispanic times could be examined. They probably came from graves that were partially or completely destroyed during the numerous transformations of the settlement's center. The remaining 103 individuals were found in graves. The pits of the graves were mostly not recognizable neither in the plana nor in profile. Dating



Fig. 1: Map of Amazonia showing the Llanos de Mojos and the approximate distribution area of the Casarabe culture.

the graves by stratigraphy was therefore only possible in exceptional cases. In addition, the graves were mostly devoid of grave goods. Only in 20 cases were ceramic vessels included that allowed a relative chronological dating (Jaimes Betancourt 2012). Body adornments were found in four graves, but these finds offered no clues for dating. Therefore, samples were taken from a relatively large number of skeletons for C14 dating. The chronological sequence for these 21 graves is shown in Fig. 3. The burials date over a period of almost 700 years, with a focus on the 8th–11th century AD. In fact, there are two peaks in this phase, one in the 8th century and one in the 11th century. Here, “population explosions” or immigration could actually have been recorded in the grave findings. All these burials definitely belong to pre-Hispanic populations.

Funerary customs

5 The Salvatierra burials exclusively involve body burials, with no evidence of burned bone material from cremations. In general, these are individual burials in grave pits that do not show any built-in structures, but do have grave goods. Overall, these are not very frequent and are mostly limited to individual ceramic vessels. However, dark soil discoloration within the pits suggest the deposit of organic materials, such as baskets with food.

6 An above-ground marking of the grave sites seems likely given the numerous burials located close together, but the frequent later intrusions suggest that such markings for burials may not have lasted for very long.

7 The orientation predominantly follows a northwest-southeast axis, although the orientation of the head side varies. In 31 cases the head is oriented to the northwest and in 15 to the southeast (Fig. 4). The other graves vary around the north-south axis. A

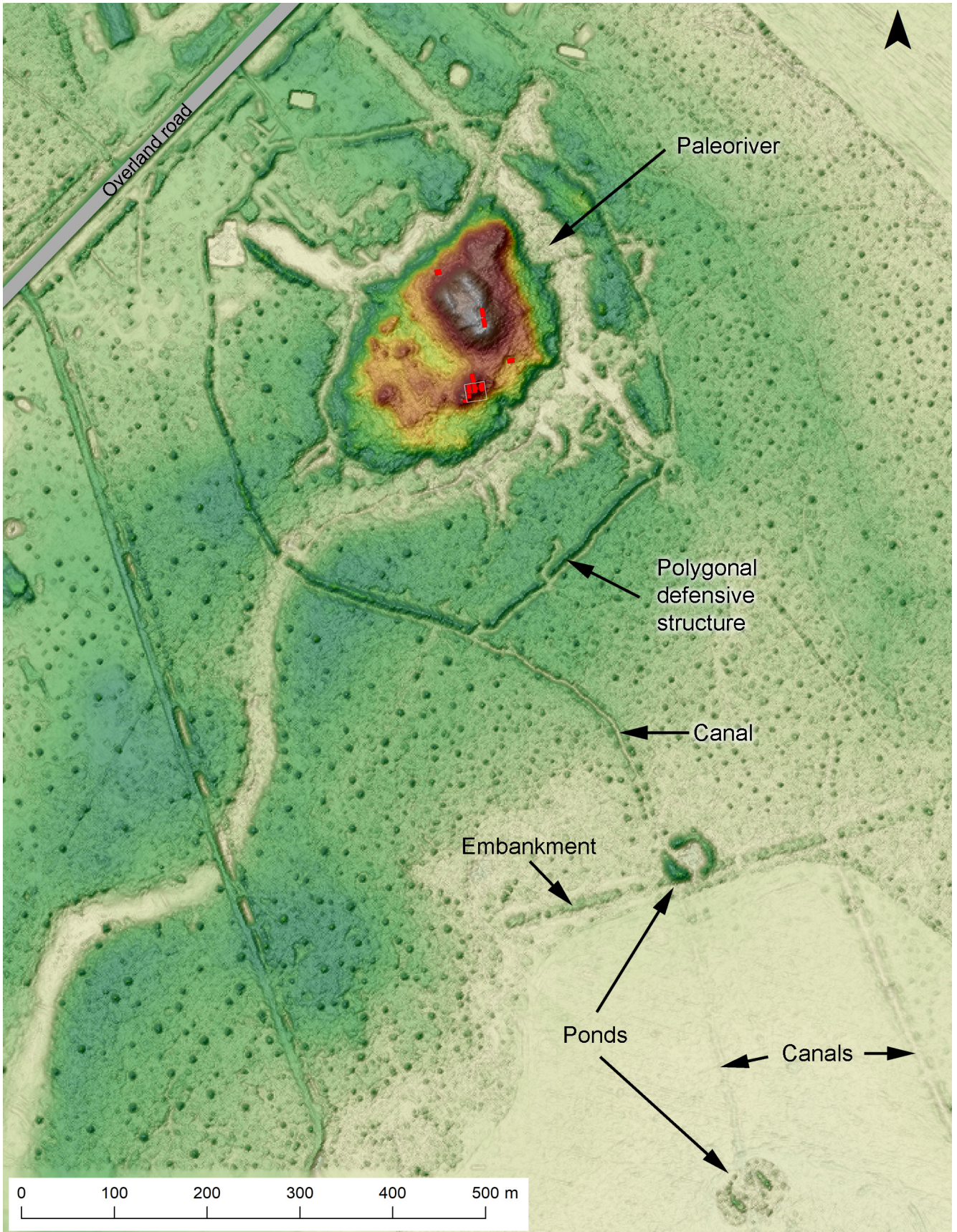


Fig. 2: Plan of the Salvatierra settlement. Red rectangles indicate the location of the excavation units.

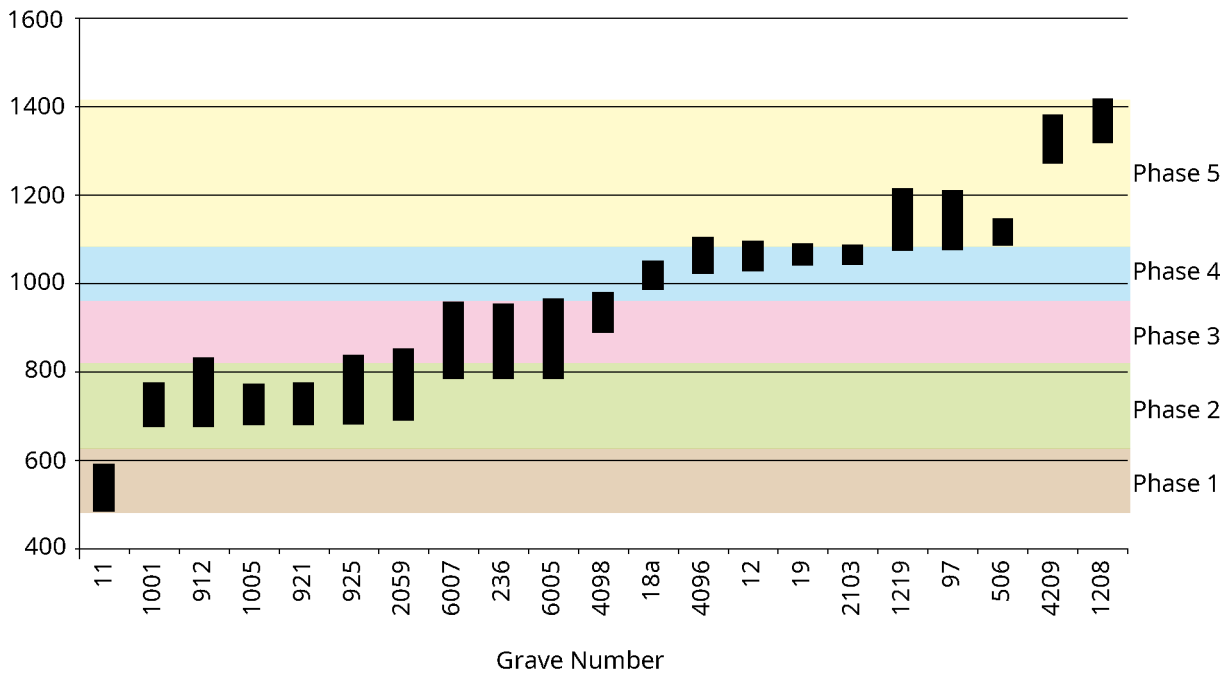


Fig. 3: The 14C-dates of the selected skeletal remains in chronological order.

clear east-west connection only occurs once (Ind. No. 098). Neither the age nor sex of the buried person plays a role in the orientation of the grave. There is also no connection with location or topography.

⁸ When it comes to postures, a surprising variety of positions can be found: While a stretched supine position is most common (in 17 cases), both crouched and stretched side positions, a crouching prone position, and even cross-legged burials can be found also. A few individuals were buried in large clay vessels: five of them were female and under five years of age, but one individual (No. 2102) was a mature man. This case is probably a secondary burial after the primary grave was accidentally disturbed.

As with grave orientation, there are no statistical regularities in correlation with age and sex for the type of deposition of the body in the grave. An exception is the burial of children in vessels and the dead in a sitting position: out of five individuals in this unusual position, four are male. However, the overall number is too small to make a statistically reliable statement. Future investigations will show whether the variations in burial practices recorded at the Salvatierra site are purely coincidental. If not, they may be attributable to chronological differences, or express a membership to certain social segments that were not marked by the biological characteristics of age and gender, among others.

⁹ In fact, radiocarbon data provide evidence for chronological reasons. The earlier burials appear to show stretched positions, while the more recent ones appear to have variants of squatting or sitting postures. The change appears to have occurred in the late 8th century. This change in mortuary customs may have religious, ideological or simply “fashion” reasons, but an influence from outside – possibly with an influx of strangers – is still conceivable. For this reason, particular attention should be paid to the end of the 8th century in further investigations.











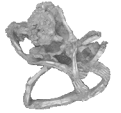

	Phase														
	2			3			4			4/5			5		
	♀	♂	?	♀	♂	?	♀	♂	?	♀	♂	?	♀	♂	?
	912 1154 2049	921 925 1001 1005 2066		911 926 934	230 913 1127 4098 4099 6023				4028		97		4195	4200 4202 4208	
	933 2059 2063 2128	7007		236 927 935 1121 6021							1115				
						4171									
	2067			6011	916 919 931	1115	15A 15B				1103		1209	4201	
				928	910 6022a	917a		1220							
				231 238				10 11 2103					1210		1217 1218
					237 915 2104 6007		225				98				
				6005				4096							
							15a 19						1219		
								1213					1208 4203	4209	4207
								12 18					1211a 1212a	209 506 1213	1214
							218		223	932		1206	213 1222	2102	95 1215 1216

Fig. 4: Orientation, body posture and burial type arranged in chronological order.

Materials and Methods

¹⁰ Skeletal remains of a total of 125 individuals were recovered from 103 burials, and as scattered finds in cultural layers. For anthropological examination, some of the material was brought to the University of Tübingen, Institute of Prehistory and Quaternary Ecology, Department of Paleoanthropology, and some was also processed on site. The processing included numerous scientific analyzes that were carried out in laboratories at the universities of Tübingen, Kiel and Göttingen.¹

Conservation status

¹¹ Typically, soil and weather conditions in tropical rainforest environments are detrimental to the preservation of bones. Mineral-poor and acidic, highly permeable red laterite soils as well as high temperatures and amounts of rainfall plus dense plant growth and acidic humus decompose and demineralize bones rapidly, often dissolving the bone matrix completely and making good skeletal preservation from archaeological sites a rare occurrence. Therefore, there is only a very small number of pre-Hispanic burials from the South American lowlands. A human skeleton series of this size therefore represents a rare stroke of luck. The elevated position of the burial sites and the dense, mineral-rich clay soil of the settlement mound contributed to bone preservation by preventing leaching. The absence of coffins or wooden structures further facilitated bone preservation.

¹² The present study also benefits from the comprehensive recovery and documentation of the burials. All of the graves recorded during the three excavation campaigns were recovered as completely as possible and carefully documented. Pelvis remains and skulls in a fragile condition were recovered en bloc for later preparation. The exposure by hand and a stabilization of the remains, which was partly carried out in the field by soaking them with Ponal© white glue, allowed the best possible preservation of the bone material.

¹³ All bodies were primary interments. Secondary deposits of moved bodies were not observed. Apart from a few burials in large ceramic vessels, most were direct burials in the earth without coffins or anything similar. In some cases the situation suggests that the dead were tightly wrapped in a shroud. Such burial conditions usually have a positive effect on bone preservation. However, disturbances and displacements caused by later ground interventions appear to have occurred very frequently, resulting in entire sections of skeletons being lost.

¹⁴ Generally, the unearthed skeletal material is light to medium brown in color, and only a few individuals show surface weathering in the form of craquelure and flaking or root damage. There was never any clear evidence of animal bites, and there was no discoloration due to the accumulation of decomposition fluids in the grave. In order to avoid detailed descriptions for each individual, a classification into categories was undertaken to facilitate direct comparison. A distinction was made between the completeness (quantitative preservation) of the skeleton and the condition (qualitative preservation) of the bones. These two factors do not always have to correlate. In fact, it is often the case that under normal decomposition conditions, long bones and parts of the skull are preserved for the longest time, while disturbances usually cause the larger bones to be lost.

¹⁵ Completeness refers to the approximate percentage of preserved bone material from an individual. The condition of the bones describes the degree of decomposition,

¹ At this point we would like to expressly thank the DFG for funding the project "Anthropological study of a pre-Hispanic population from the Llanos de Moxos Bolivia".

but also the extent of fragmentation, which usually depends directly on stability. Four degrees were distinguished here (transitions were possible, mostly due to differences that occurred on different parts of the skeleton):

- hard: The bone has been hardened by postmortem mineral deposition; it is break-resistant, resistant to water and sounds similar to well-fired ceramic when tapped on the surface with a metal probe.
- firm: The bone is only slightly or not at all decalcified, the structure of the surface remains unchanged, the compacta is dense, and the spongiosa is largely preserved. When handled normally, it does not break and is not sensitive to water; it sounds like wood when tapped.
- fragile: The bone is clearly decalcified, the surface is rough and cracked, the compacta is peeling off in places, and most of the cancellous bone has disappeared. The bone must be handled with care to avoid spontaneous fractures. When tapped, it it sounds like cardboard.
- brittle: The bone structure is largely dissolved, the shape is usually only held together by adhering earth. Accordingly, the bone breaks down into needle-like particles when it comes into contact with water or completely dries out. The bone can only be worked with after it has been hardened by consolidants.

On average, the completeness of the skeletons recovered from the Salvatierra site is only 33 % (10 %=50 ind., 20 %=19 ind., 30 %=11 ind., 40 %=10 ind., 50 %=9 ind., 60 %= 5 ind., 70 %= 2, 80 %=5 , 90 %=6 , 100 %=6 ind.) and the completeness of more than three quarters of the skeletons is less than 50 %. In many cases, the absence of entire skeletal parts is not due to decay, but rather caused by disturbance, presumably due to soil intrusions by later and quite intensive construction work that affected the graves of earlier occupation phases. This statement is supported by the generally good condition of the bone remains: the majority of individuals was preserved firm or better (brittle=17, brittle-fragile=10, fragile=36, fragile-firm=15, firm=42, fragile-hard=1, hard=2). Altogether, the finds provided a solid basis for metric data recording and the assessment of pathological changes as well as special anatomical features.

Methods

16 The anthropological examination of skeletal material from Loma Salvatierra, conducted by M. Trautmann, Z. Obertová, and I. Trautmann, primarily employed macroscopic analyses. Exceptional cases underwent X-rays or microscopic examinations for differential diagnosis in pathology reports.

17 Depending on the state of preservation, the bone material was cleaned wet or dry and partially hardened with Ponal® solution in a dilution ratio of 1:5. Fragmented bones were then reassembled using Ponal® as an adhesive. For time-saving reasons, metrically irrelevant material (e.g. ribs) was not reconstructed, and arbitrary bridging and additions were also omitted. If reconstruction was possible with a high degree of certainty – for example by comparing sides or sufficiently large contact points – the reconstructed bone part was included in metric evaluation. However, all bone fragments were examined for pathological evidence, signs of adaptation, or hereditary anatomical variants.

Thereafter, all preserved bone parts were documented in a skeletal form sheet in order to obtain a comparable overview of the preservation and completeness. These records also provided a point of reference for clarification in case of unclear contexts of finds or surplus or missing skeletal elements. Dental documentation adhered to the two-digit system of the Fédération Dentaire Internationale (Fédération Dentaire Internationale 1971; see Fig. 5) and included descriptions of dental wear and pathology.

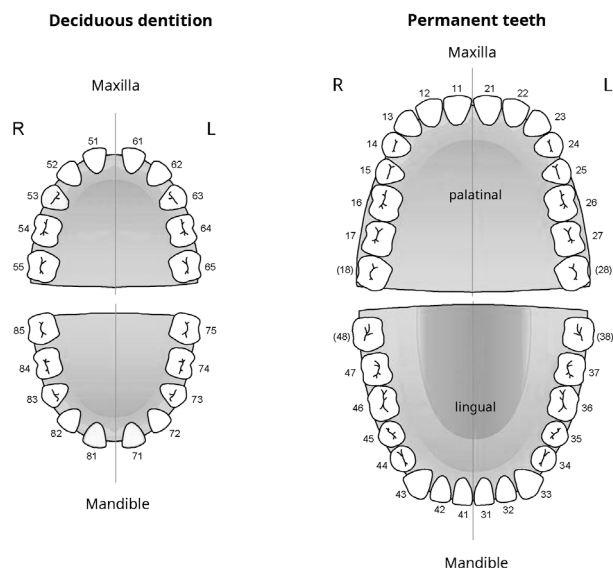


Fig 5: Dental scheme.

18 The assessment of individual sex followed the established standards of anthropological determination based on skeletal traits (e.g. Ferembach et al. 1979, Herrmann et al. 1990). In addition, in view of the sometimes very poor level of preservation, further criteria were used, such as the angle of the internal acoustic meatus (Graw et al. 2005). The method can be validly used also for sex-determination of subadults. In the Salvatierra population sample, however, it became apparent that there was a slight tendency towards misidentification as female when compared to other reliable characteristics. This population-specific characteristic was taken into account when weighting the individual characteristics. To control results, possible sex differences in tooth crown size were also tested in individuals whose sex was otherwise reliably determined, with the results tentatively applied

to individuals with limited morphological sex determinants. The mesio-distal and bucco-lingual dimensions of the upper central incisors and especially the canines were taken into account as relevant (Alt – Pichler – Vach 1995, Teschler-Nicola – Prossinger 2001). Furthermore, sex-dependant differences in postcranial bone dimensions were examined, mostly based on markers of robustness (diameter and circumference dimensions).

19 To determine age-at-death, we followed established guidelines (e.g. Ferembach et al. 1979, Herrmann et al. 1990), including the assessment of dental development (Ubelaker 1982) and fusion of epiphyses in sub-adults (Buikstra – Ubelaker 1994), as well as long bone and skull measurements of children up to 12 years of age (Fazekas – Kosa 1978, Scheuer – Black 2000a, Scheuer – Black 2000b, Stloukal – Hanáková 1978).

20 In adult and older individuals, the assessment of cranial suture ossification (Perizonius 1984) as age indicator was used primarily if feasible, degenerative changes to sternal rib ends (İşcan – Loth – Wright 1984), the articular surface of the clavicle (Szilvássy 1977), the surface of the pelvic symphyseal facies (Brothwell 1981) or the cancellous bone density of the humerus and femur (Acsádi – Nemeskéri 1970) were also taken into account.

21 The degree of abrasion of the teeth (Smith 1984, Brothwell 1981, Molnar 1971, Broca 1879) was included in the documentation in detail and used to estimate age when better criteria were lacking, but only after calibrating age-dependant wear stages with individuals of this population sample, to take lifestyle-related peculiarities into account. However, since the comparability of the nutritional habits and thus the age-dependent tooth wear of the present series with the reference groups is uncertain, an overly high level of precision as suggested in some studies was omitted, and the determination was simplified accordingly.

22 Microscopic examination techniques such as osteon counting (Kerley 1969; Yoshino et al. 1994) or chemical analyzes of bone substance (Lengyel 1968) were not used – time effort, costs and a lack of validation of the methods were the reasons for exclusion.

23 The microscopic counting of dental cement rings, which according to previous studies (Wittwer-Backofen – Buba 2002) is said to be a very exact and precise method of diagnosing age in adults, was tested but excluded for evaluation in the preset study. The main reason for this is the fact, that the physiological processes causing the formation of dental cement rings is still poorly understood (Obertová – Francken 2009). Furthermore, it is still unclear whether human populations from tropical latitudes, i.e. regions with less pronounced seasons, show the same annual accumulation of dental cement as people from higher latitudes. In order to investigate this problem, six teeth were examined by

M. Francken, then University of Tübingen, Germany. The results seemed promising, but were of no relevance to this study because of the small sample size. They may be included in a later study devoted to this specific topic.

In addition, preliminary tests for aDNA preservation of two individuals (1001 and 1005) were initially carried out by L. Fehren-Schmitz from the University of Göttingen. Later, analyzes of genetic relationships were carried out in a total of 31 individuals by C. Pusch and N. Gaultier from the Human Genetics Department at the University of Tübingen. Studies on pathogen DNA in suspected treponematoses cases among 15 Loma Salvatierra individuals also took place here.

24 H. Bocherens and D. Drucker from the Institute of Geosciences Department of Biogeology at the University of Tübingen analyzed the C and N isotopes, which provided additional insights into utilization of different food sources. H. Taubald and C. Knipper from the Institute of Geosciences, Department of Geochemistry at the University of Tübingen carried out measurements of trace elements and Sr isotope profiles, which, in addition to further information on nutrition, were intended to examine the population sample for the presence of possible immigrants. P.M. Grootes from the Leibniz Laboratory for Age Determination and Isotope Research at the University of Kiel carried out the AMS-14C dating on 21 human skeletal individuals, which enabled a temporal breakdown of the remaining test results.

Demographics

25 The skeletal remains examined came from 125 individuals (=MNI) recovered from 103 different contexts. The sample is biologically representative – all age groups and both biological sexes are represented among the burials ([Appendix 2](#), table 1). A ritual selection of only a specific biological or social part of the community is therefore not probable. On the contrary, the variants in grave customs already described with regard to location or positions of the dead or the furnishings of grave goods could indicate that the burial site was used equally for all the dead in the settlement community and burial customs were not very restrictive or selective, despite possible social differentiation. As already mentioned, diachronic influences could likely be mostly responsible for the differences.

Sex ratio

26 Despite the overall rather poor completeness of the skeletons, a fairly reliable statement about biological sex could be made in the majority of cases – only 28 individuals could not be assigned. These are usually sparse bone remains that had no diagnostic features. If only taking the very reliably determined individuals into account, the ratio is 31 male to 21 female, resulting in a masculinity index (MI) of 1476. An MI of 1000 indicates a balanced ratio, while values above this indicate a predominance of men. If the less reliably determined individuals are included in the calculation, the ratio is better balanced – 52 male and 45 female, resulting in an MI of 1156. The group studied can therefore be considered balanced with regard to biological sex, representing a normal and stable, long-term resident population. There are no signs of an exodus of “colonists” (mostly young men) or circumstances that would have led to a disproportionate outflow of women.

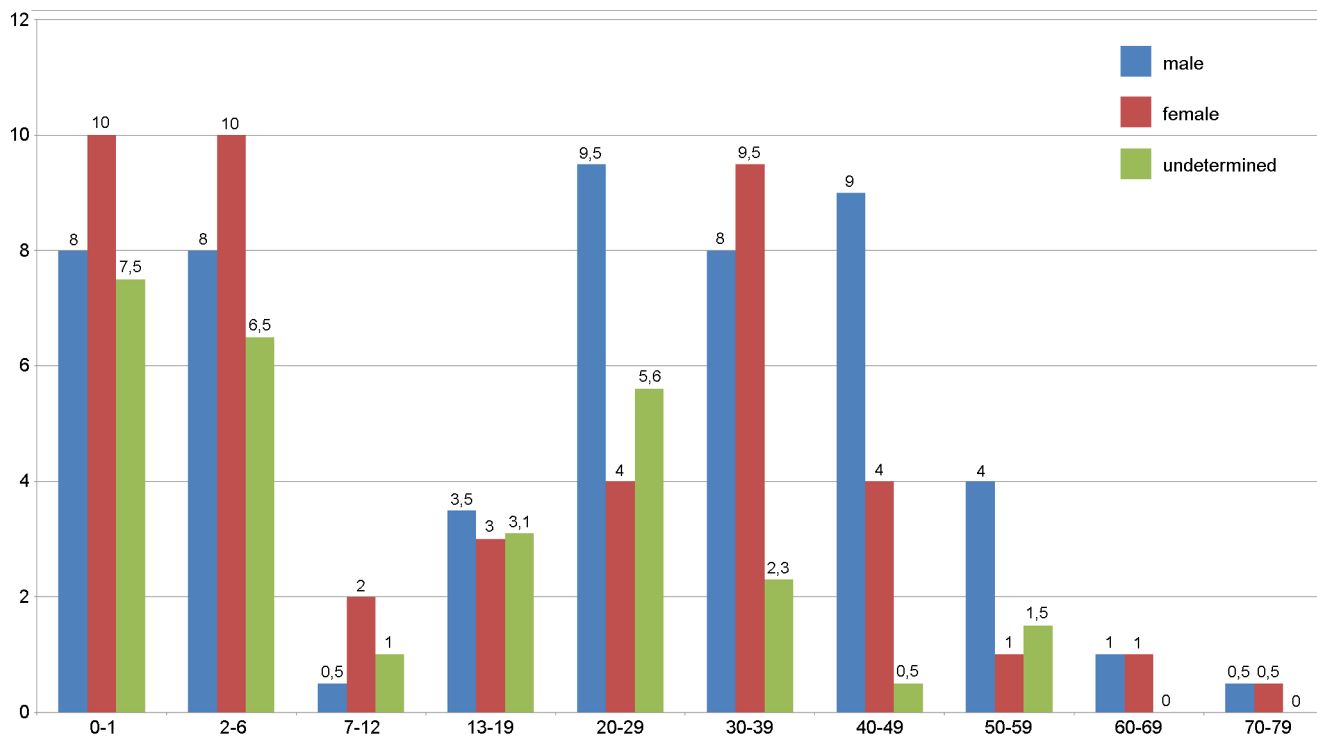


Fig. 6: Age groups by biological sex (the non-natural numbers derive from the computational distribution of those individuals whose determination spanned more than one of the age cohorts).

Death distribution and life expectancy

27 A significant proportion of the skeletons represent infants and children. Just over half of the burials recovered from the Salvatierra site belong to individuals who died before the age of 20 (64 ind., 51.2 %). Of these, 26 (20.8 %) died in the first year of life (Fig. 6 and Fig. 7). Since a disproportionate loss of subadult skeletons is not to be expected in the present series, the values found are likely to reflect actual mortality patterns (Appendix 2, table 2).

28 So, at first glance, subadult mortality appears to be very high, but actually it is within the sub-adult mortality rate of 45–60 % considered to be normal for 20th century non-urban, pre-industrial populations of non-developed countries (United Nations 1955). A direct transferability of these data to prehistoric groups was questioned repeatedly, but at least one of the points of criticism – the derivation of the numbers from tropical or subtropical populations – does not come into play when comparing with the population of the pre-Hispanic settlement of Salvatierra.

29 Compared to European groups of the Neolithic (Trautmann 2012: 326 ff.), who probably had similar standards of living, they are also at a medium level. Even in the Baroque era, historical sources report that in Germany around a third of children died in their first year of life and only half reached adulthood (Jungklaus – Niemitz 2001). Remarkable is the visible predominance of female individuals among the dead in the lower age groups overall, but especially their relatively higher mortality in childhood. Due to theoretically better genetic fitness, female infants should actually have a higher chance of survival in the first years of life and should therefore be found less frequently among the deceased². Perhaps there was a better parental care for male offspring which in turn could imply a higher social standing for men in the group examined.

2 Generally, male mortality is higher in early childhood because X-chromosome-linked genetic defects cannot be compensated for and are more likely to lead to congenital conditions that can end fatal. Thus, the male-to-female conception ratio is around 130:100, the birth ratio is around 106:100, and over the course of the first years of life there is usually a balance (Glücksmann 1981: 9 ff.)

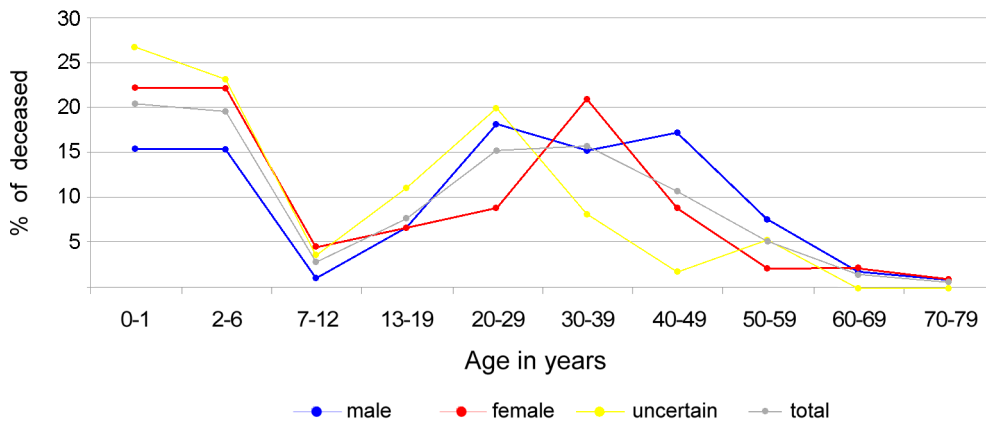


Fig. 7: Proportionate mortality in the age classes, by biological sex.

30 For both sexes, mortality is lowest between the ages of 7 and 12, which is probably attributable to the fact that childhood illnesses are no longer a particular danger at this age, and the risks of adulthood (birth complications, conflicts, work accidents) are still pending. Mortality slightly increases at the ages of 13 to 19 and then more in both sexes. Mortality in early adulthood is higher for men than for women, which soon offsets the slight male excess among childhood survivors in the living population.

31 Rather unexpected is the low death rate for juvenile and early adult women. Apparently, birth complications with fatal outcomes were a rarity – or perhaps these women (four to six individuals would be expected) were deliberately buried elsewhere. However, a statistical artifact cannot be ruled out, given the relatively small sample size.

Age group (years)	a	D_x	d_x	l_x	q_x	L_x	T_x	e^0_x
0-4	5	47,5	38,0	100,0	47,5	405,0	1926,0	19,3
5-9	5	5,5	4,4	62,0	7,1	299,0	1574,0	25,4
10-14	5	4,3	3,4	57,6	6,0	279,5	1284,8	22,3
15-19	5	5,8	4,6	54,2	8,8	259,0	1015,5	18,7
20-29	10	19,1	15,3	49,5	30,9	418,5	676,8	13,7
30-39	10	19,8	15,9	34,2	46,3	263,5	335,8	9,8
40-49	10	13,5	10,8	18,4	58,7	130,0	139,0	7,6
50-59	10	6,5	5,2	7,6	68,4	50,0	49,0	6,4
60+	20	3	2,4	2,4	100,0	24,0	12,0	5,0
Total		125	100,0					

Fig. 8: Mortality table for the Casarabe culture population of the Salvatierra site.

a: Age span of the cohort in years

D_x : Number of individuals who died per age group

d_x : Relative frequency of individuals who died per age group (in ‰)

l_x : Relative number of survivors per age group

q_x : Probability of death per age group (in ‰)

L_x : Total number of years lived between two age groups

T_x : Total number of years to live per age group

e^0_x : Life expectancy in years per age group

Overall, the death distribution reflects a stable natural population that was able to develop over a long period of time without major disruptions (selective emigration or immigration, war, epidemics, social segregation, modern medicine).

32 The apex death rate for the entire population is between 30 and 40 years of age, only slightly lower than within comparable historical populations of Central Europe. Nevertheless, only about 4 % lived to be over 60 years old. The mean age at death for the entire series (n=125) is 21.7 years, excluding subadults 39.2 years. Broken down by sex, it is 26.8 years old for males (n=52) and 20.6 years old for females (n=48). The life expectancy in the different age groups is calculated in the life table (see Fig. 8). These values can be viewed as average for a pre-modern society (Séguy et al. 2008) with a slightly increased risk of female mortality in early childhood.

Phenotype

Postcranial metrics

33 The first look through the long bone material gave the impression that the inhabitants of the Loma Salvatierra must have been fairly large in terms of stature and robustness. This is especially noticeable in comparison to groups that are approximately the same time and spatially close (Costa – Alva Neves – Hubbe 2004). In fact, the measurements of the postcranial bones resulted in values that in some cases even exceed the lengths of Neolithic population samples from Central Europe. On the other hand, some extremely small individuals were also noticeable (see [Appendix 2](#), tables 3–6).

34 When calculating body height during lifetime from the existing long bones, the question arose as to which regression formula would be best suited for the available material. The calculations according to Olivier et al. (Olivier et al. 1978), which provide convincing results for historical European skeletal material, resulted in an average height across all long bones of 167.2 cm for men (n = 20) and 158.3 cm for women (n = 7). However, the formulas used are based on samples of recent Central European individuals, which limits transferability due to possible differences in proportions. Regression formulas based on Mongoloid ancestry and Mexicans exist from Trotter – Gleser (Trotter – Gleser 1958). These would result in values of 170.4 cm and 168.8 cm for men (there are no formulas for women). However, the Trotter – Gleser formulas generally tend to produce quite high values in other populations – mean upward deviations of 4 cm were found.

35 Finally, calculations were carried out according to Genovés (Genovés 1967), which gave an average height of 163.8 cm for men and 151.3 cm for women. The formulas are based on studies of Mesoamerican populations and therefore seem to be most suitable, at least from a geographical point of view. Whether they do justice to the ethnic-genetic background is another question.

36 It is noteworthy that when comparing the mean values of the postcranial lengths, the Loma Salvatierra series is consistently larger than the Mexicans of Genovés (Genovés 1967) by an average of 3.9 % for men and 2.4 % for women. Compared to the French reference series used by Olivier et al. (Olivier et al. 1978), the difference is lower – here the Bolivian series is smaller by 1.3 % and 2.3 % respectively. The difference in size is particularly striking in the humerus, which is significantly longer in Europeans.

37 This special difference in proportions is clearly reflected in the Humero-radial index (Ra1/Hu1x100), which in Olivier's group is on average 73.7 for men, but for the Bolivians it is 78.1. Genovés' Mexicans show a value of 76.4. The situation is similar with the legs. Here too, the Amerindian groups have relatively longer distal limb

parts with 85.0 and 84.7 compared to 81.3. The latter may – according to Bergmann's rule – be an adaptation to the warm tropical habitat (Bergmann 1847; Newman 1953). Such adaptations are genetically fixed and only change gradually due to changing environmental conditions via genetic drift. It can therefore be assumed that the ancestors of the Loma inhabitants had inhabited the warm tropical lowlands for a long time and did not just migrate from the colder Andean highlands.

38 On the other hand, the same shift in limb proportions in favor of the distal lengths also occurs in the phenomenon of secular growth acceleration, which was observed in the last century, especially in Europe. Not all parts of the body contributed equally to the observed general increase in size – in particular, the length of the distal extremity sections increased significantly. The reason for this is assumed to be an improved nutritional situation, especially with animal protein in the growth phase. Thus, the peculiar proportions of the Loma Salvatierra people could also be influenced by their diet (see Weinstein 2005). The overall comparatively high height of the population in itself indicates a good nutritional status (see below).

39 Since the overall dimensional differences to the reference series of Olivier et al. (Olivier et al. 1978) appear smallest, the results of these formulas were used below. An average height of around 167 cm for men and 158 cm for women is around 1–2 cm above the Central and Latin American level up to 1945 (Baten – Blum 2020). Today the average height in this region is around 170 cm or 158 cm, including the admixture of European ancestry. A comparison with pre-Hispanic populations from the neighboring highland regions shows a similar picture. For example, the men in the San Pedro de Atacama series had heights of only 159 cm (pre-Tiwanaku), 163 cm (Tiwanaku) and 159 cm (post-Tiwanaku), and the women 151 cm (pre-Tiwanaku), 153 cm (Tiwanaku) and 152 cm (post-Tiwanaku) (Pomeroy – Stock 2012). The population of the Loma Salvatierra can therefore be described as being comparatively tall.

40 What is interesting is the trend towards a decrease in average height from around the year 1000 AD. A similar phenomenon was also evident in the above-mentioned series from San Pedro de Atacama and is attributed by the authors to worsening economic and nutritional conditions in the post-Tiwanaku phase and a general deterioration in the climate in South America between 1000 and 1400 AD (Costa – Alva Neves – Hubbe 2004: 113). In the graphic showing this trend for the Salvatierra site (Fig. 9), only men were taken into account because the sample is larger here. Blue are the calculated body heights, black is the moving average as a trend line.

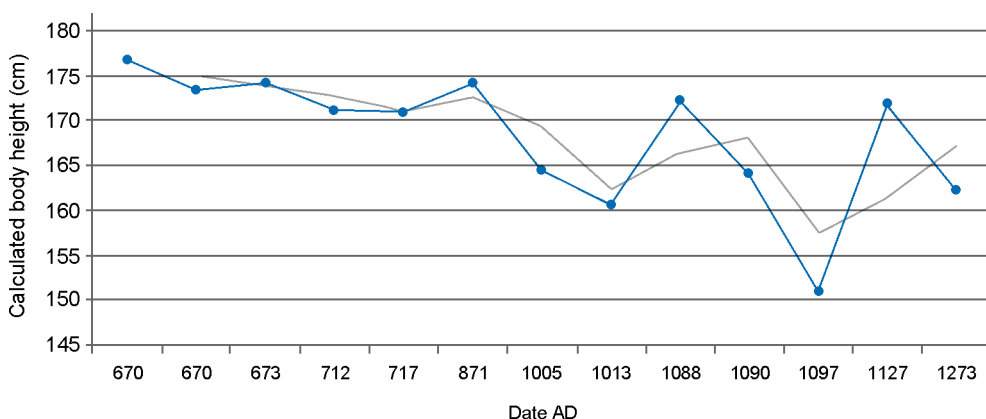


Fig. 9: Body height of the men at the Salvatierra site in diachronic comparison.

41 The postcranial measures are less suitable for comparisons of intraserial homogeneity due to their greater environmental dependence, but corresponding calculations were nevertheless carried out on a test basis. For this purpose, the present individuals were divided into an earlier (before 1000 AD) and later group (after 1000 AD) according to their chronological classification (via 14C dating, partly also via the

archaeological findings). Unfortunately, the respective samples for men and women are quite small, but both show the same trend: The later population is smaller in all measures of length and robustness and the mean heterogeneity index, or also coefficient of variability, (standard deviation/mean x100) across all individual measures increases from 4.74 to 5.54 for men and decreases from 6.91 to 4.56 for women. Thus, the metric variation increases for men and decreases for women. The extent to which this is environmentally dependent or related to a change in the gene pool should be clarified by the corresponding examination of the cranial measurements.

Cranial metrics

42 Skulls of only a small proportion of the individuals were more or less completely preserved. Hardly any measurement is documented by more than twelve individual values, and only two skulls provide all the measured distances. For this reason, the results obtained must be viewed with the appropriate statistical reservations.

Morphognostically, most skulls show more or less pronounced mongoloid features: a medium-round neurocranium (LBI σ 79.6/ φ 80.4) with a slightly protruding occiput, a broad forehead, a rather low height (LHI σ 70.1/ σ 71.3, BHI σ 86.6/ φ 87.5) and pronounced parietal tubercles. The mastoid processes are long and robust in both sexes. The forehead is usually steep but low, and the superciliar area shows a strong relief. For the face, broad and protruding cheekbones and wide bonial breadths of the lower jaw are noticeable. The interorbital distance is generally rather large (σ 26.3 mm/ φ 23.5 mm), and the bridge of the nose is slightly protruding, resulting in a probably prominent and slightly konvex nose shape. The faces are very wide in relation to their height (OGI σ 59.5), despite the pronounced lower jaw area. Moderate prognathism is often present, sometimes with protrusion of the front teeth. The eye sockets are very high and round (OI σ 91.8/ φ 97.6). The width and height of the nose vary surprisingly, but overall they are in the mesorrhine range (NI σ 48.5/ φ 46.9).

43 The unexpected morphological diversity of the skulls is also clearly reflected in the metrics (see [Appendix 2](#), tables 7–10). The average heterogeneity index for men is 6.7 and for women it is 7.7, which is a rather high value, indicating that the overall population was composed of several rather diverse lineages with distinct morphological characteristics.

44 Of special interest here is the nasal index NI (nose width/nose height x100. The width of the nasal opening shows a climate-correlated adaptation in most populations: in humid and warm climates, shapes tend to be wide and low, while in dry and cold

Fig. 10: Sex-related stature ratio in inter-population comparison (mean height women: mean height men x100; modified after Trautmann 2012, Tab. 46, Jaeger/Bruchhaus et al.1998; Tab 1 and http://en.wikipedia.org/wiki/Human_height).

	♂	♀	Sex ratio in %
Linear Pottery culture	165,8	156,6	94,5
Corded Ware culture	171,0	159,7	93,4
Aunjetitz	170,3	160,7	94,4
Early Medieval	172,2	160,6	93,3
Loma Salvatierra	167,2	158,3	94,7
High Middle Ages	170,9	160,4	93,8
Early Modern Times	169,0	159,4	94,3
19th century	166,7	158,8	95,3
2nd half of 20th century	175,5	162,4	92,5
Germany (youngest generation)	181	167	92,3

areas, shapes tend to be high and narrow. With the wide range of NI measurements observed, it seems quite possible that parts of the population derived from Amazonian lowland regions while others had ancestry in colder and drier highland regions.

45 Diachronic differentiation is problematic due to the small sample of dated and well-preserved skulls. While there are at least six individuals for men who date back to before or after 1000 AD, there are only four or two for women. However, there is a trend towards decreasing heterogeneity for both sexes – for men the HI falls from 6.4 to 4.7, for women from 8.77 to 7.43. Overall, this trend would be expected of a long-lasting population in which originally different lineages become more similar through mixing over the generations, and did only receive moderate new genetic influx.

46 Put together with the heterogeneity changes in postcranial measurements (increasing in males, decreasing in females), the overall picture seems less clear. While there is an overall trend to homogenization, some external differentiating factors (like lifestyle or diet) seem to have affected especially the male individuals.

Sexual dimorphism

47 The sex differences between men and women is not only detectable morphologically in the skeleton, but also metrically in length and robustness dimensions. A comparison can be determined by indexing certain measurements (e.g. reconstructed body height, or sum of the greatest femur and tibia length, or humerus circumference or diameter of the femoral head): $\text{DimensionW}/\text{DimensionM} \times 100$.

48 Although metric sexual dimorphism largely has genetic and hormonal causes, according to recent findings, environmental factors such as nutritional situation and different activity patterns play a major role, and probably also psychosocial factors (Hermanussen et al. 2022). A diachronic comparison therefore reveals differences in the expression of sexual dimorphism, which are most likely related to changes in such external factors (Trautmann 2012: 369; Trautmann – Rampp – Kuljukka 2023).

49 Larger differences in stature between the sexes can arise, for example, if men are better able to exploit their genetically higher growth potential in phases with a plentiful intake of high-quality food (especially animal protein). This explains the development in Germany since the 19th century: While men gained an average height of 14.3 cm, women only gained 8.2 cm. A stagnating height among men and a decrease among women can indicate periods with limited food resources (especially in periods of scarcity and conflict), when men were preferred over women and were better provided with food. The reverse case is also conceivable.

50 A low sexual dimorphism can indicate a nutritional situation in which the food supply is limited in quantity or quality, regardless of gender. As a result, height growth is inhibited relatively more in young males. Heavy physical workload at a young age also has a negative impact on the final height achieved. In addition, screening effects that are difficult to understand, for example due to changing ideas of beauty, could also have played a role. For the dead of the Loma Salvatierra, there is an exceptionally small difference between the sexes, especially in comparison to European groups of pre-modern times (Fig. 10).

51 This low sexual dimorphism with regard to height is somewhat unexpected in contrast to the observed infant mortality that suggested a social preferential treatment of male individuals. While statistical over-interpretation due to small sample size is possible, it could also indicate an equal supply of food for both sexes in terms of quantity and quality.

52 Presented as a ratio index (women's measurement \times 100 / men's measurement), the sex difference in individual postcranial measurements can be compared (see [Appendix 2](#), table 11). Some of the highly differing values can potentially be used to

	Hu1	Hu5	Hu7	Ra1	Ra a	Fe6	Fe7	Fe8	Fe9	Fe10	Fe19	Ti1b	Ti8a	Ti9a
p	.004	.0000	.0000	.0006	.0000	.0000	.0029	.0000	.0147	.0020	.0000	.0001	.0000	.0069
WB	298.7	21.3	58.1	236.2	20.8	27.5	26.6	84.7	30.1	25.2	44.1	365.0	32.2	21.8

Fig. 11: Calculated boundary values for gender-specific differences in postcranial skeletal measurements (WB=weighted boundary).

differentiate the sexes of otherwise unidentifiable individuals within a population. In order to check the usability, a t-test was used to determine how high the probability of a random deviation is. A value of $p < 0.05$ indicates a significant dissimilarity, which is probably related to gender. For the corresponding dimensions, a weighted boundary calculation (WB) can be used to set a limit below which an individual is likely to be female and above which it is more likely to be male (Fig. 11).

Family relationships

53 The reconstruction of family relationships in a population unit is of fundamental importance for understanding its social structure. It also serves to clarify questions of ancestry and mobility of individuals or the group as a whole and relationships with other populations. Anthropological studies can of course only detect genetic connections, i.e. in the sense of parent-child or sibling relationships, but not legal-social relationships such as those between spouses. In principle, there are two approaches available to clarify family proximity:

- The direct comparison by examining certain sections of the genome, which can prove a close relationship by genetic similarities. However, the examination of aDNA is severely limited by the state of preservation of the bones, especially organic remains such as collagen, and is also very time-consuming and expensive.
- The indirect approach using phenotypic characteristics that are most likely hereditary and can therefore serve as indicators of genetic kinship. These characteristics may be metric or non-metric that traits that allow morphological comparisons. The dimensions of the skull are particularly important because the postcranial skeleton is modified to a much greater extent by environmental influences such as diet or workload. Small-scale anatomical variants can also be used, which generally occur rarely, but which showed familial clustering in studies and which are therefore likely to be hereditary.

54 In contrast to the direct examination using aDNA, with the indirect methods there is always a residual uncertainty about the uniqueness of the genetic basis of the identified characteristics. However, the indirect methods can be used without additional costs. Both approaches were followed in the present skeleton series. As conservation status permitted, metric and non-metric descriptors were recorded and evaluated for all individuals. In addition, 45 individuals were sampled for retained aDNA.

Anatomical variants

55 When recording anatomical variants (formerly also epigenetic features, discrete or discontinuous or non-metric traits), all traits that could be observed were first recorded in accordance with the state of research (Czarnetzki unpubl., Alt – Pichler – Vach 1995, Hauser – deStefano 1989). In addition, morphological variants that could possibly be hereditary special characteristics but have not yet been described or validated were also taken into account.

	Phase 2				2/3	Phase 3														4	Phase 5								
	921	1001	1005	925	2059	912	910	915	927	236	6007	6005	928	1121	4098	18a	506	4096	97	12	11	1219	2103	19	1222	4202	4209	1208	
Foramen supraorbitale	+										+	+	+		+	+			+					+					
For. mast. extrasut.	+					+				+																		+	
Phalanges with dimples	+					+		+	+			+			+		+		+							+	+		
Foramen olecrani	+					+										+						+	+	+		+		+	
For. parietale on the right	+		+	+						+									+	+									+
For. zygomaticofac.	+		+		+	+		+						+	+	+			+				+	+			+	+	
Teeth 13, 23 Tub. dentale		+	+				+				+			+		+				+					+				
Incisivi shovel shaped		+	+	+		+	+				+			+	+	(+)			+		+		+		+				
Teeth 37, 47 For. molare		+	+			+								+			+	+	+								+		
Incisivi rotated		+	+																+										+
Teeth 36, 46 For. molare			+			+					+			+	+	+			+	+					+				
Teeth 18, 28, 38, 48 absent			+																										+
Ossicula lambdoidea				+				+											+			+	+	+		+			
Foramen frontale				+				+							+				+			+					+	+	
Poirier's facet					+	+																							
Teeth 16, 26 Tub. Carabelli							+				+		+																
Teeth 18, 28, 38, 48 tongue like enamel projection									+								+		+										
Canini marginal ridges																+				+	+			+					
Os apicis lambdae																										+		+	

56 The overall only moderate preservation meant that features that may have originally existed in many individuals could no longer be observed. Above all, the considerable wear on the teeth limited the ability to capture subtle details, like accessory minuscule cusps. For this reason, only a positive recording could be carried out, i.e. only the confirmed presence of a feature was noted. Only features that were represented in more than one single individual were included in the analysis. Since references for spatial and temporal close populations were not available, weighting according to significance was not possible, which is why each of the listed variants counts equally (see Fig. 12).

Fig. 12: Occurrence of anatomical variants in the population of the Salvatierra site by occupation phase.

57 Of particular interest in this comparison is the time around the year 1000 AD due to the observed change in burial customs and macro-phenotype. Possible changes in the pattern of non-metric traits would provide useful insights regarding possible population shifts. Unfortunately, a distinct diachronic component to the occurrence of certain features cannot be recognized. Almost all features can be found from the early to the late burials. However, some trends are noticeable: The supratrochlear foramen shows an increase in frequency from the 11th century onwards, as do suture bones in the lambda area and marginal ridges on the canini. All other features, such as the finger phalanx pits (Fig. 13), appear for the first time quite early (from the 7th to 8th centuries AD) and were probably brought with them by the founding families. The similarity between the individuals from the presumably earliest burial phase (Ind. 912 to 925) is only moderate, which suggests a quite heterogeneous founding population.



Fig. 13: Examples of phalanges with dimples (anatomical variant). a Individual 912; b individual 1210, c individual 95, d individual 1154.

58 There is no evidence of an accumulation of certain anatomic variants in individuals over time, which indicates there was no internal endogamous behavior, but a mostly open reproductive community. However, the sample itself is too small and the preservation is not sufficient to make such statements with certainty. But a basic genealogical knowledge and corresponding marriage taboos between closely related people within the community can be expected.

59 It is also noteworthy that the occurrence of certain anatomical variants in the present sample cannot be brought into line with the kinship circles based on the mt-DNA haplotype. This probably shows how complex nuclear DNA, mt-DNA and phenotypic expression are connected to one another. Overall, the analyzes based on small-scale morphological variants as well as the cranial metrics and morphology data indicate that the Loma Salvatierra population was founded by a relatively heterogeneous group of several families, whose descendant lines probably lasted until the end of the occupancy. Around the 10th/11th century AD there appears to have been another smaller influx of genetically different individuals, but there was no replacement of the existing population. Otherwise, a slight isolation resulting in a slowly increasing homogenization of the population but no profound inbreeding effects can be recognized.

Osteometric analysis

60 Skull measurements are more suitable for kinship analyzes than the body skeleton due to their lower immediate response to environmental influences. Unfortunately, the small amount of available measurements does not allow a statistical evaluation of the metric data with regard to a diachronic development (see Fig. 14). Especially when it comes to the shape-describing skull dimension indices, the minimum limit of n>5 is not even reached in men.

Fig. 14: Mean values of cranial metrics for earlier and later population groups (SD = standard deviation).

		LBI	LHI	BHI	LOI	BOI	JFI	OGI	OI	NI
Early group (ca. 650-900 AD)	921	75,7	x	x	67,4	x	71,1	x	91,9	x
	1001	x	x	x	x	x	x	56,2	89,5	47,3
	1005	79,8	70,8	88,7	60,7	90,7	79,9	58,2	91,9	41,1
	925	77,8	x	x	63,8	x	x	x	x	x
	4098	86,0	77,3	89,9	64,0	88,3	72,5	x	100,0	57,8
	Mean	79,8	74,1	89,3	64,0	89,5	74,5	57,2	93,3	48,7
	SD	4,4	4,6	0,8	2,7	1,7	4,7	1,4	4,6	8,4
Late group (ca.1000-1400 AD)	4096	80,2	67,8	84,5	53,7	x	69,7	63,6	90,2	40,4
	97	x	x	x	x	x	x	x	x	x
	12	x	x	x	x	x	72,9	x	x	x
	2103	76,7	66,9	87,1	56,4	x	x	x	x	x
	19	73,2	x	x	x	x	70,3	x	97,4	59,5
	4209	81,6	67,6	82,8	60,0	x	72,5	60,1	82,1	50,0
	Mean	77,9	67,4	84,8	56,7	x	71,4	61,9	89,9	50,0
	SD	3,8	0,5	2,2	3,2	x	1,6	2,5	7,7	9,6

61 Shifts in mean values can be seen, but their significance cannot be calculated. For this reason, the cranial measurements can contribute little to the relationship analysis. A look at the individual measurements shows that among the men, individuals 1001, 1005, 1209 and 4099 stand out for their extreme values several times, and among

the women, Ind. 236 and 1121. These could possibly be ‘immigrants’ – the comparison of the morphological variants with the immediate ‘contemporaries’ would support this.

aDNA studies

62 In the laboratory of the Institute of Human Genetics at the University of Tübingen, teeth from 40 individuals were sampled for aDNA. Five additional samples for reference analyzes were collected from long bone areas. For the genetic analyses, after extensive cleaning and decontamination of the entire tooth, the crown of the tooth was separated from the root area and prepared for isotope analysis. The root part was pulverized, the powder was lysed, and in initial test series it was subjected to four different extraction techniques. It turned out that both the MCM and the enzyme lysis protocols (Pusch – Scholz 1997, Pusch – Bachmann 2004) were best suited for the teeth from the Salvatierra site. In terms of quality and quantity of isolated DNA, it offered the optimum yield and was consequently used as a combined standard protocol for the analyzes described here. The nucleic acids were evaluated using gel electrophoresis methods and NanoDrop measurements. The PCR method was used to amplify mitochondrial and treponemal DNA, but also to control for contamination (negative, mock, and blank extraction controls). In order to free the extracts from any inhibition, separate column purifications (e.g. gel extraction kits, PCR purification kits) were used. Enrichment was sometimes carried out via vacuum centrifugation. Various PCR primers were designed manually, synthesized on order and, after preliminary testing, were successfully used in the ancient DNA PCRs and also inhibition PCRs. Optimization strategies for the successful amplification of the DNA sections were also carried out and, if necessary, existing PCR products were selectively subcloned in order to be able to evaluate the variations in the base sequence of individual clones of a PCR product. Ligations, transformations and streak-outs on selective culture media were largely carried out using standard methods (Invitrogen). The clones were tested for insert presence using so-called colony PCRs. Positive recombinants, but also PCR products per se, were cycle-sequenced using the Sanger method (model ABI 3100) and edited and analyzed using Lasergene (DNASTar) or BioEdit. The sequences obtained were checked for sequence integrity in various NCBI databases (BlastN and other algorithms). A subset of the data collected in Tübingen was retested in an independent second laboratory (Paleopathology Munich, AG Prof. A. Nerlich) and the data sets were compared with each other.

63 Of the 45 samples, 11 clearly contained DNA, 22 only contained very small traces of DNA and 12 were no longer extractable (no nucleic acids present). Although no measures were taken to avoid contamination of the residual DNA during the excavation, recovery and examination of the skeletal material, mitochondrial DNA sequences of HVR1 could be created in 17 individuals, whereby the sequence signatures can be divided into 4 haplogroups. A total of seven sequences could be assigned to three haplogroups

Type	Individuals	Number of changes	Position	Type of change	Interpretation
1	506, 2103	2	16293, 16344	A>G C>T	haplogroup pre-CZ
2	915, 927, 1222, 4096	2	16298, 16344	T>C C>T	haplogroup CZ, pre-C
3	910	3	16293 16298 16344	A>G T>C C>T	haplogroup CZ, pre-C
4	11, 12, 18a, 19, 928, 1001, 1121, 4098, 4202, 4209	0	-	-	rCRS or non-rCRS

Fig. 15: Results of mitochondrial analyses.

(type 1 to type 3) based on their diagnostic mutations (Fig. 15). The fourth haplogroup (type 4, 10 individuals) is not informative enough because it has no mutations in the sequenced region. In this case, additional examination of the hypervariable region 2 (HVR2) is indicated, but this was not pursued in more detail due to time and funding reasons. All detected changes are transitions, which is typical for human mitochondrial DNA.

64 The three informative haplogroups are very similar in the composition of their base changes and can be assigned to a precursor of haplogroup C, namely CZ, pre-CZ, or pre-C. The decisive factor here is position 16298. The fourth mitochondrial haplogroup is so far identical to the rCRS (revised Cambridge Reference Sequence), and could therefore also represent recent contamination with mitochondrial DNA. Only amplifying and sequencing the HVR2 would provide final security here.

65 Haplogroup C is the third most common mt haplogroup with around 21 % frequency in southern Amerindians (South America) after B (38 %) and D (32 %) (Lalueza et al. 1997). It is noteworthy that high frequencies of haplogroup C are to be found in the southern highlands and the northern coast of Peru, the Carribean coast of Columbia, as well as southern Brazil and northern Argentina (Bisso-Machado – Bortolini – Salzano 2012: 381, Fig. 2). However, haplogroup C is hardly represented in the Andean region of Bolivia, which borders the Llanos de Mojos to the west. Genetics thus seems to confirm that the Casarabe population had no interaction with the expansive cultures of the Andean highlands, such as Tiwanaku.

66 In addition to determining the membership of a genetic lineage, the haplogroup, the studies on the Salvatierra samples also allowed the differentiation of smaller circles of relatives based on so-called haplotypes (see Fig. 15, first column). Types 1 and 3 are very close, while type 2 is a separate group. In terms of time, type 0 individuals can be found from the 7th to the 13th century AD, i.e. over the entire occupancy period. Type 2 is most likely to occur between the 8th and 11th centuries. The two individuals of type 1 date to the 11th century, and type 3 is more likely to date to the early phase around the 8th century. The few values do not allow statistical analysis, but all haplotypes appear to have been represented from the earliest occupancy phase. The founding group must therefore already have included several family groups with at least four unrelated women. Analyses of the nuclear DNA would have provided a better insight into the family relationships, but these could not be carried out because the DNA residues were too degraded.

Population history

67 As stated above, the possible interpretations regarding the family relationships of the series examined are limited. Despite the very favorable situation in which plenty of 14C dating and aDNA studies could be carried out to accompany the results of the analyzes on metrics and anatomical variants, methodological limitations, statistical uncertainties and the still small sample size limit the reliability of the statements. In addition, there are practically no comparable series available from the region and neighboring areas. Nevertheless, it is possible to say that the residents of the Salvatierra site descend from a founding group of several unrelated families who formed the basis of the later population in the 7th century. These lineages existed until the end of settlement in the 13th/14th century. Probably during the 11th century, there was a limited immigration of unrelated individuals, who, however, did not replace the locals, but seem to got subsumed in later generations. Still, the overall increasing homogeneity based on the skeletal record suggests that the inhabitants of the Loma Salvatierra rarely received new additions apart from this “input” and behaved more or less endogamously. In context with the limited inbreeding effects, this indicates a rather large and already

somewhat heterogenous base population. Both can be reconstructed from the estimated high number of burials of the site's extents as well as the indicators of diverse founder lines as discussed before. It can be assumed, that there was little if any genetic kinship with people of the Andean highlands, as the Salvatierra population differs significantly from them in skeletal dimensions and the mt haplogroup. However, there appear to have been a relatively close relationship with the peoples of the Brazilian Amazon region.

Pathology and adaptations

68 To reconstruct the living conditions of a historical population, the study of pathological and adaptive characteristics in archaeological skeletal material represents an important source of information (e.g. Buikstra 2019). Stress caused by everyday work, the nutritional situation, illness and other factors of life are reflected in characteristic marks on the bones. The comparison with populations whose living conditions are well known from historical and archaeological data allows to understand the corresponding traces on the skeleton as markers of activity and lifestyle. However, most of the corresponding studies come from temperate latitudes, primarily Europe – there are hardly any corresponding studies for the tropics and especially the South American lowlands (Wahl 2006; Trautmann – Trautmann – Wahl 2015). Therefore, the diagnosis of the pathology of the relatively large sample from the Salvatierra site has a pioneering character.

69 An important tool for the interpretation of specific pathologies is the comparison with diseases that can be observed in recent populations (with traditional or urbanized lifestyles) in the Bolivian lowlands. Thankfully, medical literature can provide a large amount of information here.

70 All bone elements present were subjected to a meticulous macroscopic examination. Doubtful surface changes were examined under the binocular with reflected light, and in two cases x-ray images were made for clarification or differential diagnosis. Palaeogenetic studies were also carried out on the specific question of infection with treponema, which are presented in a separate section.

71 When assessing the frequency of certain pathologies in particular, several factors must be taken into account:

- The overall only moderate preservation of the skeletal material. Only one in ten skeletons is at least 90 % complete. However, since it is unlikely that diseased parts of the body were lost disproportionately often, the material that can be assessed is probably a statistically meaningful sample.
- Surface weathering of the bone matrix. Even though most of the Loma Salvatierra finds show only minor weathering, more discrete surface changes caused by disease may have become unrecognizable. This could result in an apparent predominance of “severe cases”. The opposite case – that erosions are incorrectly interpreted as pathologies – can be largely, but not completely, ruled out.
- The high proportion of subadult individuals. Although of course there must be a cause for their early demise, pathological changes in the skeleton of children are generally rare. Degenerative conditions or traumata in small children are of course not common. Other detrimental conditions, mostly from infections, would be expected to be visible more frequently. But many infections, which can often be fatal in children (e.g. diarrheal diseases), do not leave traces at all on the skeleton. Others who may affect the bone only appear after a prolonged

period of illness, but compared to adults usually either heal quickly or become lethal quickly in children.

72 Symptoms of nutritional deficiencies on the other hand can be expected to be found more often in sub-adult individuals, due to higher sensitivity to malnutrition phases during growth. Also, in adults the signs of earlier hunger phases may become unrecognizable due to recuperation and remodeling of affected bone structures.

Stress-related pathologies

73 In almost all skeletal populations with a traditional – especially agricultural – lifestyle, degenerative phenomena on the skeleton, i.e. “wear and tear” due to age and physical stress, are very common. It is characterized by sclerotic or erosive changes of the joint surfaces (arthroses), the detachment of small cartilage and bone fragments from the joint surface (chondropathies and sequestration), the formation of bizarre compact outgrowths at the edge of the joint (osteophytes) and extreme roughness in the area of the tendon and ligament attachments (enthesiopathies).

74 Sometimes symptoms associated with inflammatory processes (arthritis) also occur in the joint area; such inflammations can be caused by infection, but also by reactions to underlying degenerative processes. Here, we use the term arthrosis to describe degenerative damage to articular surfaces; when inflammatory reaction can be recognized involved in the process, we use the term arthritis. The commonly used catch-all term osteoarthritis (OA) is too imprecise in our opinion. The type, degree and localization of degenerative changes indicates the type of regular workload suffered. For instance, degenerative phenomena on the vertebral bodies (spondylosis) or the intervertebral joints (spondyloarthrosis) often occur in conjunction with arthrosis of the rib joints and are characteristic of a high workload on the upper body, usually caused by carrying heavy loads or prolonged unphysiological posture, as in working on the field. Degenerative changes on the lower extremities may indicate a high mobility in rough terrain, as from herding or hunting expeditions. Also a sign of use wear is the abrasion of teeth, which is caused by hard and abrasive solids in food, or by the use of teeth as tools. The latter in particular can also result in areas of tooth enamel chipping off. Only in particularly severe cases does tooth abrasion have a pathological significance, for example if it leads to a malfunction in the chewing process or to the opening of the dental pulpa. However, the overall presentation of dental health will be presented in a separate section.

75 The Loma Salvatierra population examined shows – as expected – a rather high incidence of degenerative phenomena (see [Appendix 2](#), table 12). Signs of arthrosis were found in 33 of all 125 individuals (26.8 %) (see Fig. 16). Among the exclusively affected adults (n=64) alone, this is 51.6 %. Of these, 14 are women and 22 are men – the latter are therefore represented to a higher extent than their share of the total population would suggest.

76 Calculating the average degree of stress, 13 of 36 individuals (36.1 %) show overall minor signs of wear (grade 0.1–1.0), 20 (55.6 %) show moderate changes (grade 1.1–2.0) and 3 (8.4 %) show severe signs of wear (grade 2.1–3.0). The individuals in the last group are likely to have experienced not only pain but also restricted mobility due to their illness.

77 In comparison it is noticeable that there is no difference between men and women in severity (on average 1.35 to 1.34), but there is a difference in the distribution pattern: For men the lumbar spine, elbows, knees, cervical spine and thoracic spine (in descending order) are most affected, in women the order of severity are lumbar spine, knees, jaw joint, thoracic spine, and cervical spine.



78 Rupture injuries and sequestra in the cartilage-bone area were only found in five individuals, with one exception the knee joint was affected, and only one was female. Joint damage caused by massive short-term overload in the sense of trauma therefore seems to be a rare occurrence and is probably more likely due to accidents. They also occurred primarily (four out of five cases) in men and show gender-related differences in stress exposure. Therefore, gender-specific differences in activity can be

Fig.16: Examples of degenerative pathologies. a, b: Impingement syndrome (Ind. 921); c, d: Harris lines, tibia of individual 921; e: Metatarsal fused with os cuneiforme (Ind. 912); f Diffuse idiopathic skeletal hyperostosis (Ind. 4096); g, h Spondylosis, vertebrae of individual 4029.

suspected – like women being more occupied with carrying loads or food preparation and men with construction work, fishing or hunting, and both sexes working the fields.

79 A chronological breakdown shows no clear trends; on the one hand, this may be due to the relatively small size of the subgroups (mainly due to the influencing factor of different individual ages), but it may also mean that the type and extent of physical stress did not change significantly over time.

80 The overall high number of corresponding findings (after all, the cancellous joint areas in particular are often heavily weathered and therefore cannot be assessed) demonstrates that everyday physical workload must have been generally quite high and extended to all parts of the population. Only eleven of those over 20 years old with a preservation of at least 40 % show no or only minimal signs of arthrosis. However, it cannot be said with certainty whether these individuals were members of a population segment that was exempt from hard work for social reasons; genetic causes or coincidences in preservation could also contribute. However, the “low-stress” group encompasses eight male but only three female individuals. If there were indeed status advantages that exempted a small proportion of the population (just under 10 %) from heavier physical work, they apparently applied more to men than women.

81 Overall, the picture that emerges is of a community with a rather high physical workload but activity differences in both sexes. A high level of specialization cannot be derived, it seems most people were occupied with fieldwork, carrying of loads, construction work, hunting or fishing, various crafts and preparation of food, while only a minority may have been exempt from hard labour.

Nutritional pathologies

82 Diet-related pathologies are usually the result of long-term malnutrition, but in rarer cases can indicate metabolic diseases too. Certain phenomena on the teeth – especially caries and pathological wear – could also be included in this category, but will be considered separately later. One of the most frequently mentioned deficiency symptoms are the so-called cribra orbitalia, sieve-like porosities of the roof of the orbit. They are commonly considered to arise from hyperplasia of the red bone marrow in the diploe, which is understood as a reaction to anemic conditions (İşcan – Kennedy 1989; but see Rothschild et al. 2021). Anemia can result from a lack of iron or vitamin C in the diet, but also from blood diseases such as malaria or parasite infestation, especially worms. Such diseases are particularly likely to occur in tropical climates.

83 Cribra orbitalia have been observed in a total of 22 cases. In two individuals (933, 1219) the phenomena were particularly pronounced, in three (15b, 209, 2103) they were healing, while in the remaining individuals (98, 218, 912, 917-1, 921, 925, 1005, 1154, 1208, 1212b, 1220, 2049, 2059, 4028, 4096, 4202 and 6006) they indicated a still ongoing condition.

84 Among the 22 findings of Cribra orbitalia, there were 13 women but only 9 men – a fact that could be attributed to women's menstrual periods and thus a higher risk of anemia, but also differences in diet. The two severe cases are also women, while the healed cases included two men and one woman. However, of the 13 women, only 4–5 are actually of the appropriate age, while the rest are too young or too old to be convincingly effected by menstrual blood loss. On the other hand, there are six infants who cannot actually suffer from nutritional anemia, as well as two other children (around 2 and 4 years old) among the individuals. Overall, the distribution largely corresponds to the age pattern of the entire population. There is no unusual accumulation. It is noteworthy that members of the “privileged” group (1208, 4028 and 4202) are also included, which could also argue against nutritional deficiencies as the cause.



85 In order to validate this finding, hypoplasia lines of the tooth enamel can be used as further deficiency or stress indicators. These arise from periods of reduced growth or reduced mineralization during the formation of the dental crowns. The grooves persist later and indicate periods of hunger or illness during childhood. Measurements can even be used to determine the age at which the crises occurred. Such enamel hypoplasias were recorded in 30 individuals (11, 15a, 15b, 18a, 19, 209, 213, 238-1, 308, 915, 921, 926, 1001, 1005, 1102, 1127, 1208, 1215, 2059, 4028, 4096, 4098, 4099, 4195a, 4200, 4201a, 4202, 4203, 6007). Of these, 17 are male, 11 female and 2 indetermined. The larger male proportion could be interpreted as indicative of poorer care for boys in childhood, but it may also be related to the generally somewhat greater

Fig. 17: Enamel hypoplasia on the maxillary permanent teeth of individual 97.

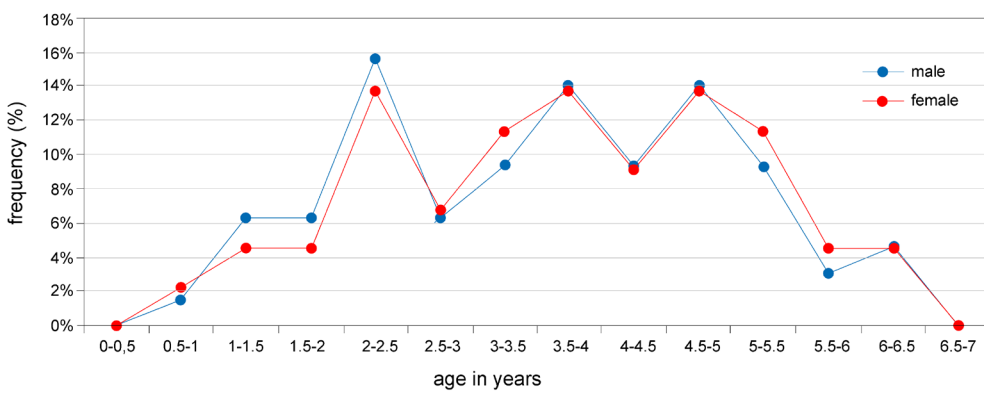


Fig. 18: Age of formation of enamel hypoplasia broken down by biological sex.

health crisis susceptibility of male children. Overall, the difference is too small to make a clear statement.

86 Not even half (9 of 22) of the individuals with cribra orbitalia also show enamel hypoplasia (see Fig. 17), and vice versa only 9 of 30. A correlation of the two symptoms is therefore not apparent, and a causal relationship is thus unlikely. Hence, the present cribra orbitalia in this series should rather not be interpreted as a sign of food deficiency, but rather as an indicator of intestinal parasite infestation or malaria. Moments of clustered occurrence of enamel hypoplasia may indicate particularly critical periods during childhood. For the individuals of the Salvatierra site, these seem to have been at the age of two to two and a half years – possibly the usual time of weaning – and around the fourth year of life (see Fig. 18). At this age, children’s diseases may have left their mark, but eventually also food shortages, which may have affected children of this age as much as adults.

87 Other characteristic signs of poor nutrition – e.g. Harris lines (Papageorgopoulou et al. 2011) or rachitic changes – only occur in a very few cases (Fig. 16 c, d). This may be partly due to the state of preservation of the skeletal material, but a high incidence of such phenomena is nevertheless not to be expected.

88 Altogether, while the Loma Salvatierra skeletal series has a very high rate of health stress markers, most are probably rather associated with a high burden of infections and parasites and less with frequent food shortages. Both sexes are affected to a similar extent and there are no temporal differences. The food supply with respect to caloric intake, on the other hand, appears to have been largely secure, metabolic signs of disease – e.g. gouty arthritis or rickets or scurvy – were not apparent.

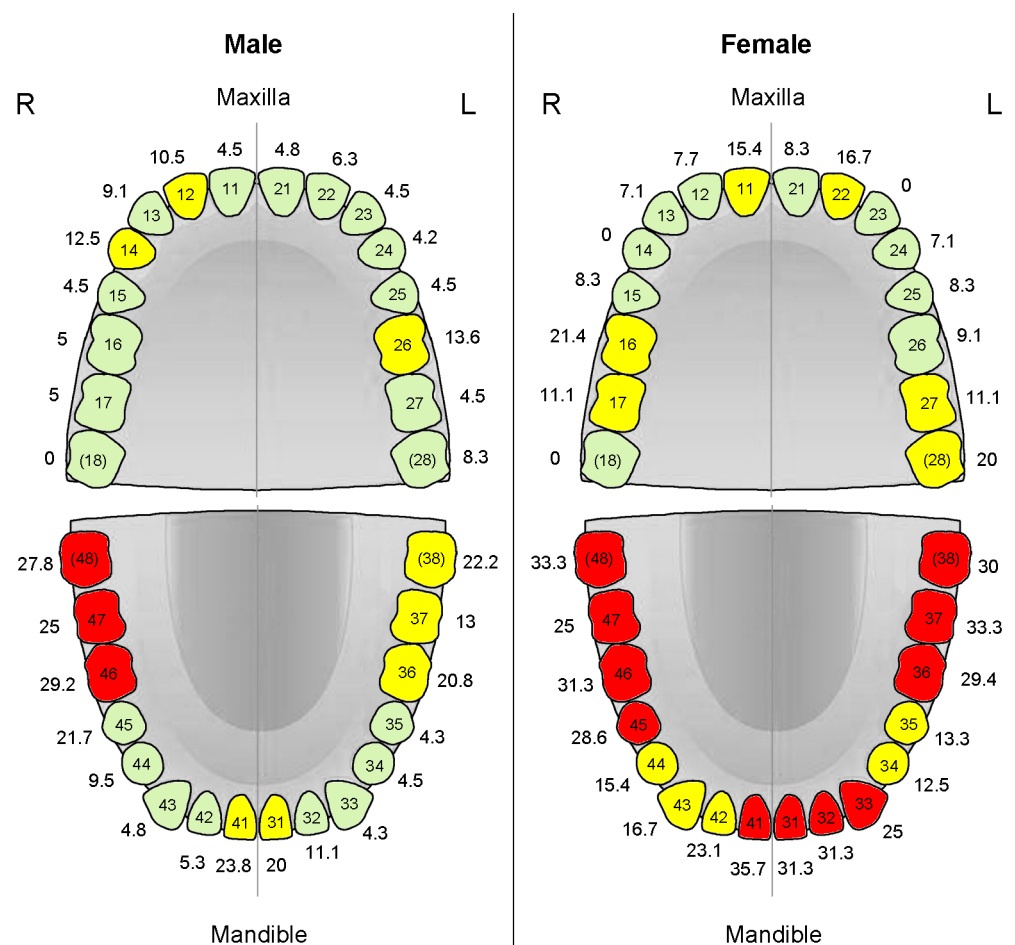


Fig. 19: Tooth loss (in %) in men and women from the Salvatierra site. In red the teeth with a high loss rate (>25 %), in yellow the teeth with a medium loss rate (10–25 %) and in green the teeth with a low loss rate (0–10 %).



Fig. 20: Examples of very severe and complete tooth loss. a, mandible of individual 236 with only one tooth left; b, mandible of individual 1219 with complete tooth loss.

Dental pathologies

89 The health status of the teeth is determined by several parameters. Caries, periodontal diseases, misalignments, abnormal wear of the tooth crowns and tooth loss make up the majority of pathologies. Causes of diseases of the teeth and periodontium can be very different (genetic, infectious, mechanical, chemical, etc.), but due to the strong interactions, an overall assessment is recommended (e.g. Alt et al. 2013).

Tooth loss

90 Tooth loss can be the result of carious destruction, periodontal degeneration, but also of accidents or pathological stress. For the pre-Hispanic population of the



Fig. 21: Detail of central incisors of individual 1121 worn down to thin lamellae and perforated due to the prolonged use of a lip plug.

Fig. 22: Tooth loss caused by wearing a lip peg (individual 921).



Salvatierra site, tooth loss was the norm (Fig. 19). In individual cases, the losses were quite extensive and sometimes resulted in the complete loss of teeth (Fig. 20).

91 In individuals of both sexes, a high rate of loss of incisors, especially of the lower jaw, is remarkable. Caries can be ruled out as a cause here as it is generally rare in front teeth, including in the present sample population. Violence as a possible cause is also unlikely, as no accompanying injuries were found. However, one element of body adornment, the lip peg, can very probably be identified as the main cause. In a few cases, stone specimens have been preserved (e.g. Ind. No. 1005), but more often only traces of defects on the teeth and jaws indicate the wearing of a lip peg made of wood or other perishable material. A total of twelve individuals, including an equal number of men and women, show characteristic wear marks on the front surfaces of the incisors as well as irritations on the alveolar ridge of the lower jaw (individuals Nos. 912, 915, 927, 933, 935, 1005, 1103, 1115, 1121, 4098, 4202, 4203). All lip peg wearers were adults or older.

92 The mechanical irritation the interior part of the object protruding into the mouth's alveolar area proved to be extremely detrimental to dental health. If present, the front surface of the upper and lower incisors were heavily worn down by the abrasive movement of the peg when speaking or eating, sometimes reduced to only thin enamel lamellae (Fig. 21). Inflammatory irritation and atrophy of the mandibular alveolar ridge led to the loss of teeth 31, 32, 41 and 42 in many cases (Fig. 22).

93 However, the majority of tooth loss, especially in the side, is likely to due to caries and secondary symptoms such as root tip suppuration (apical granulomas). One indication of this is the higher rate among women, which also correlates with a higher frequency of tooth decay.

Caries

94 The men of the Salvatierra skeletal sample showed a mean caries intensity of 15.1 % (maxilla) and 10.3 % (mandibula). This means that 12.7 % of all present teeth are carious. The side teeth are predominantly affected (95.5 %); cases become more frequent and more severe distally. The caries rate is even higher in women: the average caries intensity in the maxilla is 19.8 % and that in the mandible is 17.2 %. This means that 18.5 % of all existing teeth show caries defects. Here too, the molars are predominantly (85.7

Fig. 23: Dental caries on molars of individual 4096.



%) and are more severely affected (see Fig. 23). Only relatively few individuals show no caries at all (11 male and 9 female individuals). This means the caries frequency among men is 66,7 % (22 of 33 individuals with existing teeth have at least one caries defect in their teeth), while among women it is 70 % (21 out of 30 individuals). Of the children with primary teeth, Ind. Nos. 209, 213 and 919 are without caries, i.e. only three out of 28 individuals. The caries frequency is therefore 89.3 %. These are exorbitant high values for a pre-industrial population without access to refined sugar products. While genetic reasons or very low fluoride levels of local food and water may contribute, the reasons are predominantly a lack of oral hygiene and food composition.

95 Apparently, staple foods contained a high proportion of carbohydrates, including short-chain ones such as sugar. Since caries defects in the Salvatierra population sample are very often found on the necks of teeth, dental plaques full of caries-causing bacteria, must have been solid and sticky. Garland-like enamel defects are often found around the neck of the teeth too, which indicate the erosive effects of fruit acids. Starchy and sticky tubers or seeds such as yucca and corn and sour fruits like tamarillo could well have created an oral environment that is responsible for the high incidence of tooth decay. These foods formed probably the basis of daily diet for most of the individuals examined.

96 Caries is also an infectious disease and the relevant microbes can be passed from person to person through close contact. The unusually high frequency of caries in children could indicate that the mothers (and perhaps even several women) fed pre-chewed food to at least the smallest children³. This would explain the high level of “infection” even among the youngest individuals.

Dental abrasion

97 The wear of tooth crowns caused by normal chewing activity is not pathological in itself, but it can reach pathological proportions in exceptional cases. The extent of dental wear was noted for each individual tooth during the individual data recording.

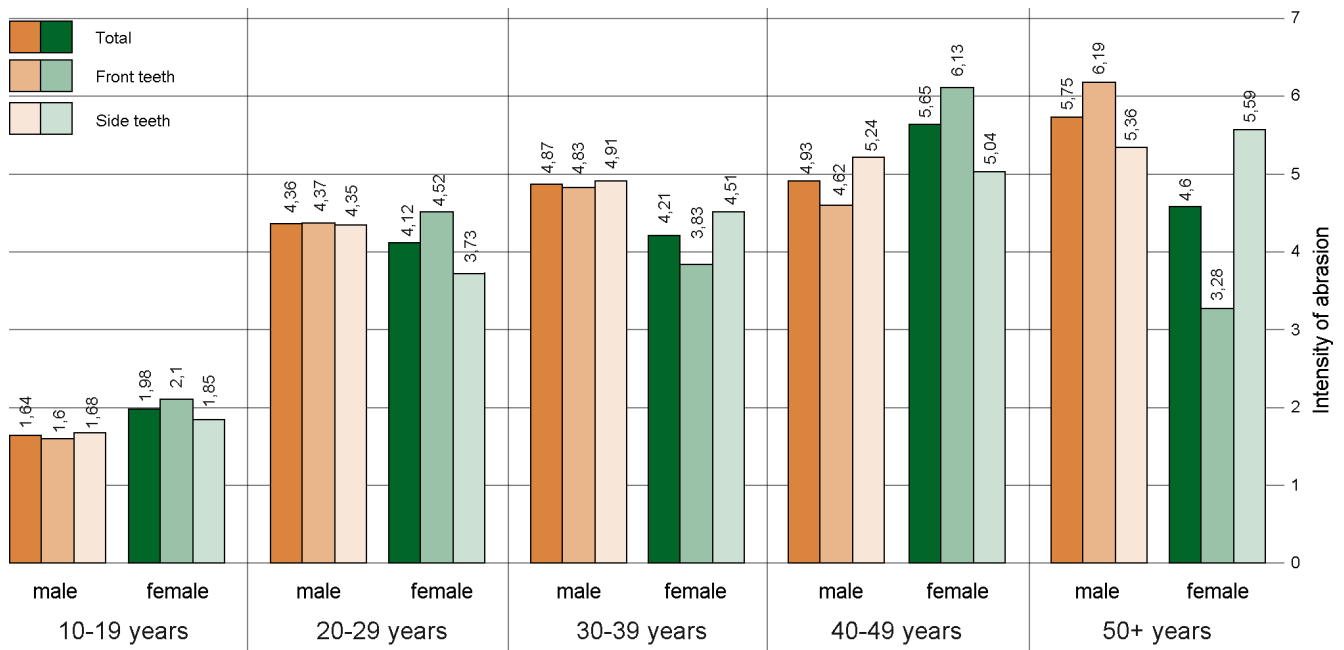


Fig. 24: Level of abrasion according to age, biological sex and dental area.

3 The higher level of degenerative symptoms of the temporomandibular joint in women also makes a practice of pre-chewing food more likely – perhaps not only for children, but as common step of food preparation.

Fig. 25: Severe abrasion in the entire dentition of individual 4202.



The classification followed the scheme of Molnar (Molnar 1971) into severity levels from 0–8. A differentiation according to tooth quadrants was not made, although the abrasion plane (horizontal, sloping buccally or lingually) was noted.

98 The abrasion intensity was differentiated according to sex, age, front or side teeth and upper or lower jaw (Fig. 24). Due to the differentiation, some values are inevitably based on a relatively small database, which limits the statistical certainty. However, the numbers are sufficient for general statements. The abrasion of the frontal teeth (incisivi and canini) does not show any drastic differences compared to the posterior teeth (premolars and molars). With the exception of the oldest group, side

abrasion predominates slightly among men (the overall average Index Front:Side is 0.97), while there is no difference among women (Index Front:Side 1.00). The use of teeth is unlikely to have differed between genders. In particular, there are no indications of their use as a tool. The polish and wear on the upper front teeth found in many prehistoric and traditional populations which results from the scraping and rubbing of skins on the teeth during leather production is not evident.

99 The extent of tooth abrasion in the Salvatierra sample can be classified as high (see Fig. 25). On average, the overall wear of teeth exceeds that of coevals from early medieval populations in southwest Germany, for example, and is also above the values of Neolithic comparison groups in the same area. However, there is greater similarity to Central Europeans of the High Middle Ages or to late Maori populations (Trautmann 2012: 325; Molnar 1972; Kieser et al. 2001).

100 Food-related tooth wear is primarily due to a high content of abrasive components (silicates, silica crystals and cellulose) in the daily diet, mainly from plant foods. In the examples given before, in the High Middle Ages grain (as porridge and bread), often barely dehusked, made up the largest part of the diet of commoners, while the Maori had to include the tough components of tree ferns in their diet after having hunted most larger prey animals to extinction. In contrast, meat and possibly dairy products probably played a much larger role in the diet in the population samples of the late Neolithic and early Middle Ages.

101 According to the archaeobotanical findings, the plant food spectrum of the inhabitants of the Salvatierra settlement included maize and yucca, and probably various wild plants from the area. The isotope chemical analysis of the food spectrum (see below) supports the assumption that plant-based food clearly predominated.

102 Furthermore, during preparation for consumption, e.g. grinding or grating, additional hard particles from the grinding tool get into the food, which further increases the abrasive effect. During excavations at the Salvatierra site, numerous fragments of ceramic grating bowls were found, which in experiments proved to be very suitable for peeling and grinding yucca tubers, but are also suitable for grinding corn kernels. Stone grinding devices, however, were not used. Due to the low resistance of the ceramic devices, a large amount of clay particles and sand probably got into the yucca pulp and the corn flour. The resulting abrasion characteristic with a buccal bevel of the chewing surfaces and cup-like depressions, which was often observed in the teeth of the skeletons of the Salvatierra site, is typically found in populations with abundant grain consumption (Kieser et al. 2001). For this reason, it can be assumed that corresponding products (flour, porridge, flatbread, pastries) were also produced and consumed here. Differences between male and female individuals are relatively small. In general, men seem to show somewhat more pronounced abrasion levels (which may be related to greater pressure during mastication). The deviation in the age group 40–49 years is probably due to the small amount of data available for women, while that in the age group 10–19 years is mainly due to the unusually high level of dental wear in the young woman 4195a. Overall, the values do not indicate gender-specific differences in food composition – starchy plant food resources dominated the diet for both sexes, while animal-based food (meat, fish, eggs) probably played a supplementary role.

103 A chronological correlation cannot be determined either: early and late time periods are represented in both the dated individuals with particularly strong and particularly low tooth wear (see Fig. 26). In relation to the type of burial, however, it can be seen that those buried earlier – those buried in a stretched-out supine position (*) – are represented disproportionately high, namely in 7 out of 10 cases among the individuals with the lowest abrasion, while with 3 out of 10 cases they are represented too low among the group with maximum tooth wear. The expected value corresponding

	10-19 years	20-29 years	30-39 years	40-49 years	50+ years
minimal abrasion					
male	913* (0.74)	1001* (3.09)	1005* (3.36)	2103 (3.72)	4098* (4.33)
female	928 (1.50)	1208 (3.81)	1121* (2.24)	4203* (3.33)	912* (3.98)
maximum abrasion					
male	97* (2.26)	4028 (5.08)	915 (6.35)	931 (6.42)	4209 (7.43)
female	4195a* (3.30)	1154* (4.44)	15b (5.67)	1219a (8.00)	236 (5.38)

* = individuals buried in an extended dorsal position

Fig. 26: Individuals with the lowest and highest abrasion. (* = individuals buried in an extended dorsal position).



Fig. 27: Root abscess on the left side of the lower jaw from individual 2103.

to the proportion of all those buried would be 5 out of 10. An increase in more abrasive food in the later phase (from around 1000 AD) is therefore conceivable.

104 This could mean that these individuals had access to food with lower abrasive effects. Since they also have a larger average body height (maybe due to a higher proportion of animal protein in their diet), this could indicate a higher proportion of meat and fish and indicate a diachronic change in the nutritional basis. A correlation with status differences is also possible, since some of the individuals (1001, 1005, 1208, 1121) with the lowest abrasion also show only very low arthrotic degeneration. However, with 4028 there is also the case of strong abrasion without osteoarthritis stress.

105 Diseases of the periodontium, such as gum degeneration and periodontitis, inflammatory dehiscences and irritation-related hypercementoses, were found in large numbers and in some cases with high severity. Affected were Ind. 12, 15a, 15b, 192, 236, 912, 921, 925, 927, 931, 933, 1001, 1005, 1121, 1127, 1209, 2059, 2103, 4028, 4096, 4098, 4202 and 4203 – i.e. the majority of better-preserved adults. The reason for this is certainly the lack of oral hygiene among those affected. Although most individuals only have moderate tartar, this, together with food contaminated with germs, may have been responsible for chronic inflammation of the gums.

106 The high incidence of tooth decay and periodontal disease naturally also causes the formation of serious processes such as cystic abscesses and root tip granulomas in the jaw. Such potentially life-threatening changes could be observed in individuals 12, 15b, 18, 19, 912, 927, 1121, 1209, 1219, 2059, 2103 (see Fig. 27), 4096 and 4202. As expected, there are no noticeable differences between the sexes, although there seems to be an increase in individuals who date to the later occupation phases.

Special pathologies: Infections and traumata

107 Infections are a main cause of illness in populations with poor hygienic environments and inadequate medication options, especially in the tropics. Nevertheless, they tend to be rather underrepresented in the skeletal record. Most of infections affect the soft tissues and rarely leave traces on the bones. Bone lesions only occur, if at all, after a long period of illness and are often unspecific. The defensive stimulus of inflamed tissue on the periosteum can lead to vascular ingrowth and mineral deposits, which remain as periostitic plaques. Depending on the distribution pattern, size and other characteristics, the cause can sometimes be determined.

108 In individuals 19, 97 and 4098, a small local trauma with wound infection probably caused a reactive inflammation. In individuals 225, 6005, 6011, 6023 and 4171, the vascular growths and plaques are located on the inside of the skull, evidence of a presumably fatal meningitis (Fig. 28). Individuals 15b, 231, 910, 912, 933, 1115,

Fig. 28: Periosteal plaques located on the inside of the skulls of individuals 4171 and 6023.





Fig. 29: Examples of multifocal periosteal reaction caused by treponematosi.

Fig. 30: "Saber sheath" tibia of individual 236, caused by treponematosi.



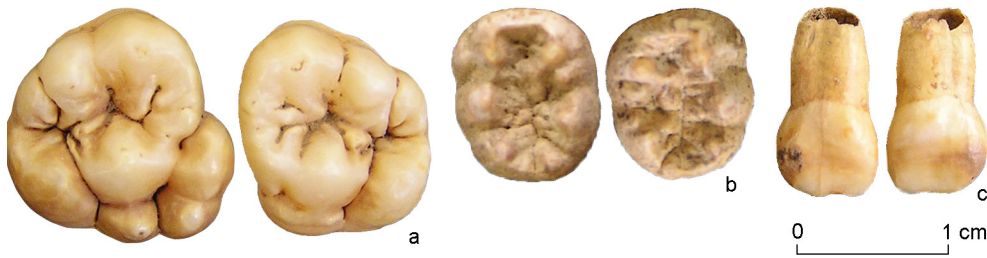


Fig. 31: "Mulberry molars" and "Hutchinson's teeth" (a from individual 6007; b, c from individual 6023).

1222, 2001, 2059, 4096, 4208, 6022a and 6022b show individual foci that cannot be reliably assigned to a specific etiology. Of particular interest, however, are individuals 97, 236, 237, 921, 925, 1102, 2059, 6007, 6011, and 7007, which show multifocal periostitis that may have spread throughout the entire skeleton (see Fig. 29). A decisive clue to the possible cause was provided by the tibia bones of individual 236, which were characteristically deformed by periosteal growths and showed the pathological picture of the "saber-sheath tibiae" (Fig. 30). This finding left no doubt about the presence of a treponematosi (Hackett 1976). A similar finding is available from 237. Individuals 6007 and 6023 showed specific dental anomalies – upper incisors with a curved incision and "mulberry molars" with an irregular crown shape (Fig. 31) – which belong to the so-called "Hutchinson triad". They are symptoms of syphilis connata, which is transmitted from mother to child during birth.

109 The affected individuals all appear – as far as can be dated – to fall into the earlier burial phase in the 7th and 8th centuries AD. Only Individual 97, in which the change could also result from a maggot abscess, dates to the 11th century. It is possible that the previously endemic disease disappeared from the Salvatierra population. The finding of treponematosi – possibly syphilis – is of particular interest and will therefore be discussed in detail in the following section.

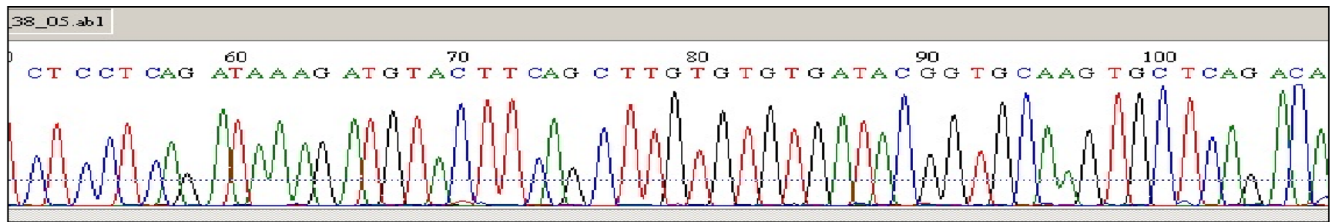
Studies on the pathogen aDNA of *Treponema pallidum*

110 The tests for *Treponema pallidum* described below were carried out with all 45 samples that were selected for aDNA analyses, some of them on different, multiple extracts. A semi-nested PCR was performed, generating a 165-bp product in the first round and a final 125-bp product in the second. The initial amplification generally did not produce a PCR product.

111 Samples from individuals 11, 18, 915, 4096, 4098, and 4202 could be tested repeatedly positive. It should be noted that these samples are extracts with good-quality-quantitative DNA and little to no inhibition. This is also proven by the fact that all treponema-positive samples had already worked very well in the mitochondrial PCR (see individuals column in Fig. 15). It must also be emphasized that intrinsic, i.e. laboratory-internal, staff contamination is ruled out because none of the employees suffer or have suffered from syphilis or related diseases. The result can therefore be assessed as authentic.

112 To dispel any doubts, we sent sample 0018 to the reference laboratory in Munich (Institute for Paleopathology, Prof. Dr. A. Nerlich), with the request for renewed, independent extraction of the sample, PCR and DNA sequencing. Sample 0018 also tested positive for a conserved section of the DNA polymerase A gene from *Treponema pallidum* in the Munich laboratory (Acc. No. U57757.1). The result is shown in Fig. 32.

113 The DNA data were also illuminating with regard to the assessment and interpretation of the criteria for determining syphilis in the pre-Hispanic population of the Casarabe culture of the Salvatierra site. Of the 6 positive individuals, none is clearly trepanematous after detailed morphological examination. However, the 15 treponema/syphilis candidates previously favored due to special bone and tooth characteristics



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>gb|CP000805.1| D Treponema pallidum subsp. pallidum SS14, complete genome
Length=1139457

Features in this part of subject sequence:
  DNA polymerase I

Score = 169 bits (91), Expect = 2e-39
Identities = 91/91 (100%), Gaps = 0/91 (0%)
Strand=Plus/Plus

Query 1      CGAGTTGCGGCTGAGCACTGTCATGTTGTGATTATCTCCTCAGATAAAAGATGTACTTCAG 60
Sbjct 116172  .....

Query 61     CTTGTGTGTGATACGGTGCAAGTGCTCAGAC 91
Sbjct 116232  .....

```

Fig. 32: Treponema test. Sequencing result of a 125-bp PCR product of sample 0018 (top, a characteristic part of the whole sequence is shown, primer sites were removed). The BlastN result shows 100 % coverage (E-value of 2e-39) of our PCR sequence with the treponemal sequences available in the database (bottom).

did not test positive (i.e. individuals 19, 97, 236, 237*, 912, 921, 925, 934, 1115, 1222, 2059, 6007, 6011, 6023, 7007). The latter can be described based on the morphology or serious pathology with the diagnosis “stage 3 syphilis” (“+++”). Only individuals 0011, 0018, 4098 received a single “+” (out of 3 possible, correlation with the severity of the disease). The remaining 3 individuals (0915, 4096, 4202) do not show any pathotype at all (i.e. healthy). Our positively typed individuals are therefore all people with syphilis in the earlier stages 1 or 2. The transition from stage 2 to stage 3 can sometimes take 30 years.

114 Consultation with clinicians from the area of “infectious diseases” revealed that the pathogen can no longer be detected systemically in stage 3 (i.e. peptide and DNA titers are below the methodological detection limit), so it can no longer be detected in bone tissue. However, detection is possible in stage 1 of syphilis and rarely in stage 2 of syphilis, a phase in which the characteristic bone symptoms cannot yet be addressed morphologically. From this it can be concluded that the infection rate with *Treponema pallidum* in this population must have been high overall, but only a small proportion of those affected reached late stage III.

Trauma

115 Pathologies caused by trauma occur rarely in the overall population. Corresponding evidence was only found in five individuals: Ind. 12 (male) shows a healed fracture in the epicondylar area of the right humerus. The shear fracture was probably caused by a fall, not a blow. The Colle's fracture on the right radius in Ind. 6005 (female) is also typical of a fall injury that was caught with an outstretched arm. The same applies to the radius fracture near the hand on the right in Ind. 236 (female). In Ind. 912, the cuneiform bone on the right is fused to the first metatarsus, possibly as a result of a long-ago compression fracture.

116 Otherwise, there may be bone injuries in Ind. 2067 (female, ribs) and 4096 (male, metacarpus IV) as well as a healed small depression fracture on the occiput in Ind. 2059 (female). Given its location, the latter is also more likely to have been caused by a fall than by a blow.

117 Not a single case clearly indicates interpersonal violence. All fractures were probably caused by banal accidents involving falls. This finding speaks for an extremely

“peaceful” life. Conflicts within the community seem to have been resolved without violence using appropriate strategies, and armed conflicts with other groups can probably be ruled out.

Congenital malformations

118 Malformations of a disabling or disfiguring nature or conspicuous growth disorders could not be identified, nor were there any indications of genetic disease syndromes. It is possible that newborns with such defects were immediately abandoned. The most likely to fall into this category are the strikingly shallow acetabula of the hip joint in individuals 506 and 4028a, and in a somewhat weaker form in individual 912 (Fig. 33), which are probably to be understood as a mild form of congenital hip joint dysplasia. The present signs of coxarthrosis indicate limited function and resilience of the joint, which supports the diagnosis. The finding could also indicate a closer genetic relationship between the individuals mentioned.



Fig. 33: Shallow acetabulum showing a form of congenital hip joint dysplasia, resulting in arthrotic degeneration (individual 912).

Living conditions

Activity adaptations

¹¹⁹ As a living organ, the skeleton is subject to constant remodeling processes, which take place not only as part of growth or defect healing, but also as an adaptive reaction to biomechanical stress. In general, there is a reinforcement of the bone matrix in mechanical stress zones of the skeleton, but a reduction in areas with little stress. These adaptations can be recorded in the bone as morphological or structural changes and give insight to individual biomechanical stress conditions. Similarly, joint surfaces adapt to certain frequently held postures to avoid overloading. Nevertheless, these occur quite often, especially when the level of stress repeatedly exceeds the body's ability to adapt. The following indications were examined as specific skeletal markers for physical activity:

1. Squatting facets of the ankle joints. They occur from a habitual crouching or squatting position, often used as a resting or working posture, in which the buttocks rest on the heels and the weight is shifted forward.
2. Poirier's facets on the anterior part of the femoral neck near the joint. They occur when sitting in a straddle position on an object, with the body's center of gravity tilted forward.
3. Muscle attachment marks and enthesopathies. The insertion points of the muscles can hypertrophy under high force and become rough and nodular.
4. Mechanical overloading of certain parts of the body causes characteristic degenerative changes in the stressed joint area.
5. Diaphyseal shaft cross sections. Particularly on the legs, the shape of the shaft cross-section changes compared to the normal shape under bending load.

Squatting facets were only found in seven cases in the skeletons from Loma Salvatierra. However, this low number is probably primarily due to preservation, as the epiphyses of the long bones in particular were weathered in many cases.

¹²¹ As expected, the observed cases (Ind. 231, 921, 1127, 1154, 2059, 4096 and 4098) are adults and both sexes are equally represented. There is therefore no evidence of a different burden between the genders due to the specific distribution of tasks. Poirier's facets are even rarer, although the caput femoris shows a slightly better preservation frequency. Only Ind. 921, 1208 and possibly 912 and 2059 show this change. Activities that require appropriate sitting postures were probably unusual.

¹²² The differentiated assessment of muscle attachment marks is still problematic and reproducible descriptive systems and assessment criteria are still being discussed (Villotte et al. 2016). For this reason, the inclusion of these criteria in this series is limited to relative descriptions. In general, the Loma Salvatierra population shows rather robust bones and strong muscle attachments. In almost all cases these are adult or older male individuals (12, 19, 26, 237, 915, 921, 931, 1001, 1002, 1005, 1103, 1127, 1209, 1211b, 2104, 4028, 4098, 4099, 4209 and 5001). These 19 cases compare to only five among women (912, 1154, 1208, 1219 and 6005). This fact is probably due to the greater average muscle strength in men and, accordingly, a higher load on the muscle attachments, but also heavier physical strain. In contrast to the articular facets, gender differences can definitely be seen when it comes to locating strong muscle marks: in women, only the hand and chewing muscles are affected, in men 10x the arms and 6x the legs, but only 3x the jaws. These results correspond to the signs of stress on the joints (see above), which showed a high frequency of arthrosis of the elbow joints in men and of the jaw joints in women and confirm the assumption of a gender-dependent form of division of labor.

	Index platymericus (Fe10/Fe9x100)		Index cnemicus (Ti9a/Tia8ax100)	
	Male	Female	Male	Female
n	24	14	22	14
max	123,1	107,7	81,3	78,1
min	67,7	71,9	52,8	57,1
Mean	85,8	82,7	68,6	69,0
Standard deviation	12,4	10,5	6,8	6,20
HI	14,4	12,8	9,9	8,99

Fig. 34: Comparison of diaphyseal cross-sections of the femur and tibia.

Another indicator of biomechanical workload is the diaphyseal cross-section shapes of long bones, especially of the femur and tibia. Their cross-sectional shapes are described by the measurement indices Index platymericus (femur) and Index cnemicus (tibia).

123 What is noticeable is the quite considerable spread of the maximum and minimum values (Fig. 34). In addition to unclear genetic influences, different stress patterns are likely reflected. The greater heterogeneity among men may also arise from both causes. In men, the femora show a more rounded cross-section, in women it is more platymeric. This difference is known to have anatomical reasons, as in women the muscle pull in the upper femur area tends to be in a lateral direction due to the wider pelvic proportions. The cross section of the tibia is mesocnemous in both sexes. The differences are not significant. The values indicate a mostly balanced dorsoventral and mediolateral bending load on the leg skeleton. There are no indications of either special sitting positions nor extensive movement through rough terrain with steep slopes. This leads to the conclusion that the load on the lower extremities was only moderate in the Salvatierra population.

Nutritional situation

124 Not only diseases and mechanical stress, but also the amount and composition of food leave their mark on the skeleton. Some of these traces can be detected macroscopically, others can be detected using physical-chemical measurements.

1. The wear of teeth – in strength and shape – is an important indicator of the general character of the food: hard, tough, fibrous or soft and rich or poor in abrasive particles.
2. Although tooth decay and tartar formation depend on several factors, food still plays a major role in the pathogenesis of these phenomena. Foods rich in carbohydrates promote the development of tooth decay, while foods rich in proteins promote the development of tartar. Highly acidic foods can cause demineralization, especially in the cervical area of the teeth.
3. The final body height, especially in terms of limb length, is significantly influenced by the availability of primarily animal proteins during growth (Wurm 1984).
4. The composition of the diet, especially with regard to animal and plant components, can have an impact on the deposition of certain trace elements in the mineral bone matrix through accumulation or sieving effects. The elements Ca, Cu and Zn, especially from animal foods, as well as Mg, Ba and Sr from plant foods, are particularly relevant here.

5. The ratio values of the carbon isotopes ^{12}C and ^{13}C as well as the nitrogen isotopes ^{14}N and ^{15}N , which also show differences from different food sources, can also be used as an indicator of certain food sources.

Both the tooth abrasion characteristics and the caries burden of the population examined have already been discussed in Chapter 5. Both criteria indicate a dominant proportion of starch and sugar-containing products in the diet, i.e. such as maize flour or yuca tubers. The preparation of food also apparently led to heavy contamination with abrasive particles. It is likely that tubers and grains were not only boiled until soft, but also ground into flour on grinding plates. The serrated ceramic bowls found on site would serve this purpose well, but the brittle clay material would produce many hard particles that contaminated the food.

125 Overall, tartar occurs to a remarkably low extent by prehistoric standards, although with individual exceptions. This suggests a rather acidic oral environment, possibly due to regular consumption of fruits. The high caries morbidity is probably partly caused by this oral environment, which weakens the tooth enamel. Buffering by phosphates from milk and meat foods is also unlikely.

126 In order to be able to use body height as an indicator of protein supply, reference series with appropriate genetic backgrounds and different diets would be necessary, as well as diachronic comparisons. Neither was available, unfortunately. As already mentioned in Chapter 3, the people of the earlier settlement phase (7th–10th centuries) appear to be relatively tall, which could indicate a good supply of protein. In the following period (11th–14th centuries), however, body height decreased – a possible indication of a quantitative or qualitative deterioration in food.

127 Trace element studies are a promising method of understanding the composition of food on bones. However, individual metabolic differences and diagenetic influences can distort the picture in a way that cannot be reconstructed, which is why the corresponding analysis results must be interpreted with caution (Fabig 2002). Data were obtained from 28 individuals from the Salvatierra site (Fig. 35, see also [Appendix 2](#), table 13). Powdered dentin obtained from intact molars was examined. Due to the protection of the surrounding tooth enamel and the denser structure, dentin has a better chance than bone of being able to provide authentic and less diagenetically modified measurements.

n=28 samples	Ca (ppm)	Al (ppm)	Fe (ppm)	Mn (ppm)	Mg (ppm)	Ba (ppm)	Sr (ppm)	Zn (ppm)	La (ppm)
Mean	305760	6507	3953	160	2740	317	530	110	27
Normal range*	380 K	15-130	9-111	<5	3-11 K	5-570	100-4400	70-550	<0,1
max	347464	29570	14190	500	4070	549	724	243	35
min	229007	0	890	10	1950	119	352	23	16

Fig. 35: Results of the trace element analyses (* See Tütken, Knipper, Alt 2008).

128 The first thing to notice is the slightly too low proportion of Ca and the greatly increased values of Al, Fe and La. These elements can be understood as indicators of diagenesis – a significant increase indicates the substitution of bone minerals by soil minerals. In the samples examined here, they indicate a moderate exchange of elements. Apparently the dentin was not spared from diagenetic changes. As expected, an additional bone sample from Ind. 1001 showed in comparison that bone indeed underwent even more pronounced changes. However, the overall spread of results is considerable, so results need to be read with care.

129 The ratios of Ba/Ca, Sr/Ca, Mg/Ca and Zn/Ca are of interest for nutritional reconstruction. High ratios of Ba, Sr, and Mg indicate a predominantly plant-based diet, while Ca and Zn are particularly absorbed through meat, fish, milk and eggs. The corresponding values for the Casarabe population at the Salvatierra site are on average as follows:

- Ba/Ca*1000 1.063
- Sr/Ca*1000 1.752
- Mg/Ca*1000 9.193
- Zn/Ca*1000 0.367

The ratio values of Sr and Ba (Fig. 36) indicate an extremely high proportion of plant food in the diet, especially in comparison to herbivores (Capra, Ovis, Bos) and omnivores (Sus) and a late Neolithic population whose subsistence is probably based on pasture farming based. Even if Ba and Sr are referred to a Ca standard value (to compensate for distortion due to Ca leaching and replacement by other minerals), the data speak for a predominantly vegetarian diet. The comparatively low proportion of Zn supports this interpretation (Aras et al. 1999) and confirms the results obtained by osteological analysis, as described before.

	n	log(Sr/Ca)	log(Ba/Ca)
HOMO (Salvatierra)	28	-2,97	-2,76
dto. (corrected to typical Ca-value)	28	-3,08	-2,86
CAPRA / OVIS	41	-3,21	-3,61
BOS	7	-3,32	-3,64
SUS	290	-3,42	-4,16
HOMO (Corded Ware culture)	9	-3,59	-4,65

Fig. 36: Ratio values of Sr and Ba.

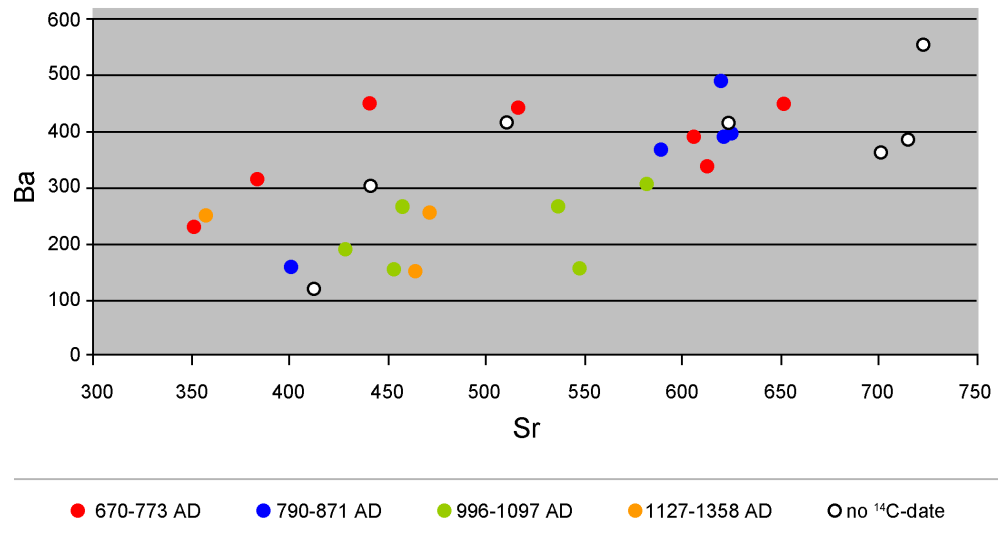
130 Breaking down the data by chronology could reflect dietary differences over time. To test this, the dated individuals in the sample were divided into an earlier (up to around 1000 AD) and a later (from around 1000 AD) group. In fact, there were clear differences in the mean values (Fig. 37). However, the comparison indicates stronger diagenesis processes in the older skeletal remains – lower Ca content, but higher values of Fe and Al. The higher values of Ba, Sr, Mg, Mn and Zn in the older samples may also reflect accumulation over time.

131 An even finer breakdown of the data into Ba and Sr actually reveals a time-dependent decrease in the Ba ratio. In principle, it is conceivable that the proportion of plant food decreased from the 7th to the 14th century, although soil chemical replacement processes are more likely. In the case of Sr, on the other hand, no time-related order is

Fig. 37: Breakdown of trace elements according to their chronological position.

n=10/11 Samples	Ca (ppm)	Al (ppm)	Fe (ppm)	Mn (ppm)	Mg (ppm)	Ba (PPM)	Sr (PPM)	Zn (PPM)	La (PPM)
Standard range	380 K	15-130	9-111	<5	3-11 K	5-570	100-4400	70-550	<0,1
Mean (early)	306033,6	6852,7	4086,4	149,1	2884,5	383,9	547,2	120,8	22,2
Mean (late)	311616,6	4534,0	2993,0	123,0	2545,0	211,7	470,2	106,4	31,6

Fig. 38: Sr and BA content (ppm) according to the chronological position of the samples.



recognizable, maybe due to differences in the ease of leak and wash-out effects (see Fig. 38). With a high degree of scatter, they suggest a predominance of vegetarian food throughout the entire period examined. Finally, the ratio of Zn to Sr was calculated. In the earlier group it is 0.24, in the later group it is 0.23. The composition of the diet as a whole is therefore unlikely to have changed much.

132 Overall, the results of the trace element analyzes must be assessed critically, as soil diagenesis apparently had a strong influence (Fabig 2002; Schäuble 2005). However, the data support a predominance of plant-based foods, while meat or fish played a minor role.

133 Another method to reconstruct dietary composition from the skeleton is to measure the isotope ratios of $\delta^{15}\text{N}$ to $\delta^{14}\text{N}$ and $\delta^{13}\text{C}$ to $\delta^{12}\text{C}$. The isotopes, which occur in different concentrations in the atmosphere and in the soil, are fractionated by organisms as part of metabolic processes due to slightly different physicochemical properties. The changed isotope ratios can therefore provide information about their path through the food chain. For example, $\delta^{15}\text{N}$ accumulates by approx. 3–5‰ at each trophic level (Bocherens – Mariotti 2002). Higher numbers therefore indicate a higher proportion of animal food.

134 The initial value of the N isotope in question varies geographically, which must be taken into account when interpreting the measurement results. In the region of eastern Bolivia, 6–9‰ $\delta^{15}\text{N}$ can be expected (Amundson et al. 2003), so herbivores of the first trophic level are likely to be around 9–14‰, carnivores and freshwater fish at 12–19‰. The exact values depend on local conditions such as rainfall and temperature (they increase with higher heat and dryness). The average bone collagen value of the 20 samples examined is 8.57‰ and is therefore extremely low, i.e. in the expected range for herbivores. These results therefore support the impression gained from the trace element analysis or the dental and metric examinations.

135 The values of the $\delta^{13}\text{C}$ measurement can even provide further information on this. On the one hand, the isotope value depends on the carbon source – atmospheric carbon dioxide or marine bicarbonate – and on the other hand on the metabolism that fixes the carbon in the organism. Marine food sources are not expected for the site in the Bolivian lowlands, but the second factor is even more interesting. There are three different photosynthesis pathways in green plants: the C3-Calvin cycle, which most plants in temperate and cool latitudes have, the C4-dicarboxylic acid cycle in many tropical grasses, and the CAM cycle in some thick-leaf plants.

136 The average $\delta^{13}\text{C}$ value for C3 plants is -26.7‰, that of C4 plants is -12.5‰ (Cerling – Harris 1999). In tropical South America, the proportion of C4 plants is over

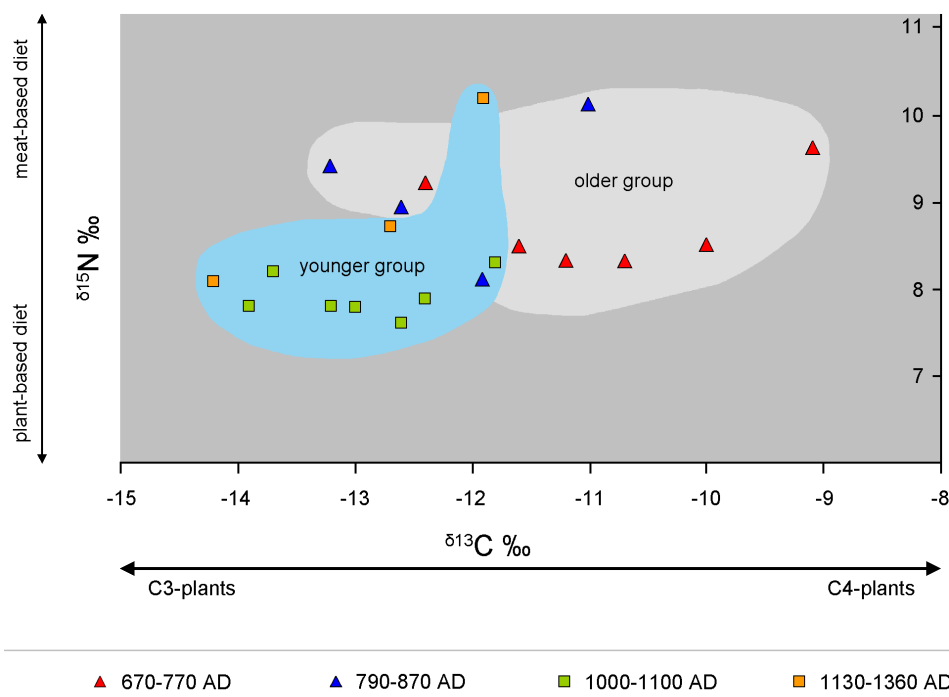


Fig. 39: C13 and N15 isotope values according to the chronological position of the samples.

60 ‰, which is why very low $\delta^{13}\text{C}$ values are to be expected for both herbivores and carnivores. Enrichments of up to 5 ‰ per trophic level are possible in larger mammals (Schwarcz 1991). For the Loma Salvatierra individuals sampled, the average $\delta^{13}\text{C}$ value was -12.2‰ , (see Appendix 2, table 14) i.e. in the range of C4 plants, which probably made up a large part of the diet. Among the C4 plants cultivated in South America are corn (*Zea mays*), amaranth (*Amaranthus edulis* and *A. tricolor*) and quinoa (*Chenopodium quinoa*). While the latter are more likely to be highland dwellers, there is evidence of corn in the form of charred grains and corn starch residues in ceramic vessels at the site (Bruno 2010, Dickau et al. 2012).

137 Yuca (*Manihot esculenta*), a tuber plant from the spurge family (*Euphorbiaceae*), which is also a traditional food plant in the region, shows an unusual C4-like metabolism (El-Sharkawy – Cock 1986) and is therefore unlikely to counterbalance maize in the Loma Salvatierra diet, which may justify the quite clear values. The breakdown of the measurements according to chronology is very interesting (Fig. 39). Accordingly, the individuals with a date before the 10th century AD (red and blue) have on average slightly higher $\delta^{15}\text{N}$ values (on average 8.89‰) than the later ones (on average 8.24‰), so they may have had access to more animal protein, such as freshwater fish. The temporal influence on the $\delta^{13}\text{C}$ values is even more striking. Here the older individuals are significantly higher than the later ones (-11.37‰ versus -12.93‰), which indicates an extreme dominance of C4 plants in the diet and the hunting of grass-eating animals. All in all, the studies on the nutritional situation provide a fairly clear picture. The inhabitants of the Salvatierra settlement lived primarily on plant food, probably corn and yuca. From 1000 AD onwards, the diet changed in that less meat/fish was available, the proportion of corn decreased and collected plants from forested regions played a greater role.

138 The use of corn, probably even as the main source of food for the Casarabe population, has a nutritionally interesting aspect. Although corn is a high-yield grain that provides plenty of starch as a source of carbohydrates, it is lower in protein than most other grains. For this reason, a corn diet must be supplemented with other protein sources. According to the N isotopes, the role of hunting prey and fish appears to have been limited in the Salvatierra population, and intensive use of plant protein sources

can therefore be assumed. On the one hand, legumes such as beans, which are very often grown together with corn as a staple food in Central America, would come into question here. Another source of protein can be the leaves of the yuca plant, which, unlike the tuber, are rich in protein. This plant comes from the region of Brazil and Paraguay and is grown primarily for its starchy rhizomes, which are extremely low in protein and essential amino acids. The leaves, on the other hand, when eaten as leafy vegetables, are very good sources of protein. Quinoa and amaranth would also be very good plant-based protein sources, but have not yet been documented for the location where they were found.

139 It is also interesting that although two high-yield calorie sources were available, yuca and corn, both plants are nutritionally problematic and require specialized processing. Yuca contains the glycoside linamarin, which is released when plant tissue is injured; various catalytic processes result in toxic hydrogen cyanide compounds. Only thorough washing and degassing of the ground plant parts removes the toxic components. Corn is not only unsuitable as an untreated staple food because of its relative lack of protein, the essential vitamin B3 (niacin) only occurs in a form that cannot be absorbed through normal digestion. A diet that is too dependent on corn can lead to the vitamin B3 deficiency disease pellagra, which affects the skin, nervous system and digestion. The process of nixtamalization, cooking the corn kernels in an alkaline solution, makes the niacin bioavailable and also improves the corn's other nutritional properties. Traditionally, calcium hydroxide, i.e. slaked lime, is used for nixtamalization, which is made from quicklime. The latter, in turn, can be produced by lime kilns from various calcium-containing rocks. However, there are no limestones available in the alluvial Llanos de Mojos Loma Salvatierra area – perhaps snail shells or bones were burned for this purpose. Alternatively, the necessary lye can also be produced with potassium hydroxide from wood and plant ash (potash), which is more likely for the Salvatierra site.

Mobility

140 Questions about the mobility of individual group members or an entire population can be addressed by using isotope studies, especially the isotope ratios of ^{87}Sr to ^{86}Sr in the bone. The ratio of the two isotopes depends on the geological age and the geochemical composition of the underground rock and therefore has regional specifics. The weathering products enter the soil above, the vegetation and, via the food chain, animals and people in a region, resulting in a local imprint. If human or animal bones show significant deviations from the local isotope value, this suggests either an important food source from a distant region or the immigration of the corresponding individuals. Since bone is constantly remodeling, it slowly comes closer to the local value over the course of a few years. Tooth enamel, on the other hand, remains largely unchanged after its formation during childhood, thus preserving the isotopy of food during the first years of life, in contrast to local soil signatures or later bone values.

141 Of those buried at Loma Salvatierra, the molar tooth enamel of 17 individuals was examined for their Sr isotope profile, as well as a mixture of sediment remains from graves from all excavation sections. In addition, soil samples were collected from a wide radius (up to 700 km) and tested for their strontium isotope profile in order to get an impression of the geological diversity of the wider catchment area around the Salvatierra settlement. The isotope ratios of both the human remains (see [Appendix 2](#), table 15) and the local sediment (Fig. 40) show extremely high $^{87}\text{Sr}/^{86}\text{Sr}$ ratios, which speaks for very old, continental and Rb or K-rich underground rocks.

142 The isotope values of the sampling locations show two extreme outliers, but also a clear variation in other respects. Measured value 1 (Bella Vista water) must

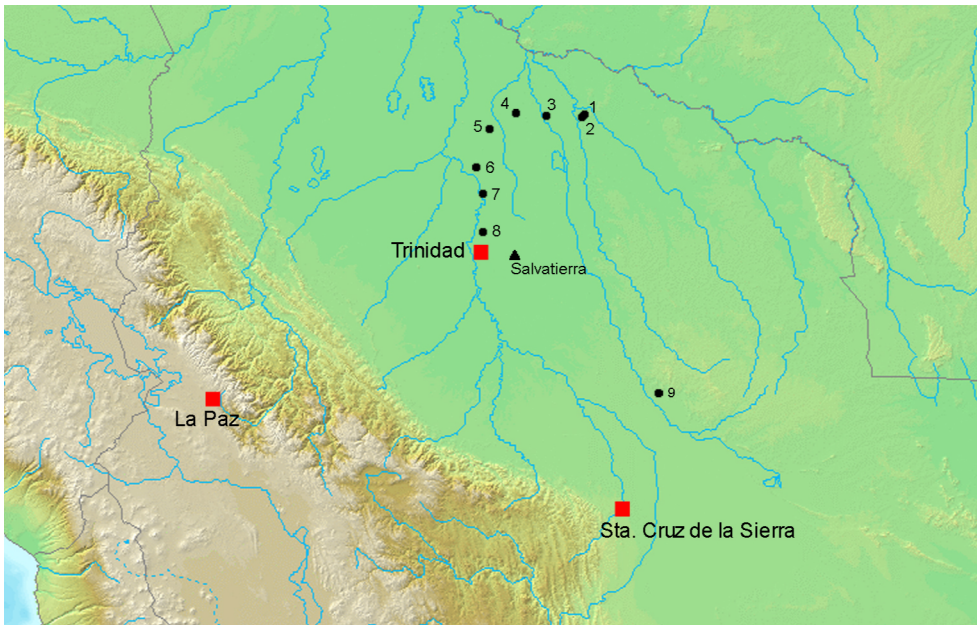


Fig. 40: Sampling locations and strontium isotope values.

Sample	Material	Coordinates (WGS 1984 UTM Zone 20S)	$^{87}\text{Sr}/^{86}\text{Sr}$ -ratio
1	Water	0425081 E, 8535074 S	0,769191
2a	Sediment	0422856 E, 8532225 S	0,726549
2b	Sediment	0422856 E, 8532225 S	0,728223
3	Sediment	0378578 E, 8534212 S	0,728292
4	Sediment	0338516 E, 8537449 S	0,719714
5	Sediment	0306430 E, 8516221 S	0,726978
6	Sediment	0288060 E, 8465800 S	0,725820
7	Sediment	0288500 E, 8432618 S	0,725546
8	Sediment	0297460 E, 8384490 S	0,728556
9	Sediment	0524132 E, 8181424 S	0,772268
Salvatierra	Sediment		0,725150
Salvatierra	Bone		0,725575

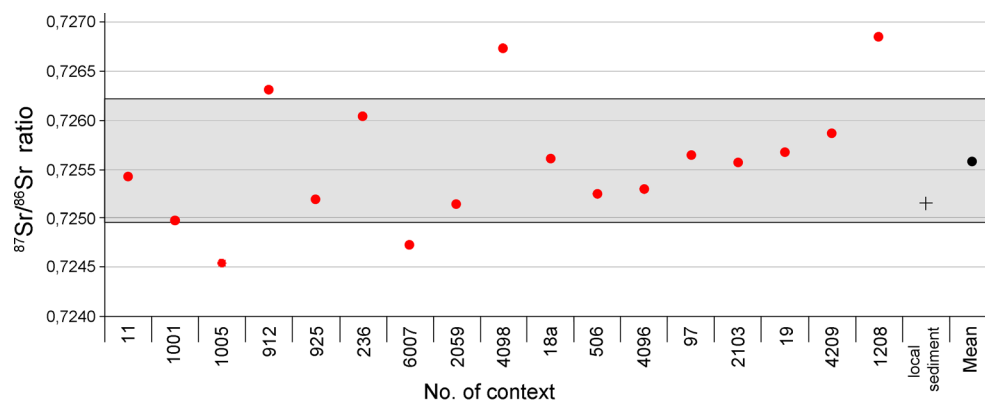
probably be ignored for technical reasons, as its value differs significantly from the local land value. Measurement 9 also shows a strong deviation, with an exceptionally high value. Unfortunately, it is the only sample from this far southeastern region. However, the relief map suggests that extensions of the Precambrian formations were recorded here, to which the data could fit.

143 The distribution of the measurements seems to indicate that the catchment areas of the two separate river systems – the Rio Grande/Rio Mamoré and the Rio San Miguel/Rio Itomanas – show different Sr isotope characteristics: the former, coming from the Andean region, having lower (i.e. younger) data, the second higher due to the presumably Precambrian subsoil. Depending on their contribution to the extensive flooding of the Moxos, these two rivers probably shaped the isotope profile in the area around the Loma Salvatierra. The apparently quite variable isotopy in the area around the Loma Salvatierra is noteworthy. Perhaps local deposition mechanisms of the two river systems mentioned above play a decisive role here.

144 As expected, the origin of most of the sampled individuals and their food sources falls in the region directly in the area, tending to the north of the Salvatierra site (measuring points 5, 6 and 7). Individuals with lower Sr values are more likely to be associated with the western part of the region – the Rio Mamoré region – and those with higher ones with the east.

145 When analyzing the origins of the individuals examined, the relative comparison is first of all important. In Fig. 41, the measured Sr isotope data were presented in a chronological order to make it easier to detect possible immigration phases. The fact that the data series mean is higher than the value of the local sediment

Fig. 41: Distribution of individual Sr-isotope values, arranged in chronological order (shaded in grey is the local range).



can probably be attributed to the small sample and the therefore very effective “outliers” 4098 and 1208. Overall, however, it can be assumed that the local geological signature and the nutritional signature of the individuals examined correspond. This is shown by the fact that most individuals scatter within the 1σ range around the mean of the series (gray bar) and only the Ind. 1005, 912, 6007, 4098 and 1208 deviate more and thus possibly used different food sources than the rest of the group.

146 It is also noteworthy that the spread of the individual values for the earlier dated individuals (up to Ind. 4098 around 871 AD) is much greater than in the later period. This homogenization from 996 AD onwards, which can also be understood anthropologically and has already been mentioned, refers again to the already mentioned turning point around 1000 AD. It can either indicate that immigration from isotopically different areas is coming to a standstill, or that the area from which food is sourced is becoming smaller. The latter may be due to the loss of previously used diverse resources and increasing specialization or narrowing to a particular food source. According to the results of nutritional reconstruction, this could be, for example, a decrease in the proportion of fish and prey and an intensification of local plant cultivation.

147 The relatively large deviation of the Sr isotope signature from the series mean for Ind. 1005, 912, 6007, 4098 and 1208 would usually be interpreted as an indicator of possible immigration. However, the close resemblance of these people to the overall population does not support such an assumption – they fit well into the overall picture. What is noteworthy, however, is that both the men (1005, 4098) and the two women (912, 1208) are among the largest individuals, all with the lowest joint wear and the lowest tooth wear in their age groups. Therefore, they may be more likely to be assigned to a privileged group who had access to a more varied diet even from further distances from the settlement. Alternatively, they could be members of genetically close but distant populations who only came to the Loma Salvatierra area after childhood. The origins of 1005 and 6007 would then be more to the west, those of 4098 and 1208 more to the southeast. However, it is also conceivable that the first settlement phase used resources from the western catchment area, while the second phase was more oriented towards the southeast.

Social differentiation

148 The social hierarchy system of a past population can only be addressed to a limited extent by biological anthropology. Only if a certain social position is more or less permanently associated with living conditions that deviate considerably from the norm can corresponding evidence be expected on the skeleton. In the case of particularly favored individuals, this would be, for example, a qualitatively and quantitatively better diet, less physical stress and a generally better state of health. For disadvantaged individuals, more or less the opposite would be expected. Also conceivable are body

modifications such as skull deformations, tooth filings or similar, through which a certain class affiliation is intended to be demonstrated.

149 Lip pegs were found in situ in some graves of the Casarabe settlement of Salvatierra. In addition, characteristic marks on alveolar bone and teeth have been found in 12 individuals: severe frontal wear on the lower incisors, severe signs of irritation on the mandibular alveolar arch below the incisors with periostitis and root dehiscences, and isolated loss of the lower incisors. Six men (Ind. 915, 1005, 1103, 1115, 4098 and 4202) and six women (912, 927, 933, 935, 1121 and 4203) were affected, so the lip peg is definitely is not a gender-specific type of adornment. It already appears with the earliest burial phase (Ind. 1005) and is found up to the late 9th century (Ind. 4098). There is no clear evidence of a later occurrence. Five of the individuals (912, 1005, 1121, 4098 and 4203) are among the ten individuals with the lowest tooth wear in their age group, but one (915) is among those with the highest abrasion. This may be related to chronology (the average tooth wear increases in the late phase), but it is nevertheless noteworthy that these individuals in particular show lower-than average abrasion levels. Otherwise, there are no significant similarities in terms of relatedness or postcranial dimensions, and a below-average risk of osteoarthritis or generally better health status is also not recognizable. It is therefore not likely that the lip peg was the mark of a particularly privileged or disadvantaged group or a close family circle.

150 If there was indeed a group of people among the inhabitants of the Loma Salvatierra who show evidence of a privileged lifestyle, then they can be assumed to be among individuals 11, 1001, 1005, 1121, and 1208, who are characterized by only minor physical stress markers, by a better dental status and overall good health, even if they certainly show signs of stress during childhood. Since no biological family connections can be identified, it is more likely that these were individual fates. A hereditary social primacy of individual families does not seem to have existed which makes fixed hierarchical differences rather unlikely.

Individual 1005 – an exceptional individual?

151 What the burials of the Salvatierra settlement have in common is what can generally be described as sparse grave goods. Only one individual, buried in the central location of a platform building, clearly made an exception to this: body ornaments such as bracelets made of deer bone, a stone lip peg, a necklace with jaguar teeth and earrings made of copper sheet and armadillo carapace highlight individual 1005 as apparently particularly privileged or as an “important person” (Fig. 42).

152 The skeletal preservation of the individual is among the best in the entire site, probably due to the position and depth of the burial pit. The bone structure is solid and shows only minor signs of weathering. The skeleton is almost 100 % preserved apart from defects in the shoulder blades, sternum and pelvic blades.

153 Individual 1005 can undoubtedly be classified as male according to all relevant morphological characteristics, only some secondary criteria on the temporal bone of the skull base (the meatus acusticus internus angle) were not clearly male. The age of death is determined to be late adult, more precisely 35–40 years, due to the ossification of the cranial sutures. All sutures inside the skull roof are fused, and the first signs of fusion are visible on the outside, and section S4 is already obliterated.

154 The dental status is remarkably good (see [Appendix 3](#)). No recognizable intravital tooth loss, and there is only one questionable caries defect of the initial stage on the front neck of the lower incisor 42. What is noticeable are the massive tartar incrustations, which indicate an alkaline oral environment that inhibits caries, but in turn was responsible for at least moderate periodontal disease. Tooth wear is very high for age compared to modern populations, but is within the normal range for pre-industrial societies. The abrasion is slightly stronger on the left side of the jaw, which

Fig. 42: Views of the tomb of individual 1005. The grave goods consisted almost exclusively of body ornaments, such as a copper plate on the forehead (A), earplugs (B), jaguar teeth on the thorax (C), and a bracelet made from deer bone segments (D).



suggests a preference in chewing for that side, but not a pathological asymmetric load. The posterior teeth are more worn down than the front teeth, which would indicate a diet that required intensive grinding and chewing. Still, wear on the central incisors is noticeable, so based on tooth abrasion alone, it is not possible to decide with certainty whether plant-based or meat-based food predominated. Nevertheless, the largely absence of caries, the high level of tartar formation and an average abrasion value of 3.4 compared to 4.9 in the Loma Salvatierra men of approximately the same age group could plausibly indicate differences in diet, with a higher proportion of non-abrasive and non-cariogenic, tartar-promoting comestibles, mainly meat and fish.

155 Individual 1005 also shows a generally good state of health. Despite his advanced age, there are only minor signs of degenerative articular changes: the costoclavicular

fossa on the right is deep and rough, the left acromion appears widened, and some of the vertebral-rib joints show arthritic changes. There are pre-arthrotic signs on the elbows and wrists, and traces of mild to moderate spondylosis and spondylarthrosis on the lumbar spine. There may have been a slight herniated disc in the second lumbar vertebra. Minor signs of osteoarthritis can be seen in the hip joints, and there are even slight signs of inflammation on the right.

156 Overall, this man is still one of the almost 30 % adults at the site with very little or no significant arthrosis, which suggests a lower-than-average physical workload. In contrast to the majority of those examined, the clearest signs of stress can also be found in the area of the hands and forearms. The enthesal attachment sites of muscles to the bones of the upper extremities are also stronger than those of the lower ones, with an emphasis on the right side of the body. The observed muscle attachment marks appear generally rather pronounced and rough, but apparently the individual generally tended towards a formation of osteophytes (e.g. also on the pelvis and roof of the palate), which is why it cannot necessarily be assumed that there was strong physical strain.

157 Altogether, most activity markers seem to differ from the type of stress experienced by most of the other residents of the Salvatierra settlement. While these mostly show stressors that can be best explained by building and agricultural work using tools such as hoes and shovels and by carrying loads, 1005 rather shows a pattern congruent with manual work in a sitting position. So, in addition to the above-mentioned signs, the skeleton exhibited so-called Poirier facets on the femoral neck, squatting facets on the dorsofrontal surface of the talus, and a plantar extension of the articular surface of the big toe phalanx, which indicates a frequently assumed squatting posture. The superior expansion of the patellar surface on the left knee joint and the significant forward bending of the femoral shafts could also result from holding such a working posture for prolonged time.

158 Also of interest are the microtraumas in the temporomandibular joint fossa, the marks of extremely strong chewing muscle activity, and the forward expansion of the temporomandibular joint fossa, which could indicate special chewing habits. Interestingly, the activity pattern of Ind. No. 1005 is more similar to those of female members of the group, rather than his male peers.

159 Some stress markers that indicate times of crisis during childhood – be it due to hunger or illness – are also noteworthy. Proportionally, noticeably small kneecaps and very small and delicate vertebrae with a narrow spinal canal were found, which is sometimes referred to as a food-related growth-deficiency indicator. Above all, however, hypoplasia lines in the tooth enamel that developed around the 2nd, 4th and 5th year of life, as well as the clear but already healed cribra orbitalia signal several health crises during childhood. Harris lines in the cancellous bone of the long bones could not be observed, but it is conceivable that the Schmorl impressions of the vertebral plates were also caused by temporal developmental disorders.

160 If 1005 actually survived several serious crises in his childhood, he would probably have been spared from them later. No corresponding symptoms such as weakening of the bone substance or florid cribra were found, no symptoms of malnutrition or diet deficiencies, no profound injuries or infectious diseases. Some trivial disease symptoms were found however, in accord with the generally high risk observed in the Loma Salvatierra population sample. So, Ind. No. 1005 showed a small area with inflammation of the periosteum on the dorsal surface of the 5th metatarsal on the right foot, probably caused by a small injury. Traces of a slight bone inflammation are also visible on the left cheekbone and perhaps also on the inside of the skull of the left parietal bone, perhaps the consequences of a parasitosis. On the inside of the frontal bone there were changes that resembled the beginning of hyperostosis frontalis interna – possibly signs of an endocrine disease such as diabetes mellitus.

161 The question of whether 1005 was a “normal” genetic member of the population studied or a stranger cannot be answered conclusively. However, both the anatomical variants and the morphological and metric criteria indicate that individual 1005 belonged to the early population of the Loma Salvatierra and was not an immigrant stranger.

Appendix 1: Descriptive catalogue of individuals

162 Individual No. 10

Articulated skeleton (20 %) of an adult male (?), stretched out lying on the right side and oriented approx. S-N.

Bone condition: Brittle.

Evidence of disease: Tooth 43 tilted considerably to the distal side due to intravital loss of tooth 44.

Anatomical variants: Teeth 18 and 48 probably not developed; teeth 17 and 47 without wear facet.

Individuum No. 11

Articulated skeleton (40 %) of a male (?), aged about 20–40 years, stretched out lying on the right side and oriented approx. S-N. Radiocarbon dated to 1623 ± 30 BP (KIA 31856).

Bone condition: Fragile.

Evidence of disease: Enamel hypoplasia.

Anatomical variants: Teeth 11, 21: pronounced shovel-shaped; teeth 23, 43: marginal ridges; teeth 37, 47: Foramen molare.

Individuum No. 12

Articulated skeleton (80 %) of a male, aged about 30 years, buried seated, cross-legged, and facing southeast. His living stature was calculated to 159 cm, so he was not large, but robust with tendency to strong muscle marks and enthesopathies. A bone was radiocarbon dated to 956 ± 25 BP (KIA 31857).

Bone condition: Brittle.

Evidence of disease: Gonarthrosis II bilaterally (femur, patella, tibia) with rims, grooves and ossified sequestra; calcaneus and os naviculare left arthrotic I; humerus right healed fracture of medial epicondyle with fused fragment in fossa olecrani > elbow arthrosis II; Spondylosis I–II (osteophytes) on cervical vertebrae and thoracic spine; spondylarthrosis III on lumbar vertebrae; rib joints arthrotic II; tooth 26: hypercementosis; tooth 11: periodontitis, apical abscess.

Anatomical variants: Metatarsus I bilateral small spherical cavities 2–3 mm in diameter below the distal articular surface (genetic cause or cysts?); Ossiculum lambdoideum left; superior and left branch of eminentia cruciformis doubled; very strong sulci arteriosi in the Os parietale; teeth 33, 43: marginal ridges.

Observations: Very pronounced arcus superciliares, transverse “grooves” in ossa zygomatica.

Individuum No. 15a

Articulated skeleton (40 %) of a 30–40 years old female (?), probably stretched out lying on the back, and oriented approx. S-N. Her living stature was calculated to 149 cm.

Bone condition: Fragile-brittle.

Evidence of disease: Ulna proximal joint with sclerotic rim (osteoarthritis I); enamel hypoplasia (approxima-

tely from the 4th – 5th year of life); advanced periodontitis (>6 mm).

Anatomical variants: Fossa subcoronoidea ulnae links; 47: Foramen molare, four-cusped and has two roots; 27: Lingula enamel, four-cusped, single-rooted.

Individuum No. 15b

Articulated skeleton (30 %) of a female (?), aged about 30 years, lying on her left side with the legs flexed. The body was oriented approx. N-S and the face was oriented towards the West. Her living stature was calculated to 155 cm.

Bone condition: Brittle.

Evidence of disease: healed cribra orbitalia; spondylosis I (thoracic vertebrae), biceps muscles insertion point (Tuberositas bicipitis radii) very strong; fan-like vascular impressions right os frontale and parietale, partly periostotic plaques; advanced periodontitis (5–6 mm atrophy); teeth 23, 26, 31, 43, 46: hypercementosis; tooth 14: apical granuloma; tooth 46: oblique abrasion to distal; teeth 31, 32: abrasion central cup, enamel hypoplasia.

Anatomical variants: Foramen supratrochleare present at left humerus; foramen supraorbitale and superciliare on left side; foramen superciliare and incisura supraorbital on right side; foramen parietale present only on left side; tooth 46: Foramen molare.

Observations: Very strong linea temporalis; erosion and caries on the necks of the teeth due to acidic food (fruits ?).

Individuum No. 15c

An ulna fragment of an adult of indeterminate sex was found along with the previously described skeletal remains of context 15. No evidence of disease and no anatomical variants were detected.

Individuum No. 18a

Articulated skeleton (60 %) of a male, aged about 25–35 years, buried seated, cross-legged, and facing southeast. A bone was radiocarbon dated to 1060 ± 25 BP (KIA 38800).

Bone condition: Hard.

Evidence of disease: Spondylosis I at thoracic vertebra, cystic cavities near the edge to ventral, diffuse and rough > infectious cause? Cavity in orbital roof (7 mm dm.) possibly due to lipoma ? strong enamel hypoplasia; tooth 21: apical granuloma.

Anatomical variants: Foramen supratrochleare present at left humerus; fossa subcoronoidea present on right side; foramen supraorbitale present on left side; two foramen zygomaticofaciale on left side; tooth 46: five-cusped; tooth 43: marginal ridges.

Individuum No. 18b

Three isolated molar roots as well as hand and foot

bones of a second individual (female?, adult) from the fill of grave context 18. No evidence of disease and no anatomical variants were detected.

Individuum No. 19

Articulated skeleton (80 %) of a male, aged about 45–50 years, stretched out lying on the back, legs flexed to a fetal position (Embryonalhaltung) and oriented North-South. His living stature was calculated to 167 cm. A bone was radiocarbon dated to 896 ± 32 BP (KIA 38814).

Bone condition: Fragile-brittle.

Evidence of disease: Os parietale left defective (lenticular, 8x5 cm), with compression marks and terrace-like indentations – probably postmortem. Arthrosis I of the right hand; Os frontale and parietale endocran vascular sprouts; ectocran at linea temporale small roundish inflammation, possibly healed trauma, with remnants of periostotic changes; Spondylarthrosis I thoracic vertebrae; enamel hypoplasia; slight periodontosis; apical abscess over tooth 12.

Anatomical variants: Marginal tubercle absent; foramen supraorbitale on right side; incisura supraorbitale on left side; foramen zygomaticofacial duplex on the left side; foramen parietale missing on both sides; ossicula lambdoidea; foramen supratrochleare present at left humerus; tooth 18: SR, hypoconid, monoradicular; tooth 17: four-cusped, single-rooted; tooth 26: four-cusped, three-rooted; tooth 27: four-cusped; tooth 28: reduced size (pearl-like); tooth 46: foramen molare; teeth 33, 43: marginal ridges.

Observations: Strikingly small vertebral bodies; exostoses on muscle marks of mandible; right tibia shows chipping 38x5 mm frontal – possibly perimortal.

Individuum No. 26

Hand bones of an individual buried directly in the ground. The actual burial was located outside the excavation unit 1 (west of it) and was not recovered; thus position and orientation of the skeleton are unknown. The burial contained an adult male whose age at death could not be determined with any more precision.

Evidence of disease: pronounced muscle marks on the bones of the hand; Phalanx media III pedis to plantar: Impression of a soft tissue reaction (encapsulated foreign matter).

Anatomical variants: Foramen at middle phalanx of the hand.

Individuum No. 41

Arm bones of an individual buried directly in the ground. The actual burial was located outside the excavation unit 1 (east of it) and was not recovered, thus position and orientation of the skeleton are unknown. The burial contained a juvenile (+) individual of indetermined sex.

Bone condition: firm.

Evidence of disease: Without findings.

Anatomical variants: None detected.

Individuum No. 92

Isolated fragment of Os parietale, apparently from a disturbed grave, found displaced in the cultural layer listed as context 92. It belongs to an 18–25 years old individuum whose sex could not be determined.

Bone condition: Fragile.

Evidence of disease: Without findings.

Anatomical variants: None detected.

Individuum No. 95

Skeletal remains (30 %) of a girl (?), aged about 2–3 years, buried in a ceramic vessel.

Bone condition: firm.

Evidence of disease: Without findings.

Anatomical variants: Possibly phalanx dimples; teeth 55, 65, 16, 26: Lingual paracone tubercle / metaconule; teeth 36, 46: deflecting wrinkle; teeth 75, 85: Entoconulid; tooth 65: Foramen molare; teeth 54, 64: Tuberculum paramolare; teeth 11, 21, 22: shovel-shaped.

Observations: Foramen frontale / Incisura frontalis absent on left side.

Individuum No. 97

Articulated skeleton (90 %) of a male (?), aged about 16–17 years, stretched out lying on the back, and oriented North-South. His living stature was calculated to 167 cm. A bone was radiocarbon dated to 957 ± 23 BP (KIA 38801).

Bone condition: Hard-firm.

Evidence of disease: Inflammation in the middle of the left tibial diaphysis: Approx. 40 mm periostitic patch around a small abscess defect (maggot abscess?), massive hypercementosis on tooth 21 due to malposition with dehiscence of the root.

Anatomical variants: Phalanx dimples on both sides; foramen parietale on both sides, foramen zygomaticofaciale absent on both sides, Incisura frontalis present on both sides, Foramen supraorbitaria present on both sides, Sutura squamosoidea left; tooth 48: Secondary roots with enamel tip lingually; teeth 18, 28: reduced size, hypocone reduction; teeth 16, 17: Carabelli's complex, teeth 16–18, 26–28: tongue-like enamel projection; tooth 28: monoradicular; tooth 26: Foramen molare; tooth 28: Lingual paracone tubercle; tooth 22: Tuberculum dentis; teeth 13, 23: poorly developed tuberculum dentis; teeth 12, 22: shovel-shaped; teeth 46, 47, 36, 37: Foramen molare.

Observations: The second Ind.-Axis would indicate an age at death of only 3–6 years.

Individuum No. 98

Articulated skeleton (20 %) of a female (?), aged 10–14 month at death, stretched out lying on her left side, oriented East-West.

Bone condition: Hard.

Evidence of disease: Slight cribra orbitalia.

Anatomical variants: Teeth 75, 85: Deflecting wrinkle;

teeth 54, 64: Lingual paracone tubercle, hypocone *reduction*.

Observations: Frontal foramen / Incisura frontalis absent.

Individuum No. 99

Isolated remains of tooth 12 or 22, apparently from a disturbed grave, found displaced in the cultural layer listed as context 99. The remains belong to an individual, aged about 8–10 years, whose sex was not determined.

Evidence of disease: Without findings.

Anatomical variants: None detected (the incisivus is not shovel-shaped).

Individuum No. 202a

Isolated tooth, apparently from a disturbed grave, found displaced in the cultural layer listed as context 202 (from quadrant 5/E). The tooth belongs to an adult individual whose sex was not determined.

Evidence of disease: Tooth 28 with calculus and caries superficialis occlusal.

Anatomical variants: tuberculum Citroen (enamel pittings), wrinkles, four-cusped, has two roots.

Individuum No. 202b

Isolated tooth, apparently from a disturbed grave, found displaced in the cultural layer listed as context 202 (from quadrant 4/E). It belongs to an individual of indetermined sex, aged 51–60 years or older.

Evidence of disease: Without findings.

Anatomical variants: None detected.

Individuum No. 204

Isolated fragments of skull, apparently from a disturbed grave, found displaced in the cultural layer listed as context 204. They belong to a male (?) individual older than 50 years.

Bone condition: Fragile.

Evidence of disease: Without findings.

Anatomical variants: None detected.

Individuum No. 209

Articulated skeleton (30 %) of a male, aged about 6 years, buried seated, cross-legged, and facing southeast.

Bone condition: Fragile-brittle.

Evidence of disease: Healed cribra orbitalia; tooth 73: Localized hypoplasia of primary canine teeth (LHPC); tooth 74: pitted enamel hypoplasia.

Anatomical variants: Incisura frontalis und supraorbitalis; two foramen zygomaticofaciale on the right side; tooth 48: placed high in ramus, tilted position; tooth 17: mesial paracone tubercle; teeth 18, 26, 27, 55: Fovea Carabelli; tooth 46: “+”-shaped fissure pattern, entoconulid, tongue-like enamel projection; tooth 85: “+”-shaped fissure pattern; teeth 36, 85: Foramen molaire; teeth 33, 43 and 73, 83: marginal ridges; incisivi not

shovel-shaped.

Individuum No. 213

Burial of a female (?), aged about 4 years, interred in a ceramic vessel. Only about 10 % of the skeleton was preserved, the bones are brittle.

Evidence of disease: Enamel hypoplasia; endostotic plaques on the right femur.

Anatomical variants: Incisivi (also deciduous teeth) are shovel-shaped; tooth 55 has two roots; tooth 85: entoconulid (sixth cusp) and foramen molaire; tooth 13: Marginal ridges.

Individuum No. 218

Burial of a female, aged about two months, interred in a ceramic vessel. Completeness: 10 %.

Bone condition: Fragile.

Evidence of disease: Possibly signs of cribra orbitalia.

Anatomical variants: None detected.

Individual No. 223a

Burial of a 3 months old neonate of indetermined sex, interred in a ceramic vessel. Completeness: 50 %.

Bone condition: Fragile.

Evidence of disease: Without findings.

Anatomical variants: Foramen Huschke on right side (age appropriate); phalanx dimples.

Individual No. 223b

Skeletal remains (only fragments of vertebrae and right ulna proximal, tooth 26) of a second individual of indetermined sex, aged approximately 18-24 months, that were found mixed with the remains of Ind. No. 223a in the urn. Completeness: 10 %.

Bone condition: Fragile.

Evidence of disease: Without findings.

Anatomical variants: Tooth 26: Mesial paracone tubercle, four-cusped.

Individuum No. 224

The knee of an adult individual buried to the east of excavation unit 2 protruded from the profile. During a heavy rain the long bones broke and these remains were bagged as context 224. The sex of the individuum could not be determined.

Evidence of disease: Without findings.

Anatomical variants: None detected.

Individuum No. 225

Articulated skeleton (20 %) of a female (?), aged about 3–4 years, stretched out lying on the right side and oriented approx. East-West. Her living stature could not be determined.

Bone condition: Fragile.

Evidence of disease: Patchy changes of the internal tabula, possibly periostitis.

Anatomical variants: Teeth 75, 85: Foramen molare; tooth 85: Deflecting wrinkle; tooth 21: Tuberculum dentale; incisivi except for 21 not shovel-shaped.

Individual No. 229

Partly articulated skeleton (30 %) of a male neonate (10 lunar month) found

Bone condition: Firm.

Evidence of disease: Without findings.

Anatomical variants: None detected.

Individuum No. 230

Articulated skeleton (30 %) of a boy, aged about 12–15 months, stretched out probably lying on the back, and oriented North-South.

Bone condition: Fragile.

Evidence of disease: Marked plaques due to meningitis in the area of the eminentia cruciformis; isolated vascular sprouts visible on tabula interna.

Anatomical variants: Incisivi have neither marginal ridges nor are they shovel-shaped.

Observations: Abrasion of the incisivi despite short age.

Individuum No. 231

Articulated skeleton (10 %) of a female (?), aged about 20–40 years, stretched out lying on the left side and oriented approx. South-North. Her living stature was calculated to 154 cm.

Bone condition: Hard.

Evidence of disease: Calcaneus left enthesopathies; left tibia with healed periostitis and squatting facet.

Anatomical variants: None detected.

Observations: Very small patella (transverse diameter 35 mm, sagittal diameter 34 mm).

Individuum No. 236

Articulated skeleton (60 %) of a female, aged about 55–65 years, stretched out lying on the back with her legs flexed to a fetal position (Embryonalhaltung) and oriented South-North. Her living stature was calculated to 148 cm. A bone was radiocarbon dated to 1240 ± 28 BP (KIA 38802).

Bone condition: Firm-fragile.

Evidence of disease: Multiple circumscribed periostotic deposits from 0.5 cm in diameter, none on the skull, moderate on the upper and severe on the lower extremities; here old and new plaques over a large area; “sabre shin”; humerus right distal porous compacta deposits; ulna left osteitis focus in diaphysis with deposits; spondylosis I–II on the entire spine and ribs; ribs inside rough (healed pleuritis?); radius right well healed fracture to palmar; coxarthrosis I bilaterally; osteoarthritis I ulna left, spondylosis I L5/S1; severe tooth losses resulting in the formation of a “chewing plate”; tooth 14: Caries profunda with apical abscess that also affected tooth 15; teeth 14, 16, 34, 35, 38, 44,

47: advanced periodontitis and hypercementosis.

Anatomical variants: Incisura supraorbitale on both sides; foramen parietale on right side; foramen occipitale at right side, ossicula lambdoidea on right side, foramen extrasuturale at the os mastoideum on the right side; accessory foramen at os zygomaticum right side; multiple foramina nutritia at hand and foot phalanges; shallow acetabula (predisposition to congenital hip dysplasia?); tooth 47: single-rooted; tooth 38: five-cusped.

Individuum No. 237

Articulated skeleton (20 %) of an adult male (?) stretched out probably lying on the back and oriented North-South. His living stature was calculated to 162 cm.

Bone condition: Fragile.

Evidence of disease: Right tibia with periostitic thickening of the surface at diaphysis; tibia left diaphysis only margo anterior and few posterior fragments: especially to distal periostitic changes; both tibiae distorted to the medial side; periostitic plaques on left fibula lateral-proximal.

Anatomical variants: None detected.

Observations: Strong muscle marks on femur.

Individuum No. 238-1

Articulated skeleton (90 %) of a female, aged about 9–10 years, stretched out lying on the left side and oriented approx. South-North. The legs were slightly flexed, the right arm slightly bent backward, hand resting on hip; left arm extended, with hand between thighs. Her living stature could not be determined.

Bone condition: Fragile.

Evidence of disease: Periosteal plaques between os parietale and frontale on the right side; in the area of the eminentia cruciformis (sinus frontalis) signs of chronic meningitis (diameter >5cm) with plaques and vascular impressions; persistent deciduous teeth; generalized mineralization disorders of the teeth (light); teeth 12, 21, 22 with subtle enamel hypoplasia, probably from the 3rd–4th year of life.

Anatomical variants: Foramen parietale on both sides; possibly insufficient space of the anterior teeth in the mandible; tooth 33: marginal ridges; teeth 11, 12, 21, 22: shovel-shaped; teeth 11, 12, 13, 23: Tuberculum dentis; tooth 38: tilted and very high in the ramus (tooth 48 as well?); teeth 16, 26, 65: pitting at Carabelli-spot; tooth 16: four-cusped and three-rooted; teeth 17, 27: four-rooted, hypocone reduction; teeth 37, 47: Lingula enamela, five-cusped, “x”-shaped fissure pattern; teeth 36 und 46: Foramen molare, five-cusped, “y”-shaped fissure pattern.

Observations: Animal gnawing on right ulna; patella on both sides joint surface altered, dimples.

Individuum No. 238-2

Ribs, left scapula (joint), right scapula (crista) of a likely

female adult, probably from a disturbed grave, found mixed with the remains of grave context no. 238.

Individual No. 301-1

Two isolated teeth, probably from a disturbed grave, found scattered in the superficial and highly disturbed layer of excavation unit 3, listed as context 301 (quadrants 8/B and 4/D). The teeth belong to an “early adult”, aged about 21–30 years, whose sex could not be determined.

Evidence of disease: None.

Anatomical variants: Tooth 27: hypoconid, four-cusped; tooth 46: “x”-shaped fissure pattern, four-cusped; tooth 27: hypoconid, four-cusped, 3-rooted.

Individual No. 301-2

Three isolated teeth, probably from a disturbed grave, found in the superficial and highly disturbed layer of excavation unit 3, listed as context 301 (quadrants 5/E and 9/C). The teeth belong to an “adult” (about 21–40 years old), whose sex could not be determined.

Evidence of disease: Dental calculus.

Anatomical variants: tooth 26: metaconule (?), four-cusped.

Individual No. 301-3

Two isolated teeth, probably from a disturbed grave, found in the superficial and highly disturbed layer of excavation unit 3, listed as context 301 (quadrant 5/D). The teeth show a high degree of abrasion (5 to 6) and belong to an individual older than 40 years (“mature+”), whose sex could not be determined.

Evidence of disease: None.

Anatomical variants: Tooth 47 Foramen molare, buccal lingula enamela, four-cusped.

Individuum No. 304

Isolated bone fragments and teeth, likely from a disturbed grave, found displaced in the cultural layer listed as context 304. The remains belong to a 14–20 years old individual whose sex could not be determined.

Bone condition: Fragile.

Evidence of disease: Teeth 27, 28: buccal cementoenamel junction mesial, hyperenamelosis, dentine hypoplasia on radix, formation at an age of 14–16 years, wrinkles.

Anatomical variants: Teeth 27, 28: four-cusped, lingual paracone tubercle.

Individuum No. 308

Isolated bone fragments and teeth, likely from a disturbed grave, found displaced in the cultural layer listed as context 308. The remains belong to a 21–30 years old individual whose sex could not be determined.

Bone condition: Fragile.

Evidence of disease: Tooth 13: Enamel hypoplasia, enamel chipping.

Anatomical variants: Tooth 13: Tuberculum dentale.

Individuum No. 312

Isolated bone fragments and teeth, likely from a disturbed grave, found displaced in the cultural layer listed as context 312. The remains belong to a 14–40 years old individual whose sex could not be determined.

Bone condition: Fragile.

Evidence of disease: Without findings.

Anatomical variants: Tooth 46: Foramen molare, five-cusped.

Individuum No. 506

Articulated skeleton (60 %) of a male (?), aged about 30 (–35) years, buried seated, cross-legged, and facing southwest. His living stature was calculated to 160 cm. Radiocarbon dated to 1041 ± 20 BP (KIA 31859).

Bone condition: Hard-fragile.

Evidence of disease: Spondylarthrosis of thoracic spine only on the left side >scoliosis? Scapula left microtrauma depression in fovea glenoidalis; acetabula very shallow (congenital hypoplasia), arthritic changes. Facies lunata left abnormal >scoliosis? Tooth 17:

Hypercementosis.

Anatomical variants: Dimple-like depressions on phalanx proximalis manus on both sides, especially III–V, cause probably genetic rather than due to stress; tooth 47: Foramen molare; tooth 48: Lingula enamela, tilted approx. 45° to mesial – in consequence abnormal abrasion (barely noticeable).

Individuum No. 910-1

Articulated skeleton (20 %) of a 3–5 years old boy, stretched out lying on left side and oriented South-North.

Bone condition: Firm.

Evidence of disease: Periostitic plaques on left radius and mandible.

Anatomical variants: Teeth 51, 61: shovel-shaped; foramina tympanica (foramen of Huschke) on both sides (possibly present due to age); foramen Vesalius absent on left side; tooth 55: mesial accessory tubercle; teeth 54, 64: metaconule; tooth 63: Tuberculum dentis; tooth 65: Carabelli’s complex, lingual paracone tubercle; teeth 74, 84: accessory cusps.

Individuum No. 910-2

Teeth of a child about 9 months old found in the fill of grave context 910.

Evidence of disease: Without findings.

Anatomical variants: None detected.

Individuum No. 911

Articulated skeleton (10 %) of a girl, aged about 15–18 years, stretched out probably lying on the back, and oriented North-South.

Bone condition: Fragile.

Anatomical variants: Teeth 51, 61, 52, 62: shovel-sha-

ped; teeth 52, 62: tuberculum dentale; teeth 54, 65: mesial paracone tubercle; tooth 11: shovel-shaped; tooth 36: Foramen molare, “y”-shaped fissure pattern; tooth 75: Deflecting wrinkle, “y”-shaped fissure pattern, and foramen molare.

Observations: Sutura metopica closed.

Evidence of disease: Without findings.

Individuum No. 912

Articulated skeleton (80 %) of a female, over 65 years old at death, stretched out lying on the back and oriented North-South. Her living stature could not be calculated. A bone was radiocarbon dated to 1316 ± 27 BP (KIA 38800).

Bone condition: firm-brittle.

Evidence of disease: Evidence of arthrosis I on the ribs; shoulder presents prearthrotic changes on both sides; Spondylose und Spondylarthrose I on cervical vertebrae and thoracic vertebra 1, Spondylarthrose I–II on lumbar vertebrae; Coxarthrosis I bilateral to cranial; osteophytes on the facia auricularis (signs of birth trauma?); diffuse cribra orbitalia; left tibia with periostitic plaques at distal end; first metatarsal right fused with Os cuneiforme medial (congenital or after previous compression fracture); enlarged mandibular fossa on both sides; mandible: Parodontose II–III, maxilla: Parodontose II; teeth: 24, 25: periapical inflammatory process.

Anatomical variants: Phalanx dimples; foramen zygomatofaciale duplex present on both sides; Foramen mastoideum extrasuturale present on right side; Poirier’s facet present on both sides; shallow acetabulum on both sides, expanded cranially – possible sign of congenital hip dysplasia (?); foramen supratrochleare present at left humerus (right unclear); arterial impressions on os frontale on both sides; marginal tubercle present on both sides; teeth 12–21: shovel-shaped, tooth 12: dens invaginatus, teeth 36, 37, 46: Foramen molare.

Observations: Clear marks of the attachments of temporalis muscle, with exostoses; extremely robust extremities, only the muscle marks on the right humerus are rather slight; very massive cervical vertebrae; tooth damage possibly also caused by the use of a labret.

Individuum No. 913

Articulated skeleton (80 %) of a male, aged about 13–14 years, stretched out lying on the back and oriented North-South.

Bone condition: Hard-firm.

Evidence of disease: Without findings.

Anatomical variants: Left ulna with two foramen nutritium; phalanx dimples on both sides.

Observations: relatively strong and robust.

Individuum No. 915

Articulated skeleton (70 %) of a male, aged about 25

(–35) years, stretched out lying on the left side, legs flexed, and oriented North-South. His living stature was calculated to 155 cm.

Bone condition: Brittle.

Evidence of disease: Spondylose II(–III) thoracic vertebrae; chondropathia retropatellaris II on right side.

Anatomical variants: Foramen frontale present on both sides; incisura frontale on right side; phalanx dimples; foramen zygomatofaciale present on both sides; ossiculum sagittale; ossicula lambdoidea present on both sides; tooth 23: Form of a premolar.

Observations: Strong muscle marks on right arm, but still gracile; loss of lower incisivi due to the use of a labret.

Individuum No. 916

Badly preserved articulated skeleton (10 %) of a boy (?), aged about 12–15 months, stretched out lying on the right side. The body was oriented North-South with the face looking to the west.

Bone condition: Fragile.

Evidence of disease: Without findings.

Anatomical variants: Teeth 54, 64: Lingual paracone tubercle; tooth 62: Tuberculum dentale; teeth 52, 62: slightly shovel-shaped.

Individuum No. 917-1

Articulated skeleton (10 %) of a 2 years old child of indetermined sex, stretched out probably lying on the back and oriented South-North. A small piece of ocher (light pink to brown) was found next to the skeletal remains.

Bone condition: Fragile.

Evidence of disease: Cribra orbitalia on both sides; endocranial many slight sproutings; exostosis in the chin region.

Anatomical variants: Foramen zygomatofaciale partitus on left side; tooth 72: shovel-shaped, tuberculum dentale; tooth 65: mesial paracone tubercle, four-cusped, has two roots; tooth 55: four-cusped; tooth 16: four-cusped, mesial paracone tubercle; teeth 75, 85: Foramen molare, five-cusped; tooth 85 has two roots; tooth 74: Distal accessory tubercle, four-cusped, two roots; tooth 84: four-cusped, two roots; tooth 21: shovel-shaped; tooth 22: Tuberculum dentale, tooth 26: mesial paracone tubercle, four-cusped; teeth 36 and 46: five-cusped.

Individuum No. 917-2

A few skull remains (10 %) were separated as context 917-2, which are from an individual of indeterminate sex approximately 3–6 years old.

Bone condition: Fragile.

Evidence of disease: Scarring structures on the ectocranium.

Anatomical variants: None detected.

Individuum No. 918

Fragments of the skull and some loose teeth of a approx. 3–6 months old girl (?). Bones of the postcranial skeleton were missing. The preserved bones had been covered by a ceramic plate (see Jaimes Betancourt 2012: 336, Lám. 161).

Evidence of disease: Without findings.

Anatomical variants: Teeth 55, 65: mesial accessory tubercle; teeth 61, 62: shovel-shaped.

Individuum No. 919

Articulated skeleton (10 %) of a female (?), aged about 7–8 years, stretched out lying on the right side and oriented approx. North-South. Her living stature could not be determined.

Bone condition: Hard-brittle.

Evidence of disease: Tooth 52 malformed.

Anatomical variants: Teeth 75, 85, 46, 36: Foramen molare; tooth 46: PC; tooth 47: “+”-shaped fissure pattern; tooth 27: mesial accessory tubercle; tooth 13: marginal ridges; teeth 11, 21, 22: shovel-shaped; tooth 22: Dens invaginatus.

Individuum No. 921

Articulated skeleton (100 %) of a male, aged about 45–50 years, stretched out lying on the back and oriented North-South. His living stature was calculated to 170 cm. A bone was radiocarbon dated to 1335 ± 26 BP (KIA 38804).

Bone condition: Firm.

Evidence of disease: Patella on both sides with Arthrose II; osteophytes at the tuberosity of the left tibia; diffuse straggly periostitis proximally along margo medialis tibiae and fibulae as well as small exostoses; Gonarthrosis I–II mainly medial; exostoses of right side distal ulna and radius; coxarthrosis I on the right (after impact trauma?); femur distal in the area of the joint capsule with signs of periostitis; left ulna is periostitic in the distal third and has signs of arthrosis I proximal and distal; left femur condyle medialis with fused sequestrum of approx. 11 mm in diameter; severe periodontitis/itis; three inflamed dehiscences and hypercementoses; cribra orbitalia; extensive signs of chronic meningitis (?); rib arthrosis I–II; spondylosis and arthrosis I of thoracic vertebrae; spondylosis and arthrosis II of lumbar vertebrae; omarthrosis I right and erosive defect approx. 4 mm; acromion and clavicle with scarred structures – impingement syndrome?

Anatomical variants: Foramen supratrochleare present on both sides; propensity to osteophyte formation (pelvis); incisura frontalis on both sides; foramen orbitale on left side; foramen zygomaticofaciale partitus on both sides; foramen parietale on right side; foramen mastoideum extrasuturam on both sides; phalanx dimples.

Observations: Noticeably thick compacta, narrow medulla at fibulae, ulnae and humeri; possibly Harris lines; very strong muscle marks (left-handed according

to humeri); stool facet on right side; hint of rider facet on both sides; very robust and strong individual with high physical load, including quick strength; numerous periostitic foci on distal extremities.

Individuum No. 925

Articulated skeleton (100 %) of a male, aged about 25–30 years, stretched out lying on the back and oriented North-South. His living stature was calculated to 166 cm. A bone was radiocarbon dated to 1300 ± 23 BP (KIA 38805).

Bone condition: Firm-fragile.

Evidence of disease: Left radius distal (periostitic?) distension; left tibia lateral with severe scarred changes of surface probably from a healed inflammation; right tibia slight exostoses towards the membrana interossea and periostitic distension of the proximal diaphyseal part; right fibula with stranded accretions; right femur with periostitis at ventral mid-diaphysis; spondylosis I–II at lumbar vertebrae 4–5 and spondylarthrosis I–II at lumbar vertebra 3; signs of a potentially healed inflammation at the pars petrosa of the os temporale; healed cribra orbitalia; severe calculus, periodontitis, hypercementosis.

Anatomical variants: Left femur with marked inward torsion; frontal foramen present on both sides; incisura supratrochleare present on both sides; foramen parietale present on both sides; ossicula lambdoidea present on both sides; teeth 11, 21: shovel-shaped.

Observations: no squatting facets; relatively gracile with few muscle marks, presumably right-handed; narrow spinal canal as a sign of malnutrition (?); post-bregmatic saddle-like concavity possibly caused by a carrying strap.

Individuum No. 926

Articulated skeleton (10 %) of a female (?), aged about 13–15 years, stretched out lying on the back and oriented North-South. Her living stature could not be determined.

Bone condition: Brittle.

Observations: Traces of use in the form of a transverse groove on the back of tooth 21.

Evidence of disease: Teeth 41, 42, 32: punctiform enamel hypoplasia; tooth 21: at least eight hypoplasia lines.

Anatomical variants: Teeth 36, 46, 37, 47: Foramen molare; teeth 11, 21, 12, 22: shovel-shaped.

Individuum No. 927

Articulated skeleton (40 %) of a female, aged about 30–40 years, stretched out lying on the back and oriented South-North. Her living stature could not be determined.

Bone condition: Fragile.

Observations: Very gracile; internal auditory canal on right side rather small; relatively thick cranial bones; very thin or non-existent alveolus at tooth 31 indicates

wearing of a labret.

Evidence of disease: Spondylosis I–II at cervical spine; arthrosis I at right tarsalia, tooth 16: abscess; teeth 17, 18: periodontosis.

Anatomical variants: Phalanx pit; teeth 27(?), 28: single-rooted, tongue-like enamel projection; teeth 37, 47, 48: enamel tongue.

Individuum No. 928

Articulated skeleton (30 %) of a female, aged about 13–17 years, stretched out lying on the left side and oriented approx. South-North. Her living stature could not be determined.

Bone condition: Fragile.

Evidence of disease: Without findings.

Anatomical variants: Foramen supraorbitale on both sides; frontal foramen present on left side; Incisura frontalis present on right side, foramen zygomaticofaciale absent on both sides; tooth 11: slightly shovel-shaped; tooth 12: shovel-shape and dental tubercle; teeth 13, 23: dental tubercle; teeth 16, 26: tongue-like enamel projection; tooth 17: mesial accessory tubercle, Carabelli's complex; teeth 21, 22: almost double shovel-shaped; tooth 27: Hypocone reduction and mesial accessory tubercle; teeth 32, 42: slightly shovel-shaped; tooth 46: "+"-shaped fissure pattern, tongue-like enamel projection; teeth 37, 47: Foramen molare, "+"-shaped fissure pattern, Entoconulid; tooth 36: "+"-shaped fissure pattern.

Individuum No. 931

Articulated skeleton (40 %) of a male (?), aged about 35–45 years, stretched out lying on the right side and oriented approx. North-South. His living stature was calculated to 161 cm.

Bone condition: Fragile-brittle.

Observations: Very pronounced lesser trochanter, strong muscle marks at the base of the gluteus maximus.

Evidence of disease: possible arthrosis I at metacarpophalangeal joint of right thumb; rib arthrosis I; spondylosis I at cervical vertebrae; maxillary periodontosis II.

Anatomical variants: Pronounced torsion of the femur; marginal tubercle present on both sides; tooth 18: single-rooted; teeth 47, 48, 37, 38: reduced size.

Individuum No. 932

Burial of a female (?), aged about 3–4 years, interred in a ceramic vessel.

Evidence of disease: Without findings.

Anatomical variants: Teeth 51, 6:1 not shovel-shaped, tooth 52: slightly shovel-shaped; tooth 64: Distal accessory tubercle, tooth 85: large tuberculum paracone (tooth 46, however, not).

Individuum No. 933

Articulated skeleton (90 %) of a female, aged about

30–40 years, stretched out lying on the back and oriented South-North. Her living stature was calculated to 158 cm.

Bone condition: Brittle.

Evidence of disease: Ribs prearthrotic; caput humeri left slightly sclerotic caudally; spondylosis I–II partly erosive at cervical spine; spondylosis (II–) III at lumbar vertebrae with Schmorl's dimples; severe cribra orbitalia; periostitic plaques at femoral diaphysis left ventrally; osteoarthritis I at calcanei on both sides; phalanx I proximal of the left foot with ossified avulsion at plantar joint edge; osteoarthritis I at temporomandibular joint on the left side; periodontitis; approx. 3 mm alveolar atrophy; hypercementosis.

Anatomical variants: Torus mandibularis; incisura frontalis on both sides; pronounced prognathism and protrusion of the anterior dentition; probably cervical rib at the seventh cervical vertebra; teeth 11, 21: "butterfly" position (perhaps secondary).

Observations: Weak muscle marks on upper extremities; many foveolae granulares; "gestation scars".

Individuum No. 934

Articulated skeleton (10 %) of a female, aged about 4–5 years, stretched out lying on the back and oriented North-South. Her living stature could not be determined.

Bone condition: Fragile.

Evidence of disease: Malformed tooth (possibly 21, 22 or 23 or molar of deciduous teeth ?), with indications of treponemal disease (Hutchinson's teeth); calculus on the right mandible – disturbed chewing function on this side?

Anatomical variants: Tooth 64: paracone tubercle; tooth 11: extreme shovel-shape; tooth 12: almost tubular; tooth 36: PC.

Individuum No. 935

Articulated skeleton (30 %) of a female (?), aged about 30–40 years, stretched out lying on the back and oriented South-North. Her living stature could not be determined.

Bone condition: Fragile.

Evidence of disease: Fenestration at teeth 15, 16, 36, 37, 47.

Anatomical variants: Incisura frontalis on left side, foramen zygomaticofaciale absent on left side; teeth 37, 38, 47, 48: "+"-shaped fissure pattern; teeth 36, 37, 47, 48: Foramen molare; teeth 37, 47, 48: tongue-like enamel projection; teeth 18 or 28: single-rooted.

Observations: Signs of frequent use of a labret: Teeth 32, 42 exist vorhanden, although alveoli are atrophied; teeth 31, 41 ground facets labial at teeth 31/41, and labiomesial at teeth 32/42.

Individuum No. 1001

Articulated skeleton (50 %) of a male, aged about (20–) 30 years, stretched out lying on the back and oriented

North-South. His living stature was calculated to 170 cm. Radiocarbon dated to 1350 ± 20 BP (KIA 31854).

Bone condition: Fragile-brittle.

Evidence of disease: Prearthrotic signs at trochlea of tali on both sides destructive and neoplastic changes at several vertebrae (unknown genesis); caries, periodontitis (entire dentition, 2–4 mm atrophy, pocket formations); enamel hypoplasia; labial grinding facets, possibly signs of bruxism; tooth 36: Enamel blasting.

Anatomical variants: Prognathism; foramen zygomaticofaciale and incisura supraorbitale absent on both sides; rounded inferior margo subnasalis; calcaneus divided joint facies; teeth 11, 21, 12, 22: shovel-shaped; teeth 37, 47: Foramen molare; teeth 13, 23: accessory tubercle; teeth 11, 21: rotated medially; teeth 13, 23: very long roots; teeth 17, 27: three- or four-cusped (hypoconus); teeth 18, 28: three-cusped; tooth 38: five-cusped; teeth 13, 23: Tuberculum dentis; all 3rd molars with central accessory cusp (conus).

Observations: Proc. marginalis left and right sides delta-shaped tip on articular facies of anterior medial part of malleolus tibiae.

Individuum No. 1002

Incomplete skeleton of a male (?) aged older than 16 years. The skeleton was only partially articulated and may have been deposited in a pit after disturbance of the original grave.

Evidence of disease: Without findings.

Anatomical variants: None detected.

Observations: Muscle markings are wide, but not much rough and strong; tibiae distinctly platycnemic.

Individuum No. 1005

Articulated skeleton (100 %) of a male, aged about 30–40 years, stretched out lying on the back and oriented North-South. His living stature was calculated to 166 cm. Radiocarbon dated to 1341 ± 24 BP (KIA 31855).

Bone condition: Firm.

Evidence of disease: Enamel hypoplasia, cribra orbitalia on both sides (1–2, healed), periodontal disease 2 on the maxilla and mandible; exostoses in the os palatinum, pronounced foveolae granularae – up to perforation; tabula interna left parietal healed endostitis (?); joint facies of the mandibular fossa extended anteriorly (chewing habits?); possibly inflammatory change at os zygomatica; microtrauma in glenoid fossa; strong masticatory muscles. Early stage of hyperostosis frontalis interna.

Anatomical variants: Two foramen zygomaticofaciale on left side; foramen condylare present on right side; enlargement of the lingula mandibulae; foramen parietale present on both sides; teeth 38, 48: absent; teeth 33, 43: insufficient space; teeth 12, 22: shovel-shaped; teeth 11 (2x), 12, 21, 13, 23: Tuberculum dentale; teeth 36, 37, 46: Foramen molare; tooth 13: rotated distally; teeth 12, 22: rotated medially; tooth 18: mesial

accessory tubercle, lingual paracone tubercle, protoconus wrinkled.

Observations: Discoloration palatally due to copper object; muscle marks on upper extremities stronger than on lower; presumably right-handedness, but more gracile right humerus; general tendency to osteophytes.

Individuum No. 1102

Articulated skeleton (20 %) of a female, aged about 30–40 years, stretched out lying on the left with legs extremely flexed so the feet are at the pelvis. The orientation was south-north; her living stature could not be determined.

Bone condition: Brittle.

Evidence of disease: Spondylosis II at thoracic vertebrae; spondyloarthrosis III at lumbar vertebrae; tibia left periostitis > 3cm at medial surface with depressions and thickening; chondropathia retropatellaris II on both sides.

Anatomical variants: frontal foramen present on right side; phalanx dimples (?).

Observations: Compacta of upper extremities very thick; very gracile proximal phalanges of hands; slight muscle marks on legs.

Individuum No. 1103

Articulated skeleton (10 %) of a male, over 40 years old at death, stretched out lying on the left side and oriented approx. S-N. His living stature could not be determined.

Bone condition: Brittle.

Evidence of disease: Spondylosis I at thoracic vertebrae; spondylosis II at lumbar vertebrae; rib arthrosis I; erosive spondylarthrosis I lumbar vertebrae.

Observations: Strong rough muscle marks on femur proximally; extremely robust bones (prox. clavicle end over 25 mm in diameter); loss of lower incisivi due to frequent use of a labret.

Individuum No. 1115

Articulated skeleton (20 %) of a male (?); some measurements indicate rather a woman, aged about 25–30 years, stretched out lying on the back and oriented South-North. His living stature could not be determined.

Bone condition: Brittle.

Evidence of disease: Left tibia with wide-spread severe periostitis and osteitis.

Anatomical variants: Phalanx dimples; foramen parietale present on both sides.

Observations: Loss of lower incisivi due to the use of a labret.

Individuum No. 1121

Articulated skeleton (40 %) of a female, aged about 25–35 years, stretched out lying on the back and

oriented South-North. Her living stature could not be determined.

Bone condition: Firm-fragile.

Evidence of disease: Caries, periodontal disease, extreme calculus, hypercementosis, granuloma below teeth 46 and 47 (sparing of this side resulted in less abrasion and more calculus), destructive periodontitis above teeth 15, 16, 25, 26; upper and lower incisivi polished by labret on entire front including root, lower alveoli absorbed from frontal.

Anatomical variants: Foramen zygomaticomaxillare on both sides; incisura frontalis left (right side unclear); teeth 11, 21, 22: shovel-shaped; tooth 38: enamel pearl; teeth 17, 28: single-rooted; teeth 17, 27: Hypocone reduction; tooth 37: five-cusped, single-rooted; tooth 38: single-rooted, 38: Paramolar complex, teeth 36, 37, 38, 46, 48: Foramen molare; tooth 24: distal rotation; teeth 24, 26(27): insufficient space.

Observations: Gracile to very gracile, minor muscle marks (slight roughness), close to loss of lower incisivi due to the habit of wearing a labret.

Individuum No. 1127

Articulated skeleton (40 %) of a male, probably aged over 40 years, stretched out lying on the back and oriented North-South. His living stature was calculated to 167 cm.

Bone condition: Fragile-brittle.

Evidence of disease: Periodontosis, periodontitis, calculus.

Anatomical variants: Teeth 11, 21, 22: shovel-shaped.

Observations: very strong muscle marks on mandible, overall very robust skull, strongly protruding nasal bone, squatting facet on right side

Individuum No. 1154

Articulated skeleton (30 %) of a female, aged about 25–30 years, stretched out lying on the back and oriented North-South. Her living stature was calculated to 167 cm.

Bone condition: Fragile-brittle.

Evidence of disease: Collum femoris with irregular excrescences approx. 15 mm in diameter; erosive coxarthrosis I on the left; arthrosis II of the rib joints; cribra orbitalia; caries; tooth loss; hypercementosis; massive calculus.

Anatomical variants: Two foramen nutrititia right humerus; phalangeal dimples (5 of 5 present); margin of apertura piriformis obliterated; marked prognathism / protrusion and very large teeth; foramen zygomaticomaxillare multiplex left; teeth 11, 21: shovel-shaped and dens invaginatus, tooth 36: “+”-shaped fissure pattern.

Observations: Rather gracile, very few muscle marks; proximal tibial epiphysis on the right with a clear line of a growth stop, squatting facet on the right, extreme muscle marks on mandible.

Individuum No. 1208

Articulated skeleton (100 %) of a female, aged about 20–25 years, hyper-flexed into a fetal position, buried face down and oriented north-south. Her living stature was calculated to 154 cm. A bone was radiocarbon dated to 596 ± 22 BP (KIA 38806).

Bone condition: Firm.

Evidence of disease: Cribra in the area of the parietalia and around lambda area; cribra orbitalia; very evident enamel hypoplasia; spondylosis I on cervical vertebrae 3–5.

Anatomical variants: Os lambdae quadripartitus; foramen parietale on right side (left side unclear), ossiculum incisurae parietalis on the right side, incisura frontalis present on both sides; frontal foramen present on left side; foramen zygomaticomaxillare multiplex on left side and simplex on right side; foramen supratrochleare present on right side; clear protrusion of the teeth; teeth 11, 21: slight butterfly position; tooth 28: developmental absence; anterior teeth in the mandible with insufficient space.

Observations: Muscle marks of temporalis muscle at origin very strong; very deep fovea mandibularis; very gracile arm bones; “gestation scars”; Poirier’s Facet.

Individuum No. 1209

Articulated skeleton (40 %) of a male (?), aged about 35–45 years, lying on his right side with the legs flexed. The body was oriented approx. N-S and the face was oriented towards the West. His living stature was calculated to 163 cm.

Bone condition: Fragile.

Evidence of disease: Calcaneus right side arthritis I; metatarsophalangeal joints I on left side and I–II on right side with arthrosis I–II; spondylose I at cervical vertebrae and possibly thoracic vertebrae; rib osteoarthritis I; maxillary and mandibular periodontosis I; severe porosity on the skull, especially in the sagittal sutura region, and thickening of the bone and, in some cases, crater-like depressions or “cuts”; tooth 36: periapical process (dehiscence).

Anatomical variants: Dimples at phalanges II–IV, very pronounced trochanter minor; trochanter tertius present on right side; marginal tubercle present on both sides; foramen zygomaticofaciale absent on both sides; foramen parietale present on left side; frontal foramen present on both sides; teeth 18, 28: single-rooted, size reduction and hypocone reduction; teeth 13, 23: Tuberculum dentis; teeth 11, 22: shovel-shaped; teeth 38, 48: size reduction; tooth 47: “x”-shaped fissure pattern; teeth 46, 47, 48, 36, 37: Foramen molare; teeth 46, 48: lingula enamela.

Observations: Strong muscle marks on humerus, especially right, ulna and legs.

Individuum No. 1210

Articulated skeleton (70 %) of a girl barely a month old, probably lying on her left side with the legs flexed.

The body was oriented approx. West-East with the face oriented towards the South.

Bone condition: Brittle.

Evidence of disease: Without findings.

Anatomical variants: Phalanx dimples.

Individuum No. 1211a

Articulated skeleton (20 %) of a female, aged about 5–6 years, buried seated, cross-legged, and facing north-northwest in a very narrow grave pit.

Bone condition: Fragile.

Evidence of disease: Without findings.

Anatomical variants: Teeth 74, 84, 36, 46, 47: foramen molare; all lower molars: “+”-shaped fissure pattern; tooth 13: surplus formation or canine-shaped 14; teeth 16, 17: Distal accessory tubercle. Upper Canini one to three tuberculae dentalia and marginal ridges; teeth 11, 21: shovel-shaped.

Individuum No. 1211b

Isolated bone fragments of a 45–55 years old male, likely from a disturbed grave, found next to the articulated skeleton of context 1211.

Bone condition: Fragile.

Evidence of disease: Spondylarthritis I und spondylose II–III.

Anatomical variants: None detected.

Observations: strong muscle marks on clavicles.

Individuum No. 1212a

Articulated skeleton (20 %) of a female (?), aged about 12–18 months, buried seated, cross-legged, and facing north in a very narrow grave pit.

Bone condition: Firm.

Evidence of disease: Vertebrae (thoracic vertebrae ?) incompletely developed around pea-sized cystic cavity; marked cribra orbitalia.

Anatomical variants: Teeth 55, 65 and 53: Lingual paracone tubercle; tooth 84: Tuberculum Citroen; teeth 53, 63: marginal ridges.

Individuum No. 1212b

Isolated bone fragments likely from a disturbed grave found next to the articulated skeleton of context 1212. The remains belong to a 6–12 months old child whose sex could not be determined.

Bone condition: Fragile.

Evidence of disease: Without findings.

Anatomical variants: None detected.

Individuum No. 1213-1

Articulated skeleton (50 %) of a male, aged about 4 years, buried seated, cross-legged, and facing north.

Bone condition: Brittle.

Evidence of disease: Ectocranial orbita on left side: very scar-like and porous.

Anatomical variants: Marginal tubercle present on both sides; foramen zygomaticofaciale absent on both sides; teeth 11, 12: shovel-shaped; teeth 16, 26: four-cusped, metaconule; teeth 36, 46: Foramen molare, deflecting wrinkle, five-cusped, “y”-shaped fissure pattern; tooth 55: four-cusped, two roots; tooth 54: metaconule, three-rooted; tooth 53: Tuberculum dentale, mesial paracone tubercle, four-cusped, three-rooted; teeth 73, 83: shovel-shaped; tooth 85: Foramen molare, five-cusped, “x”-shaped fissure pattern, two roots; tooth 84: four-cusped, two roots; tooth 74: five-cusped, two roots; tooth 75: Foramen molare, five-cusped, “y”-shaped fissure pattern.

Individuum No. 1213-2

A single tooth, belonging to an adult individual of indetermined sex, recovered along with the skeletal remains of individual 1213-1.

Evidence of disease: Tooth 15 without calculus, abrasion 3.

Anatomical variants: None detected.

Individuum No. 1214

Articulated skeleton (10 %) of a 2 years old child whose sex could not be determined, buried seated, cross-legged, and facing northwest in a very narrow grave pit.

Bone condition: Brittle.

Evidence of disease: Ribs dorsal, and less pronounced also ventral, with sprouting; tooth 73: Localized hypoplasia of primary canine teeth (LHPC).

Anatomical variants: Foramen Huschke on right side (age appropriate); tooth 16: mesial paracone tubercle, mesial accessory tubercle, Carabelli's complex; tooth 26: mesial paracone tubercle, Carabelli's complex; teeth 11, 21: shovel-shaped; tooth 46: Entoconulid; tooth 36: Entoconulid, deflecting wrinkle, Foramen molare; teeth 55, 65: metaconule, mesial paracone tubercle, Carabelli's complex; tooth 85: Foramen molare, deflecting wrinkle, Entoconulid, Citroen Komplex, tuberculum intermedium; tooth 75: Para-molare Komplex; tooth 63: Tuberculum dentis, dens invaginatus; tooth 53: Tuberculum dentis.

Individuum No. 1215

Burial of an individual of indetermined sex, aged about 4–5 years, interred in a ceramic vessel. Completeness: 10 %.

Bone condition: Fragile.

Evidence of disease: Numerous fine enamel hypoplasia on permanent teeth.

Anatomical variants: Teeth 11, 21, 12, 22, 51, 61: shovel-shaped; teeth 75, 85: Foramen molare.

Individuum No. 1216

Burial of an individual of indetermined sex, aged about 18–24 months, interred in a ceramic vessel. Completeness: 10 %.

Bone condition: Fragile-brittle.

Evidence of disease: Without findings.

Anatomical variants: Teeth 55, 65: Mesial accessory tubercle; tooth 52: shovel-shaped (teeth 51 and 62, however, are not.).

Individuum No. 1217

Articulated skeleton (80 %) of a 9 ½ lunar months old boy (?), stretched out lying on the left side, oriented west-east with the face looking north.

Bone condition: Firm.

Evidence of disease: Without findings.

Anatomical variants: None detected.

Individuum No. 1218

Articulated skeleton (10 %) of a neonatus (0 months), possibly stretched out lying on the right side, oriented west-east. The head is missing, but judging by the position of the body, he was lying facing south.

Bone condition: Fragile.

Evidence of disease: Without findings.

Anatomical variants: None detected.

Individuum No. 1219

Articulated skeleton (60 %) of a female, aged about 45–50 years. Her living stature was calculated to 149 cm. She was buried stretched out lying on the back with the legs flexed so that the knees were at the level of the thorax and the feet close to the pelvis. The burial was oriented North-South, the head was tilted to the left side facing west. A bone was radiocarbon dated to 947 ± 21 BP (KIA 38807).

Bone condition: Firm.

Evidence of disease: Extreme caries with large apical granuloma; hypercementosis, extensive tooth loss; tibia right medial condyle possibly erosive arthritis/rheumatism; gonarthrosis I on right side; severe chondropathia retropatellaris with erosive defects; cloudy postinfectious scarring and cribrous traces in the vertex area; severe cribra orbitalia; thickening of the tabula interna of the parietale on the right with sharp deepening of the venous network and partially healed inflammatory plaques along the sutura sagittalis (meningitis?); spondylosis I cervical vertebrae 1–3; rib arthrosis I; spondylarthrosis I–II lumbar vertebrae.

Anatomical variants: Significant femoral torsion on the right side, foramen parietale present on left side; frontal foramen present on both sides; incisura frontalis on left side (right unclear); foramen occipitale, numerous ossicula lambdoidea; foramen supratrochleare present bilateral.

Observations: Generally rather moderately strong, slight muscle marks; extremely gracile upper extremities with pronounced muscle marks on humerus and hand.

Individuum No. 1220

Articulated skeleton (30 %) of a male, aged about 12 (–18) months, stretched out lying on the left side with

legs extended but bent at 90 degrees from the axis of the upper body. The torso was oriented south-north, the head to the south and facing west.

Bone condition: Firm.

Evidence of disease: Possibly cribra orbitalia on left side; porosity at endocranium.

Anatomical variants: Tooth 64: tuberculum paramolare; teeth 52, 61: shovel-shaped.

Individuum No. 1221

Small group of bones that may have been articulated, but this could not be clearly determined due to their poor state of preservation. They belong to a newborn (0 months) of indeterminate sex that was buried only a few centimeters west of grave 1219, next to the right shoulder of the woman buried there.

Bone condition: Fragile.

Evidence of disease: Without findings.

Anatomical variants: None detected.

Individuum No. 1222

Burial of a female, aged about 9–12 months, interred in a ceramic vessel. Completeness: 50 %.

Bone condition: Firm.

Evidence of disease: Periostitic plaques on the medial surface of the right tibia and fibula.

Anatomical variants: Teeth 71, 72: marginal ridges; teeth 53, 73: Tuberculum dentale; teeth 51, 62: marginal ridges and tuberculum dentale; teeth 55, 65: mesial accessory tubercle.

Observations: Teeth not erupted.

Individuum No. 2001

Two long bones of an adult female (10 %) torn out of the southern profile of excavation unit 2 by unsolicited visitors during the night.

Bone condition: Hard.

Evidence of disease: Femur and tibia healed periostitis; right femur distal condyle arthritis I.

Anatomical variants: None detected.

Observations: minor muscle marks.

Individuum No. 2038

Single tooth of an approx. 1-year-old individual found displaced in the cultural layer listed as context 2038.

Anatomical variants: tooth 63: Tuberculum dentis.

Observations: Tooth not erupted.

Individuum No. 2049

Articulated skeleton (20 %) of a female (?), aged about 6 months, stretched out lying on the back and oriented North-South.

Bone condition: Firm-fragile.

Evidence of disease: Slight cribra at os occipitale, calotte otherwise without findings; pars petrosa slightly cribrous surface on both sides, as well as humeri and

radii.

Anatomical variants: Teeth 55, 65: mesial accessory tubercle; tooth 53: marginal ridges (no pronounced shovel-shape); tooth 51: shovel-shaped.

Observations: Teeth not erupted.

Individuum No. 2053

Articulated skeleton (10 %) of an approximately 12-month-old child whose sex could not be determined. It was completely covered with a ceramic plate and was recovered with it in one block.

Bone condition: Fragile.

Evidence of disease: Pars petrosa massively thickened and modified on both sides with spherical “spiky” thickenings on the inner side (due to neurinoma of the auditory nerve ?); tabula interna with coarse-grained plaques, not typical for anemia.

Anatomical variants: Foramen Huschke (age typical); incisivi not shovel-shaped.

Observations: Teeth not erupted.

Individuum No. 2059

Articulated skeleton (70 %) of a female (?), aged about 40–50 years, stretched out lying on the back and oriented South-North. Her living stature was calculated to 153 cm. A bone was radiocarbon dated to 1224 ± 24 BP (KIA 38808).

Bone condition: Firm.

Evidence of disease: Os naviculare left with arthrosis I; left metacarpophalangeal joints show stress facets and arthrosis I; left ulna with strong crista; periostotic plaques present at distal end of the diaphysis of left tibia, right femur and right humerus; right patella with incarcerated sequestra and defects; caput femoris right with arthrotic seams; spondylosis I at cervical vertebrae 3–4; spondylosis I (–II) on thoracic and lumbar vertebrae; Rib arthrosis I–II; pre-arthritis seams on the right elbow joint; coxarthrosis I–II on right side; irritations in the auricular facies; traces of healed meningitis in the vertex area; calcifications on right tibia; margo anterior with signs of periostitis or hematoma; cervical vertebrae with spondylosis II, atlas-axis show collapses in the apophysial joints; cribra orbitalia; fossa mandibularis on both sides; mandibular condyle on both sides with arthrosis I–II; possibly healed depression fracture on the *condylus occipitalis*; caries, calculus, parodontosis, hypercementosis; tooth 14: Granuloma, open pulp chamber; „Old man’s mandible“ (mandible with complete tooth loss).

Anatomical variants: Phalanx proximalis I of the left foot with joint facet dorsally; left femur with Poirier facet; no foramen vesalius right and left; foramen Huschke present on both sides; marginal tubercle present on right side; canalis hypoglossi present twice on the right side; foramen zygomaticofaciale duplex on right side; tooth 28: monoradicular and reduced size; tooth 26: Hypocone reduction.

Observations: gracile forearm bones, small vertebral

bodies, squatting facet on the right side, unusual chewing pattern of the teeth, very narrow and long but strong hand bones, low joint wear, probably generalized periostitic plaques.

Individuum No. 2063

Articulated skeleton (50 %) of a girl, aged about 10 months, stretched out lying on the back and oriented South-North. Her living stature could not be determined.

Bone condition: Firm.

Evidence of disease: Without findings.

Anatomical variants: Foramen condylare present on left side; foramen supraorbitalis / incisura supraorbitale absent on right side; no foramen parietale; teeth 51, 52, 61, 62: shovel-shaped; teeth 53, 63 additional cusp palatal; teeth 55, 65: mesial accessory tubercle; teeth 74, 84: Deflecting wrinkle.

Individuum No. 2066

Articulated skeleton (40 %) of a boy (?), aged about 6–7 months, stretched out lying on the back and oriented North-South. His living stature could not be determined.

Bone condition: Firm-fragile.

Evidence of disease: Without findings.

Anatomical variants: Two foramen nutritia at fibula on left side; foramen condylare present on both sides; shovel-shaped incisivi; teeth 55, 65: cusp of Carabelli; tooth 63: Tuberculum dentale; teeth 55, 65: Mesial paracone tubercle, mesial accessory tubercle; teeth 71 and 72 are grown together, especially at the roots.

Observations: Teeth not erupted.

Individuum No. 2067

Articulated skeleton (20 %) of a female (?) less than 1 month old stretched out lying on the left side with the head towards the north. The tomb was disturbed and neither the hip nor the lower extremities were preserved.

Bone condition: Fragile.

Observations: Ribs and vertebrae partially sintered; only *musculus acusticus internus* available for sex determination.

Evidence of disease: Series of rib fractures on left and right sides, some incomplete in several fragments, suggestive of perimortem fractures; fine sieve-like perforations on tabula interna and externa, especially near sutures; orbital roof on left side with 4 x 7 mm fenestration.

Anatomical variants: Foramen condylare present on right side; foramen Vesalius present on left side; proc. marginalis os zygomaticum present on both sides; shovel-shaped incisivi.

Observations: Teeth not erupted.

Individuum No. 2102

Burial of a male, aged about 40–60 years, interred in a ceramic vessel.

Evidence of disease: Arthrosis I of the finger phalanges; exostoses on the linea aspera.

Anatomical variants: Teeth 46, 47: Foramen molaria.

Observations: strikingly large and robust.

Individuum No. 2103

Articulated skeleton (30 %) of a male, aged about 35–45 years, stretched out lying on his left side, oriented West-East. His living stature was calculated to 146 cm. A bone was radiocarbon dated to 932 ± 22 BP (KIA 38809).

Bone condition: Fragile.

Evidence of disease: Healed cribra orbitalia, periodontosis of the front teeth, apical granuloma on tooth 36.

Anatomical variants: Foramen supratrochleare present at left humerus; Incisura frontalis present on both sides; foramen zygomaticomaxillare duplex present on both sides; ossicula lambdoidea present on both sides; foramen parietale on left side; teeth 11, 12, 21, 22: shovel-shaped.

Observations: Weak muscle marks on humerus; very gracile; strongly protruding nasal bone, post-bregmatic saddle-like concavity.

Individuum No. 2104

Articulated skeleton (20 %) of a male (?), aged about 40–50 years, stretched out lying on his left side, oriented East-West, facing South. His living stature was calculated to 165 cm.

Bone condition: Hard-fragile.

Evidence of disease: Cervical vertebra CV 7 shows fused sequestrum at right articulation intervertebralis; cervical vertebra CV 4 with apophyseal fused sequestra (osteochondrosis dissecans, possibly traumatic); fused sequestrum on humerus right at condylus medialis; right humerus possibly periostitic plaques below the proximal epiphysis medially; rib arthrosis II; spondylosis I–II of lumbar vertebrae and thoracic vertebrae, spondyloarthroses I–II mainly on left side; spondylosis I–II at cervical vertebrae 2–5, especially on the left side.

Anatomical variants: Double foramen under the coracoid process; hypoglossal canal double on right side; foramen Huschke on both sides; foramen parietale on both sides; ossicula lambdoidea on both sides; foramen supraorbitale on both sides; incisura frontalis on both sides; ponticulus mylohyoideus on both sides; marginal tubercle on both sides; foramen zygomaticofaciale duplex present on both sides.

Observations: Gracile, but strong muscle marks and relief especially on the left side – left-handed (?); clavicle with rough relief.

Individuum No. 2128

The feet of an over 40 years old female (?) buried to

the south of excavation unit 2 that extended into the excavated area.

Bone condition: Firm.

Evidence of disease: Tarsalia bilaterally (especially left) prearthrotic to arthrosis I; metatarsalia proximal arthrosis I–II, partly rheumatic with erosive defects and eburnisation.

Anatomical variants: None detected.

Individuum No. 4028

Articulated skeleton (50 %) of a male, aged about 25–30 years, stretched out lying on the back and oriented North-South. His living stature could not be determined.

Bone condition: Firm.

Evidence of disease: Marked cribra orbitalia; pronounced hypervascularization 6x7 cm at tabula externa os parietale left side (to a lesser degree also right side); rib joint arthrosis I; mild periodontitis; arthrosis I of some rib joints; mild periodontitis; enamel hypoplasia.

Anatomical variants: Very shallow acetabula (congenital hip dysplasia) with vertical ovalization of the acetabulum; phalanx dimples; os lambdae and ossicula lambdoidea; foramen parietale present on both sides; foramen supratrochleare present on both sides; foramen frontale present on both sides; teeth 37, 38: EL; teeth 36, 37: Foramina molaria; tooth 36: Lingual paracone tubercle; tooth 33: marginal ridges; tooth 38: five-cusped.

Observations: Strong muscle marks at humeri, especially right; ulnae proximal end very massive and robust.

Individuum No. 4096

Articulated skeleton (100 %) of a male, aged about 25–30 years, lying on the right side with the legs tightly flexed and the head to the south facing east. His living stature was calculated to 157 cm. A bone was radiocarbon dated to 1007 ± 22 BP (KIA 38810).

Bone condition: Firm.

Evidence of disease: Cribra orbitalia; spondylosis III at lumbar vertebra 4 to sacral vertebra 1; disc prolapse lumbar vertebra 5 / sacral vertebra 1; spondyloarthrosis II at lumbar vertebra 5; cover plate erosions and depressions mainly at lumbar vertebrae; osteophytes mainly right side; clavicles towards sternum arthrotic, periostitic plaques; gonarthrosis I on the right side; posterior patella indicates improper biomechanical load; significant shaft curvature tibia on the left side (proximal part to lateral); erosive metacarpal IV possibly a well-healed fracture; light enamel hypoplasia; most severe caries; periodontal disease with approx. 4 mm alveolar reduction; apical granuloma on tooth 16.

Anatomical variants: Lumbalisation of S1; tuberculum zygomaticum present on both sides; foramen zygomaticum multiplex on right side; sutura squamosa present on both sides; foramen infraorbitale present on both sides; incisura supraorbitale present

on both sides; frontal foramen present on both sides; foramen parietale present on right side; ossicula lambdoidea present on both sides; foramen condylaris present on left side (right side not assessable); teeth 11, 21: Butterfly position; teeth 36, 46, 47: Foramen molare.

Observations: Judging by the osteophytes on the vertebrae, a right-hander; rather gracile, muscle marks on arms rather slight, only rotators of the ulnae strong and humerus moderate on the right; slight stool facet (rather medial).

Individuum No. 4098

Articulated skeleton (90 %) of a male, aged over 60 years, stretched out lying on the back and oriented North-South. His living stature was calculated to 171 cm. Radiocarbon dated to 1156 ± 25 BP (KIA 31858).

Bone condition: Firm.

Evidence of disease: Discus prolapse in vertebral canal (thoracic vertebra); marginal sclerosis of the fossa glenoidalis scapulae and the epicondylus lateralis humeri on the left side; distension of the left radius diaphysis and periostotic signs caused by unclear infectious process that has spread to the ulna; severe periodontitis (up to 7 mm atrophy) with pocket formation; thick calculus; spondylosis II–III mainly lumbar vertebrae; spondyloarthrosis I; gonarthrosis I on left side with 27x10 mm rough area on condyle lateralis due to fused cartilage debris (?); remains of a calcified hematoma on left tibia and metatarsus III left; arthrosis I–II on tibia left distal; arthrosis I on patella right and fibula right distal; coxarthrosis I on right side; spondylosis I lumbar and thoracic vertebrae; enamel hypoplasia (crises in 2nd and 3rd year of life); severe interdental attrition; caries and tooth loss, deformation of mandibular front to oral due to use of a labret).

Anatomical variants: Foramen supraorbitale present on right side; incisura supraorbitale present on left side; phalanx dimples on left and right index finger; persisting sutura mendosa; foramen parietale present only on left side; os zygomaticum present on left side; two foramen zygomaticofaciale present on right side; condylus occipitalis bipartitus on right side; teeth 36, 46: foramen molare, five-cusped; tooth 43: tuberculum dentis; tooth 27: four-cusped and three-rooted; teeth 11, 21: barely shovel-shaped; tooth 11: enamel fold lateral; teeth 11, 21: duplicate tuberculum dentis; tooth 16: four-cusped and three-rooted; tooth 48: five-cusped and single-rooted; teeth: 47, 46, 36, 37: five-cusped, two-rooted; tooth 17: Distal accessory tubercle.

Observations: Rather robust; heavy signs of load especially on right side (also intercostal muscles); muscle marks at attachment of deltoid muscle stringy, possibly as a result of microtrauma due to throwing (?); strong rough muscle marks on proximal parts of femur; minor stool facet on right side; muscle marks weak on tibia, but extremely strong on pelvis.

Individuum No. 4099

Articulated skeleton (90 %) of a male, aged about 50–60 years, stretched out lying on the back and oriented North-South. His living stature was calculated to 167 cm.

Bone condition: Firm-fragile.

Evidence of disease: Osteoma 4 mm in diameter on right os parietale; thickening and upheaval in sagittal region of parietalia and healed signs of inflammation possibly caused by pathological shortening of skull due to premature suture closure (?); spondyloarthrosis I at lumbar vertebrae; spondylosis II–III at lumbar vertebrae; spondylosis I at cervical vertebrae and thoracic vertebrae; gonarthrosis I on right side; bone spur at metatarsus II right proximal with secondary articular surface to metatarsus I; extreme caries; general hypercementosis; teeth 32–35: insufficient space.

Anatomical variants: Acetabula very shallow, extended vertically (congenital hip joint dysplasia?); phalanx dimples on six of eight proximal finger phalanges; ossicula lambdoidea on left side; foramen parietale present on left side; tuberculum zygomaxillare present on right side (left side unclear), frontal foramen and supratrochleare present on right side; frontal foramen present on left side; incisura supratrochleare present on right side; Poirier's facet observed on both femoral bones.

Observations: Muscle marks on humeri strong, right humerus more robust; very strong muscle marks on ulna.

Individuum No. 4171

Articulated skeleton (20 %) of a child less than one month old of which the sex could not be determined. It was stretched out probably lying on the back and oriented North-South.

Bone condition: Firm-fragile.

Evidence of disease: Spongy-porous plaques on tabula interna of os frontale, most likely signs of extensive severe periostitis.

Anatomical variants: Tooth 62: shovel-shaped; tooth 74: deflecting wrinkle (?); tooth 54: mesial accessory tubercle, distal accessory tubercle.

Observations: Teeth not erupted.

Individuum No. 4195a

Articulated skeleton (10 %) of a female (?), aged about 18 years, stretched out lying in prone position and oriented North-South. Her living stature could not be determined. The burial had been disturbed most probably when the pits for the neighbouring graves had been dug. Large parts of the torso and the right arm are missing; isolated remains of tarsalia (?), pelvis (?) and femur.

Bone condition: Fragile-brittle.

Evidence of disease: Without findings.

Anatomical variants: Tooth 18: two-rooted; tooth 28: single-rooted; teeth 18, 28: reduced size; tooth 17:

hypocone reduction; tooth 28: tongue-like enamel projection; teeth 13, 23: tuberculum dentis; tooth 11: slightly shovel-shaped; tooth 48: three-cusped and reduced size; teeth 37, 47: "+"-shaped fissure pattern; teeth 36, 37, 46, 47: Foramen molare.

Individuum No. 4195b

Isolated bone fragments, apparently from a disturbed grave, found among the bones of tomb 1495. They belong to a 2–3 years old individual whose sex could not be determined.

Bone condition: Fragile.

Evidence of disease: Without findings.

Anatomical variants: None detected.

Individuum No. 4200

Articulated skeleton (30 %) of a male, aged about 40–50 years, stretched out lying on the back and oriented North-South. His living stature could not be determined.

Bone condition: Fragile-brittle.

Evidence of disease: Without findings.

Anatomical variants: Frontal foramen on right side; tooth 48: "+"-shaped fissure pattern.

Observations: Weak muscle marks on humeri; very robust cranial bones.

Individuum No. 4201a

Articulated skeleton (20 %) of a male (?), aged about 10–14 years, stretched out lying on the left side with the legs flexed. The corpse was oriented North-South, face looking to the east.

Bone condition: Fragile.

Evidence of disease: Without findings.

Anatomical variants: Incisura frontale on right side (possibly on the left as well); teeth 36, 37, 46, 47: Foramen molare; tooth 21: shovel-shaped and dens invagination; teeth 36, 37, 46: "+"-shaped fissure pattern; tooth 47: "x"-shaped fissure pattern; tooth 43: marginal ridges; tooth 24: Central accessory cusp.

Individuum No. 4201b

Isolated bone fragments of a 3–6 years old female, apparently from a disturbed grave, found among the bones of tomb 4201.

Bone condition: Brittle.

Evidence of disease: Without findings.

Anatomical variants: None detected.

Individuum No. 4202

Articulated skeleton (50 %) of a male, aged about 25–30 years, stretched out lying on the back and oriented North-South. His living stature was calculated to 161 cm.

Bone condition: Firm.

Evidence of disease: Remains of cribra orbitalia; caries; periodontitis; granulomas on teeth 18 and 28 with

fistula in maxillary sinus.

Anatomical variants: Foramen supratrochleare present at right humerus; phalanx dimples; os apicis lambdadae; ossicula lambdoidea; incisura frontale only on right side; foramen occipitale; tooth 48: Tuberculum paracone.

Observations: Gracile, very weak muscle marks; bulging pilasters on proximal femoral diaphyses due to specific loading (?); labret-polish on lower incisi.

Individuum No. 4203

Articulated skeleton (20 %) of a female (?), aged about 35–45 years, stretched out lying on the back and oriented South-North. Her living stature could not be determined.

Bone condition: Firm-fragile.

Evidence of disease: Periodontal disease (approx. 4 mm alveolar atrophy), generalized enamel disturbance due to critical phases between the 3rd to 7th year of life.

Anatomical variants: Ossicula lambdoidea.

Observations: Remarkably large interorbital distance (22 mm); face resembles that of individual 1001; lower incisi displaced orally, probably due to the use of a labret.

Individuum No. 4208

Articulated skeleton (10 %) of a male (?) adult (a more precise estimate of age was impossible), stretched out lying on the back and oriented North-South. His living stature was calculated to 161 cm.

Bone condition: Brittle.

Evidence of disease: Minor striated periostitis remnants on tibia; spondylosis I on vertebral fragment.

Anatomical variants: None detected.

Individuum No. 4209

Articulated skeleton (100 %) of a male, aged about 45–50 years, lying face down with the hyperflexed legs underneath his body. The body axis was oriented north-south with the head to the south. His living stature was calculated to 161 cm. A bone was radiocarbon dated to 740 ± 23 BP (KIA 38811).

Bone condition: Fragile.

Evidence of disease: On the right femur, the distal half of the diaphysis shows a 60x15 mm bulging medially, with a smooth surface and transverse vascular impressions – possibly a tumor in the medullary canal or compacta(?); gonarthrosis I on right side; spondylosis III with ankyloses at lumbar vertebrae; spondylarthrosis I of thoracic and cervical vertebrae; spondylosis I of cervical vertebrae; scarred facies auricularis; spondylosis I–II at promontory; calcified pedicle of a cyst or polyp in left maxillary sinus; traces of chronic sinusitis; cloudy thickening due to healed inflammatory process in sagittal sutura; hypercementosis.

Anatomical variants: Poirier's facet observed on left femur; phalanx dimples; very slight retraction of the fossa canina; frontal foramen present on both sides; foramen zygomaticofaciale present on both sides; Foramen mastoideum extrasuturale present on right side; slight protrusion of the teeth; tooth 37: Foramen molare, enamel pearls, radix paramolaris.

Observations: Load axis of spine probably rather left (left-handed individual ?); strong muscle marks on femora, otherwise rather gracile; left radius conspicuously curved; strong muscle marks on planum nuchae and clavicalae.

Individuum No. 5001

Tibia of a matur (+) male from unknown context of excavation unit 5.

Bone condition: Hard.

Evidence of disease: Tibia with endosteal deposits or calcifications, possibly indicating advanced age of the individual.

Anatomical variants: None detected.

Observations: Strong muscle marks.

Individuum No. 6005

Articulated skeleton (60 %) of a female, aged about 40–50 years, lying on the right side with the legs hyperflexed so that the knees are right at the chin and the feet are at the pelvis. The body axis was oriented east-west, head lying to the east and facing north. Her living stature could not be determined. A bone was radiocarbon dated to 1223 ± 26 BP (KIA 38812).

Bone condition: Brittle.

Evidence of disease: Caput femoris left and os naviculare left with sieve-like perforations, possibly signs of arthritis; left ulna in fossa supinatoria severe enthesopathy (“dimples”), also the left femur with enthesiopathies; fragment of acetabulum left with arthritic perforations and plaques; mandibular fossa bilaterally arthritic (old man's jaw due to loss of teeth); mastoiditis right (and possibly left): cavity with spicules; healed traces of infection (overlays) along sagittal suture with sprouting in os frontale; osteophytic tips on endphalanges of hands; spondylarthrosis II–III and arthroses on ribs (partial ankyloses), spondyloses; endost plaques in tibiae; erosive chondropathia retropatellar bilaterally; Colle's fracture radius right (possibly also left) partly healed; “stringy” periostitis femur right distal end; interno osso temporale inflammatory traces.

Anatomical variants: Attachment of flexor pollicis longus muscle strong marks; two proximal finger phalanges show dimples/craters at distal end palmar; right tibia has two nutrient foramina; foramen supraorbitale on both sides; no foramen parietale; superior branch of eminentia cruciformis double.

Observations: Possibly generalized arthritis; age determination according to relief of the facies auricularis and by spongiosa of the long bones as well as wear-induced changes in the joints; all joint surfaces

with porosities with unclear aetiology (postmortem erosion, inflammation, or a combination of both).

Individuum No. 6006

Skull of a female (?) about 1 year old deposited upright facing east.

Bone condition: Firm.

Evidence of disease: Cribra orbitalia; cloudy dendritic weathering on calotte fragment indicating very strong anemic/infectious processes, possibly related to the Möller-Barlow disease; tooth 13: Labial enamel defect.

Anatomical variants: tooth 53: additional cusps (distal and lingual); teeth 55, 65: mesial accessory tubercle; teeth 11, 21, 51, 52: shovel-shaped.

Observations: remains of another, older individual, and possibly deciduous tooth of a third individual; right superior orbital rim is also present twice.

Individuum No. 6007

Articulated skeleton (90 %) of a male, aged about 4–5 years, stretched out lying on the right side with slightly flexed legs. The body was oriented East-West, with the head to the east, facing north. A bone was radiocarbon dated to 1228 ± 23 BP (KIA 38813).

Bone condition: Firm.

Evidence of disease: Multiple periostotic plaques are found on vertebra C 1, ribs ventral, humeri, femora, tibiae, ulnae, radiae, fibulae bilaterally, partly also internally, furthermore on mandibula, os temporalia and os zygomaticum; enamel hypoplasia; numerous 1–2 mm diameter pitting defects in tabula externa, fine vascular sprouting; inferior rib edges are diffusely eroded; very strong anemic/infectious signs, possibly related to the Möller-Barlow disease.

Anatomical variants: condylar canal, foramen Vesalii present on left side; foramen supraorbitale present on left side; Incisura frontalis on left side; no foramen parietale; marked inwards torsion of the left femur; teeth 74, 75, 84, 85, 16, 26: Foramen molare; teeth 53, 63: accessory cusp (lingual-distal); teeth 74, 75, 84, 85, 36, 46: Entoconulid; teeth 13, 23: Tuberculum dentale; teeth 33, 43: DR; teeth 36, 46: tuberculum intermedium; teeth 16, 26, 17, 27: mesial accessory tubercle; teeth 16, 26: Distal accessory tubercle; teeth 17, 27: Protoconule; teeth 55, 65, 16, 26: tuberculum Citroen; tooth 26: metaconule; teeth 11, 21, 12, 22, 13, 23, 33, 34, 42: shovel-shaped, marginal ridges.

Observations: Teeth not erupted.

Individuum No. 6011

Articulated skeleton (20 %) of a female (?), less than one month old, stretched out lying on the right side with slightly flexed legs. The body was oriented North-South, with the head to the north, facing west.

Bone condition: Firm.

Evidence of disease: Signs of severe anemia, possibly Möller-Barlow disease (or rhesus incompatibility?); distinct periostotic plaques on femoral diaphysis

bilaterally, also on ulnae, fibulae, tibiae, tabula interna and orbital roof; tabula interna shows inflammatory vascular sprouting.

Anatomical variants: Incisura and/or foramen supraorbitale absent on both sides.

Observations: Teeth not erupted.

Individuum No. 6014

Poorly preserved, arguably articulated skeleton (10 %) of a male (?) full-term foetus (8–9 lunar months) buried in a north-south orientation.

Bone condition: Fragile.

Evidence of disease: Without findings.

Anatomical variants: Incisivi probably not shovel-shaped.

Observations: Teeth not erupted.

Individuum No. 6021

Articulated skeleton (10 %) of a girl (?), aged about 9 months, stretched out lying on the back and oriented South-North.

Bone condition: Fragile.

Evidence of disease: Tooth 83: Localized hypoplasia of primary canine teeth (LHPC).

Anatomical variants: Teeth 63, 73, 83: Marginal ridges; teeth 75, 85: Paraconus; tooth 85: deflecting wrinkle; teeth 55, 65: Tuberculum Citroen, lingual paracone tubercle; teeth 54, 64: Tuberculum paramolare; teeth 52, 62, 11, 21: Shovel-shaped.

Observations: Teeth not erupted.

Observations: “Cloudy” traces of gnawing on several parts of the skeleton.

Individuum No. 6022a

Articulated skeleton (20 %) of a male (?), aged about 18 months, stretched out lying on the left side with slightly flexed legs. The body was oriented North-South, with the head to the south, facing west.

Bone condition: firm.

Evidence of disease: Ribs with periostotic plaques (pleurisy?); clear vascular sprouting especially near the suture at tabula interna; anterior fontanelle is still open and has thickened edge with step formation (increased pressure, prolapse?).

Anatomical variants: Femora with two foramen nutritia each; tooth 53: Tuberculum dentale; teeth 55, 65: mesial accessory tubercle; teeth 11, 51, 62: shovel-shaped; tooth 72: rotated distally.

Observations: Teeth 11, 31 und 41 loose (incomplete, not erupted).

Individuum No. 6022b

Skeletal remains of a male (?) neonat (age at death 0 months) probably from a disturbed grave, found mixed with the remains of grave context no. 6022. No data on the deposition or orientation of this second individual are available.

Bone condition: Brittle.

Evidence of disease: distinct periostotic deposits in orbital roofs; surface of pelvis, mandible and epiphyseal areas of long bones very rough.

Anatomical variants: upper incisivi shovel-shaped; deciduous molar has almost no cusps, but circumferential marginal ridge.

Observations: Teeth not erupted.

Individuum No. 6023

Articulated skeleton (30 %) of a boy (?), aged about 10 months, stretched out lying on the back and oriented North-South.

Bone condition: Brittle.

Evidence of disease: Upper and lower incisivi show notch-like enamel defect with discoloration at incisal edge; periostotic deposits especially on internal tabula, orbital roof and distal femoral diaphyses; despite the young age abrasive facets on teeth (bruxism seems more probable than food-related abrasion, possibly caused by intermittent spasms).

Anatomical variants: Teeth 55, 65: Lingual paracone tubercle; tooth 65: small cusp of Carabelli; teeth 52, 62, 53, 63, 83: marginal ridges; teeth 75, 85: deflecting wrinkle. Observations: Teeth not erupted.

Individuum No. 7007

Articulated skeleton (40 %) of a male, aged about 3 years, stretched out lying on the back and oriented South-North.

Bone condition: Fragile.

Evidence of disease: Multiple periostotic plaques, some of them very massive, on all long bones and on the mentum, especially strong on the left humerus, where the plaques form veritable “cuffs”.

Anatomical variants: Marginal tubercle present on left side; os zygomaticum; foramen parietale present on right side; strikingly flat palate; incisivi not shovel-shaped; teeth 85, 75, 36: Foramen molare; teeth 55, 65: Distal accessory tubercle; tooth 16: mesial paracone tubercle; tooth 83: Localized hypoplasia of primary canine teeth (LHPC).

Observations: Fuzzy “dissolvings” on the ribs, possibly to be interpreted as gnawing marks of small rodents; small perforations on the ribs, possibly due to weathering.

Appendix 2: Tables

Age	Male	Female	undefined
0-1	8 (6,4%)	10 (8,0%)	7,5 (6,0%)
2-6	8 (6,4%)	10 (8,0%)	6,5 (5,2%)
7-12	0,5 (0,4%)	2 (1,6%)	1 (0,8%)
13-19	3,5 (2,8%)	3 (2,4%)	3,1 (2,5%)
20-29	9,5 (7,6%)	4 (3,2%)	5,6 (4,5%)
30-39	8 (6,4%)	9,5 (7,6%)	2,3 (1,8%)
40-49	9 (7,2%)	4 (3,2%)	0,5 (0,4%)
50-59	4 (3,2%)	1 (0,8%)	1,5 (1,2%)
60-69	1 (0,8%)	1 (0,8%)	
70-79	0,5 (0,4%)	0,5 (0,4%)	
Total (n=125)	52 (41,6%)	45 (36,0%)	28 (22,4%)

Table 1: Age classes by sex (the non-natural numbers are due to the arithmetical distribution of those individuals whose determination spanned one or more of the age cohorts) (data basis for Fig. 6).

Age	Male (n=52)	Female (n=45)	undefined (n=28)	Total (n=125)
0-1	15,38 %	22,22 %	26,79 %	20,40 %
2-6	15,38 %	22,22 %	23,21 %	19,60 %
7-12	0,96 %	4,44 %	3,57 %	2,80 %
13-19	6,73 %	6,67 %	11,07 %	7,68 %
20-29	18,27 %	8,89 %	20,00 %	15,28 %
30-39	15,38 %	21,11 %	8,21 %	15,84 %
40-49	17,31 %	8,89 %	1,79 %	10,80 %
50-59	7,69 %	2,22 %	5,36 %	5,20 %
60-69	1,92 %	2,22 %	0,00 %	1,60 %
70-79	0,96 %	1,11 %	0,00 %	0,80 %
Sum (%)	100,00 %	100,00 %	100,00 %	100,00 %

Table 2: Proportional mortality in the age groups, broken down by gender (data basis for Fig. 7).

	Hu1	Hu4	Hu5	Hu6	Hu7	Hu9	Hu10	Ra1	Ra	Ul1	Cl1	Fe1
n	11	16	21	8	22	5	6	8	16	12	8	8
Max	337	66	26	20	70	44	48	268	25	284	163	477
Min	273	55	18	16	48	36	41	223	20	244	130	410
Mean	318,6	60,4	22,7	17,5	61,6	42,4	44,7	249,4	22,4	261,3	146,6	450,8
SD	21,7	3,2	1,7	1,5	4,5	3,6	3,2	15,7	1,7	13,6	11,9	23,5
HI	6,8	5,2	7,4	8,6	7,3	8,4	7,2	6,3	7,6	5,2	8,1	5,2
Ind.No.												
10	x	x	x	x	x	x	x	x	x	x	x	x
11	x	x	18	16	55	x	x	x	x	x	x	x
12	x	57	22	18	60	x	44	x	24	244	x	x
18a	x	58	x	x	60	x	x	x	x	x	x	x
19	x	x	22	17	64	44	41	x	22	267	x	x
97	330	62	21	x	57	x	x	256	21	270	147	463
237	x	x	x	x	x	x	x	x	x	x	x	x
506	310	60	23	16	62	x	41	240	23	255	150	x
915	285	x	22	x	58	x	x	x	x	x	x	x
921	339	66	24	x	64	x	x	268	23	284	163	477
925	325	56	22	x	66	x	x	x	22	x	153	460
931	x	x	21	x	62	x	x	x	x	x	x	x
1001	336	64	23	19	62	36	46	x	22	x	x	x
1002	x	x	x	x	x	x	x	x	x	x	x	x
1005	331	64	24	20	67	44	48	266	25	277	159	x
1103	x	x	x	x	x	x	x	x	x	x	x	x
1115	x	x	x	x	x	x	x	x	x	x	x	x
1127	x	x	22	x	64	x	x	x	x	x	x	x
1209	315	60	21	x	59	x	x	x	x	x	x	440
2102	x	x	x	x	x	x	x	x	x	x	x	x
2103	273	55	25	x	48	x	x	x	x	x	130	x
2104	x	62	x	x	x	x	x	250	23	255	x	x
4028	x	60	23	16	62	44	x	x	24	245	x	x
4096	x	62	24	x	64	x	x	223	22	244	136	410
4098	337	61	25	18	65	44	48	257	24	274	x	477
4099	324	63	25	x	70	x	x	x	24	266	x	450
4200	x	x	22	x	62	x	x	x	18	x	x	x
4202	x	57	24	x	62	x	x	235	21	255	x	x
4208	x	x	x	x	x	x	x	x	x	x	x	x
4209	x	x	23	x	62	x	x	x	21	x	135	429

Fe2	Fe6	Fe7	Fe8	Fe9	Fe10	Fe19	Fe21	Ti1b	Ti3	Ti8a	Ti9a	Fi1	Pe1
8	25	25	25	24	25	19	3	11	4	23	22	7	2
480	34	34	97	38	32	50	83	403	78	39	28	402	225
402	23	24	77	26	23	41	76	340	67	26	19	330	205
447,8	29,4	27,7	89,3	31,4	26,7	45,8	80,0	383,3	71,0	34,1	23,6	367,3	215,0
28,4	2,6	2,2	5,2	3,0	2,4	2,4	3,6	21,2	4,8	3,2	2,4	25,8	14,1
6,3	8,8	7,9	5,8	9,6	8,9	5,3	4,5	5,5	6,8	9,2	10,0	7,0	6,6
x	32	29	96	x	x	x	x	x	x	38	24	x	x
x	24	25	77	29	25	45	x	x	x	29	22	x	x
420	29	27	88	30	28	x	76	363	70	33	23	342	x
x	28	26	85	29	26	44	x	x	x	x	x	x	x
x	30	28	91	31	28	45	x	x	69	34	22	x	205
x	30	24	85	27	25	45	x	390	x	31	22	x	x
x	x	x	x	x	x	x	x	x	67	26	x	355	x
x	29	27	85	34	23	46	x	x	x	35	27	330	x
x	30	25	86	29	25	x	x	x	x	34	21	x	x
470	34	28	93	32	26	47	x	403	x	35	23	402	x
457	28	29	88	31	24	45	x	394	x	32	25	375	x
x	30	30	97	34	27	x	x	355	x	35	26	x	x
480	29	31	92	34	25	50	81	400	x	38	24	381	x
x	28	28	89	31	29	x	x	x	x	x	x	x	x
454	28	34	94	27	31	48	83	386	78	35	23	386	225
x	34	28	96	31	29	45	x	x	x	37	28	x	x
x	23	26	80	30	23	41	x	x	x	x	x	x	x
x	31	29	95	33	27	x	x	385	x	37	26	x	x
x	28	27	85	26	32	48	x	x	x	34	20	x	x
x	28	28	87	32	26	x	x	x	x	36	19	x	x
x	x	x	x	x	x	x	x	x	x	x	x	x	x
x	x	x	x	x	x	x	x	x	x	x	x	x	x
x	x	x	x	x	28	48	x	x	x	x	x	x	x
402	30	27	87	32	25	43	x	340	x	32	26	x	x
473	31	28	94	35	27	50	x	400	x	38	25	x	x
x	31	30	96	37	29	48	x	400	x	39	26	x	x
x	30	26	86	38	30	43	x	x	x	x	x	x	x
x	33	25	88	29	25	44	x	x	x	34	24	x	x
x	x	x	x	x	x	x	x	x	x	31	21	x	x
426	27	27	92	32	25	46	x	x	x	32	22	x	x

Table 3: Postcranial measurements of men.

	Hu1	Hu4	Hu5	Hu6	Hu7	Ra1	Ra	U11	Cl1	Fe1
n	4	3	13	5	14	5	5	5	4	2
Max	295	62	24	15	61	235	23	265	140	420
Min	282	51	17	13	49	198	18	210	126	415
Mean	287,3	56,5	19,8	13,8	54,6	218,8	19,8	235,5	128,5	417,5
SD	6,75	5,51	2,06	0,84	3,17	13,86	1,95	21,96	6,40	3,54
HI	2,35	9,75	10,40	6,06	5,80	6,33	9,85	9,33	4,98	0,85
Ind.No.										
15a	x	x	18	14	53	x	x	x	x	x
15b	295	51	20	15	57	x	x	x	126	x
231	x	x	x	x	x	x	x	x	x	x
236	x	x	17	13	50	225	19	x	x	x
912	x	62	24	x	61	x	23	265	x	x
927	x	x	20	x	56	x	19	x	x	x
933	295	x	20	x	54	235	19	257	140	420
935	x	x	x	x	53	x	x	x	x	x
1102	x	x	x	x	x	x	x	x	x	x
1121	x	x	20	x	54	x	x	x	x	x
1154	x	x	23	x	58	x	x	x	x	x
1208	285	x	18	x	49	225	x	245	x	415
1219a	282	x	18	x	54	198	18	210	127	x
2059b	x	57	22	15	55	217	x	230	130	x
4195a	x	x	x	x	x	x	x	x	x	x
4203	x	x	21	x	58	x	x	x	x	x
4212	x	x	x	x	x	x	x	x	x	x
6005	x	x	20	14	55	x	x	x	x	x

Fe2	Fe6	Fe7	Fe8	Fe9	Fe10	Fe19	Fe21	Ti1b	Ti8a	Ti9a	Fi1
3	14	14	14	13	13	10	2	6	14	14	2
415	30	28	89	35	28	50	66	390	37	25	320
360	23	23	72	25	22	39	63	320	27	16	254
360	25,8	25,3	79,2	29,5	24,1	41,8	63	346	30	20,1	287
28,29	2,52	1,71	5,33	2,79	1,92	3,29	2,12	23,59	2,92	2,21	46,67
7,86	9,76	6,76	6,73	9,45	7,97	7,88	3,37	6,82	9,73	11,01	16,26
399	24	24	80	x	x	40	66	320	29	20	x
x	30	27	87	29	27	41	63	x	x	x	254
x	x	x	x	x	x	x	x	340	28	21	320
360	23	24	75	29	24	39	x	x	32	21	x
x	30	28	89	35	27	50	x	x	37	22	x
x	24	28	84	32	23	39	x	x	x	x	x
x	26	25	79	29	23	42	x	345	27	19	x
x	25	27	78	32	23	x	x	x	x	x	x
x	24	27	73	25	24	x	x	x	28	16	x
x	24	26	77	30	22	x	x	x	29	21	x
x	26	27	82	31	24	45	x	390	30	23	x
x	24	23	72	26	22	41	x	x	27	18	x
x	24	24	76	29	24	43	x	335	29	20	x
415	27	28	84	26	28	42	x	x	31	22	x
x	x	x	x	x	x	x	x	x	30	22	x
x	x	x	x	x	x	x	x	x	x	x	x
x	x	x	x	x	x	x	x	350	32	25	x
x	30	26	86	31	24	x	x	x	35	22	x

Table 4: Postcranial measurements of women.

	Index platymericus	Index cnicus	Humero-Radial-Index	Femoro-Tibial-Index	Intermembral-Index
n	24	22	5	6	Collective values
Max	123,1	81,25	80,4	88,9	68,8
Min	67,7	52,8	76,3	82,9	66,1
Mean	85,8	68,6	78,1	85,0	68,1
SD	12,4	6,8	1,6	2,1	x
HI	14,4	9,9	2,0	2,5	x
Ind.No.					
10	x	63,2	x	x	x
11	86,2	75,9	x	x	x
12	93,3	69,7	x	x	x
18a	89,7	x	x	x	x
19	90,3	64,7	x	x	x
97	92,6	71,0	77,6	84,2	x
506	67,6	77,1	77,4	x	x
915	86,2	61,8	x	x	x
921	81,3	65,7	79,1	84,5	x
925	77,4	78,1	x	85,7	x
931	79,4	74,3	x	x	x
1001	73,5	63,2	x	x	x
1002	93,5	x	x	x	x
1005	114,8	65,7	80,4	x	x
1103	93,5	75,7	x	x	x
1115	76,7	x	x	x	x
1127	81,8	70,3	x	x	x
1209	123,1	58,8	x	x	x
2102	81,3	52,8	x	x	x
4096	78,1	81,3	x	82,9	x
4098	77,1	65,8	76,3	83,9	x
4099	78,4	66,7	x	88,9	x
4200	78,9	x	x	x	x
4202	86,2	70,6	x	x	x
4208	x	67,7	x	x	x
4209	78,1	68,8	x	x	x

Table 5: Postcranial indices of men.

	Index platymericus	Index cneomicus	Humero-Radial-Index	Femoro-Tibial-Index	Intermembral-Index
n	13	14	3	1	Collective values
Max	107,69	78,125	79,7	82,1	65,4
Min	71,875	57,143	70,2	82,1	65,3
Mean	82,7	69,0	76,3	82,1	66,3
SD	10,54	6,20	5,3	x	x
HI	12,75	8,99	6,9	x	x
Ind.No.					
15a	x	69,0	x	x	x
15b	93,1	x	x	x	x
231	x	75,0	x	x	x
236	82,8	65,6	x	x	x
912	77,1	59,5	x	x	x
927	71,9	x	x	x	x
933	79,3	70,4	79,7	82,1	x
935	71,9	x	x	x	x
1102	96,0	57,1	x	x	x
1121	73,3	72,4	x	x	x
1154	77,4	76,7	x	x	x
1208	84,6	66,7	78,9	x	x
1219a	82,8	69,0	70,2	x	x
2059b	107,7	71,0	x	x	x
4195a	x	73,3	x	x	x
4212	x	78,1	x	x	x
6005	77,4	62,9	x	x	x

Table 6: Postcranial indices of women.

	M1	M5	M8	M9	M10	M11	M12	M13	M17	M20	M40	M42	M43	M44	M45
n	12	2	13	14	13	2	3	2	5	9	2	2	15	4	8
Max	198	95	173	107	127	139	136	108	133	144	97	112	118	115	146
Min	172	88	132	87	104	125	104	101	115	95	91	111	101	93	129
Mean	182,2	91,5	144,8	98,4	118,8	132,0	118,7	104,5	123,8	113,6	94,0	111,5	110,3	105,5	137,6
SD	7,9	4,9	10,7	5,4	6,8	9,9	16,2	4,9	7,8	15,5	4,2	0,7	5,8	9,5	6,2
HI	4,31	5,41	7,39	5,49	5,69	7,50	13,62	4,74	6,27	13,69	4,51	0,63	5,30	8,98	4,48
Ind.No.															
12	191	x	x	94	115	x	x	x	x	x	x	x	106	x	129
18a	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
19	198	x	145	97	x	x	116	x	x	x	x	x	113	110	138
97	x	x	x	100	116	x	x	x	x	x	x	x	108	x	x
915	184	x	133	x	x	x	x	x	x	x	x	x	x	x	x
921	181	x	137	101	125	x	x	x	x	122	x	x	118	x	142
925	185	x	144	99	122	x	x	x	x	118	x	x	112	x	x
931	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
1001	x	x	x	x	118	x	x	x	x	x	x	x	118	104	146
1002	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
1005	178	95	142	107	120	125	104	101	126	108	97	111	108	93	134
1103	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
1115	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
1127	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
1209	x	x	x	87	104	x	x	x	x	x	x	x	101	x	x
2103	172	x	132	94	110	x	x	x	115	97	x	x	104	x	x
2104	178	x	140	99	124	x	x	x	x	x	x	x	105	x	x
4028	x	x	152	x	x	x	x	x	x	117	x	x	x	x	x
4096	177	x	142	92	115	x	x	x	120	95	x	x	102	x	132
4098	172	88	148	103	124	139	136	108	133	110	91	112	117	115	142
4099	185	x	173	103	127	x	x	x	x	144	x	x	115	x	x
4202	x	x	143	102	x	x	x	x	x	x	x	x	110	x	x
4208	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
4209	185	x	151	100	125	x	x	x	125	111	x	x	117	x	138

M47	M48	M50	M51	M52	M54	M55	M60	M61	M65	M66	M68	M69	M70	M71	M79
5	5	4	7	7	14	8	3	3	10	15	5	19	11	18	13
135	84	27	51	51	27	56	57	72	131	126	82	41	80	37	125
124	64	25	37	32	20	42	52	67	108	90	71	25	47	30	114
128,4	78,2	26,3	40,1	37,0	24,1	49,3	54,3	68,7	119,8	101,5	75,6	32,9	62,9	33,3	118,9
5,2	9,0	1,0	5,4	6,6	2,0	5,5	2,5	2,9	7,9	9,5	5,9	4,2	10,5	2,0	3,7
4,04	11,53	3,65	13,52	17,88	8,39	11,27	4,63	4,20	6,63	9,39	7,75	12,81	16,63	6,05	3,11
x	x	x	x	x	27	x	x	x	x	96	72	36	x	33	x
x	x	x	x	x	x	x	x	x	x	x	x	25	x	x	x
x	64	27	38	37	25	42	x	x	x	98	82	32	x	36	115
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
x	x	x	x	x	x	50	x	x	109	94	x	28	54	32	118
x	x	x	37	34	21	x	x	x	126	114	x	34	64	31	122
x	x	x	x	x	x	x	x	x	126	100	x	36	51	32	117
x	x	x	x	x	x	x	x	x	x	x	x	32	x	x	x
135	82	27	38	34	26	55	54	72	x	126	71	41	x	32	125
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
124	78	25	37	34	23	56	57	67	118	97	71	38	70	34	123
x	x	x	x	x	x	x	x	x	x	x	x	30	x	x	x
x	x	x	x	x	x	x	x	x	x	x	x	27	x	32	x
x	x	x	x	x	23	x	x	x	x	x	x	35	68	33	116
x	x	x	x	x	24	x	x	x	x	90	x	38	x	35	x
x	x	x	x	x	26	x	x	x	115	94	x	30	47	31	122
x	x	x	x	x	x	x	x	x	x	101	x	x	x	31	x
x	x	x	x	x	x	x	x	x	x	x	x	x	x	33	x
131	84	x	41	37	21	52	x	x	124	100	x	32	80	37	115
125	x	26	51	51	26	45	52	67	131	106	82	33	73	30	114
x	x	x	x	x	26	x	x	x	108	110	x	37	65	36	122
x	x	x	x	x	25	x	x	x	118	97	x	31	57	34	118
x	x	x	x	x	20	46	x	x	x	x	x	x	x	x	x
127	83	x	39	32	24	48	x	x	123	100	x	31	63	37	119

Table 7: Cranial measurements of men.

	M1	M5	M8	M9	M10	M11	M12	M13	M17	M20	M40	M42	M43	M44	M45
n	5	0	4	8	5	1	2	1	2	3	0	0	7	1	1
Max	178	x	140	112	130	112	108	96	120	112	x	x	110	88	115
Min	155	x	130	83	107	112	97	96	116	106	x	x	98	88	115
Mean	168,6	x	134,3	92,0	115,8	112,0	102,5	96,0	118,0	108,0	x	x	101,9	88,0	115,0
SD	10,2	x	4,3	6,3	8,8	x	7,8	x	2,8	3,5	x	x	4,3	x	x
HI	6,0	x	3,2	6,8	7,6	x	7,6	x	2,4	3,2	x	x	4,2	x	x
Ind.No.															
15b	177	x	132	92	114	x	108	x	x	x	x	x	99	88	x
236	161	x	135	88	107	112	97	96	x	106	x	x	98	x	115
912	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
933	x	x	x	95	x	x	x	x	x	x	x	x	103	x	x
935	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
1121	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
1154	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
1208	155	x	140	88	117	x	x	x	120	106	x	x	104	x	x
1219a	178	x	130	83	111	x	x	x	116	112	x	x	98	x	x
2059	172	x	x	102	130	x	x	x	x	x	x	x	110	x	x
4203	x	x	x	96	x	x	x	x	x	x	x	x	101	x	x
6005	x	x	x	112	x	x	x	x	x	x	x	x	x	x	x

M47	M48	M50	M51	M52	M54	M55	M60	M61	M65	M66	M68	M69	M70	M71	M79
0	0	2	4	4	5	3	0	0	6	7	1	10	7	9	7
x	x	27	42	40	26	56	x	x	127	109	67	32	56	35	134
x	x	20	36	30	24	48	x	x	110	90	67	17	45	26	118
x	x	20,0	37,5	36,5	24,4	53,0	x	x	117,7	98,9	67,0	25,1	50,6	30,0	127,6
x	x	x	3,0	4,4	0,9	4,4	x	x	6,9	6,3	x	4,7	3,6	2,9	5,8
x	x	x	8,0	12,1	3,7	8,3	x!	x	5,9	6,4	x	18,7	7,1	9,7	4,5
x	x	20	x	x	x	x	x	x	x	101	x	27	x	x	x
x	x	x	36	30	x	x	x	x	114	97	67	20	x	26	134
x	x	x	x	x	24	x	x	x	x	x	x	x	x	28	x
x	x	x	36	40	24	56	x	x	127	109	x	30	52	31	126
x	x	x	x	x	x	x	x	x	x	x	x	24	56	27	x
x	x	x	x	x	x	x	x	x	113	90	x	23	52	35	118
x	x	x	x	x	24	x	x	x	110	102	x	28	51	33	130
x	x	x	42	38	26	48	x	x	117	93	x	28	51	29	123
x	x	x	x	x	x	x	x	x	125	100	x	17	47	30	128
x	x	x	x	x	x	x	x	x	x	x	x	22	45	31	134
x	x	x	36	38	24	55	x	x	x	x	x	32	x	x	x
x	x	27	x	x	x	x	x	x	x	x	x	x	x	x	x

Table 8: Cranial measurements of women.

	LBI	LHI	BHI	LOI	BOI	JFI	OGI	OI	NI
n	11	5	5	8	2	7	4	7	7
Max	93,5	77,3	89,9	77,8	90,7	79,9	63,6	100	59,5
Min	72,3	66,9	82,8	53,7	88,3	69,7	56,2	82,1	40,4
Mean	79,6	70,1	86,6	63	89,5	72,7	59,5	91,8	48,5
SD	6	4,3	2,9	7,4	1,6	3,4	3,2	5,8	7,7
HI	7,5	6,2	3,4	11,8	1,8	4,6	5,3	6,3	15,9
Ind.No.									
12	x	x	x	x	x	72,9	x	x	x
19	73,2	x	x	x	x	70,3	x	97,4	59,5
915	72,3	x	x	x	x	x	x	x	x
921	75,7	x	x	67,4	x	71,1	x	91,9	x
925	77,8	x	x	63,8	x	x	x	x	x
1001	x	x	x	x	x	x	56,2	89,5	47,3
1005	79,8	70,8	88,7	60,7	90,7	79,9	58,2	91,9	41,1
2103	76,7	66,9	87,1	56,4	x	x	x	x	x
2104	78,7	x	x	x	x	x	x	x	x
4096	80,2	67,8	84,5	53,7	x	69,7	63,6	90,2	40,4
4098	86	77,3	89,9	64	88,3	72,5	x	100	57,8
4099	93,5	x	x	77,8	x	x	x	x	x
4208	x	x	x	x	x	x	x	x	43,5
4209	81,6	67,6	82,8	60	x	72,5	60,1	82,1	50

Table 9: Cranial indices of men.

	LBI	LHI	BHI	LOI	BOI	JFI	OGI	OI	NI
n	4	2	2	3	3	1	0	4	3
Max	90,3	77,4	89,2	68,4	86,2	93,0	-	111,1	54,2
Min	73,0	65,2	85,7	62,7	75,7	93,0	-	83,3	42,9
Mean	80,4	71,3	87,5	65,7	80,1	93,0	-	97,6	46,9
SD	8,1	8,7	2,5	2,7	5,4	x	-	12,9	6,3
HI	10,1	12	2,8	4,2	6,7	x	-	13,2	13,5
Ind.No.									
15b	75	x	x	x	x	x	-	x	x
236	84	x	x	66	79	93	-	83,3	x
933	x	x	x	x	x	x	-	111	43
1208	90	77	86	68	76	x	-	90,5	54
1219a	73	65	89	63	86	x	-	x	x
4203	x	x	x	x	x	x	-	106	44

Table 10: Cranial indices of women.

	Male			Female			♀/♂*100
	♀ n	Mean	Standard deviation	♂ n	Mean	Standard deviation	
Hu 1	5	287,9	8,0	16	321,6	16,9	90
Hu 4	4	57,0	5,7	24	60,7	3,1	94
Hu 5	21	19,7	2,4	41	22,4	1,6	88
Hu 7	23	54,5	3,5	40	62,2	4,0	88
Ra 1	7	218,9	17,2	11	250,7	14,4	87
Ra a	6	19,4	1,1	26	22,7	1,4	85
Ul 1	6	245,3	17,2	15	259,4	13,4	95
Cl 1	4	130,8	6,0	11	147,3	11,4	89
Fe 2	3	383,5	5,7	10	453,2	29,3	85
Fe 6	26	25,6	2,5	49	29,3	2,5	87
Fe 7	26	25,9	1,8	49	27,5	2,3	94
Fe 8	26	79,9	5,5	48	89,1	5,1	90
Fe 9	22	29,0	3,1	41	31,1	3,2	93
Fe 10	22	24,1	2,4	42	27,1	4,0	89
Fe 19	19	41,9	3,4	31	45,7	2,4	92
Ti 1b	7	344,3	15,5	16	385,9	18,6	89
Ti 8a	21	30,1	3,2	39	34,2	3,0	88
Ti 9a	21	20,7	2,3	39	24,7	6,3	84

Table 11. Relation index of individual postcranial measurements.

Ind.No.	Shoulder	Elbow	Hand	Hip	Knee	Foot	Cervical spine	Thoracic spine	Lumbar spine	Jaw	Sum	MEAN
12		2			2	1	1	2	3		11	1,83
15a		1									1	1
15b								1			1	1
18								1			1	1
19			1					1			2	1
236		1		1			1,5	1,5	1,5		6,5	1,3
506								0,5			0,5	0,5
912	0,5			1				1	1,5	2	6	1,2
915					2				2,5		4,5	2,25
921	1			1	2			1	2		7	1,4
925									1,5		1,5	1,5
927						1		1,5			2,5	1,25
931			1				1	1			3	1
933	0,5					1	1,5	0,5	2,5	1	7	1,17
1001						0,5					0,5	0,5
1005			0,5	1					1		2,5	0,83
1102					2			2	3		7	2,33
1103								1	2		3	1,5
1154				1				2			3	1,5
1208							1				1	1
1209						1,5	1	1			3,5	1,17
1211b								2,5	2,5		5	2,5
1219a					2		1	1	1,5		5,5	1,38
2104		2					2	2	2		8	2
2128						1,5					1,5	1,5
4028								1			1	1
4096	1				1				3		5	1,67
4098	1	1		1	1	1,5	2	2,5	3		13	1,63
4099					1		1	1	2,5		5,5	1,38
4208								1			1	1
4209					1		1	1	3		6	1,5
6003		1		1							2	1
6005					2		2	2	3	1	10	2
Mean	0,8	1,33	0,83	1	1,6	1,14	1,33	1,33	2,28	1,33		

Table 12: Degenerative pathologies.

Arthrotic symptoms were classified into grades 0 to 3:

- 0: no signs of degeneration or mechanical adaptation;
- 1: mild signs such as joint edge thickening or irritation-free changes to the joint surface;
- 2: moderate traces such as osteophytes on the edge of the joint and slight usures on the joint surface;
- 3: severe changes with deformations, severe usures or ankylosis of the articular surface.

Ind. No.	Si (ppm)	Ti (ppm)	Al (ppm)	Fe (ppm)	Mn (ppm)	Mg (ppm)	Ca ₃ (PO ₄) ₂ (%)	Ca (ppm)	Na (ppm)	K (ppm)	LOI (%)	Ba (ppm)	Co (ppm)	Cr (ppm)	Ni (ppm)
11	3090	160	910	1560	260	2320	89,33	344500	3280	270	8,44	154			
18a	17500	390	6770	3850	110	2170	82,00	313186	3160	2180	14,80	152		3	
19	20230	480	7310	3970	120	2630	81,67	312129	2820	2220	10,53	251		2	
97	39590	800	13620	6550	200	2760	72,39	274300	2800	4730	15,71	262	8	7	
236	11130	310	3690	2380	60	2720	81,84	313600	2760	1230	16,10	387		8	
506	1940	130	610	1020	40	2230	84,77	326657	1990	140	14,41	303			
910	27370	630	11360	5730	150	2890	70,62	268550	2820	3730	20,61	298		13	
912	91000	1670	29570	14190	240	3990	61,80	229007	3230	10140	12,01	440		24	
913	4720	230	1770	1520	40	2510	86,55	333057	2090	550	11,90	408		2	
921	830	150	0	890	10	2030	86,33	332221	2080	30	15,78	335		2	19
925	18940	460	6250	3170	70	2460	80,38	306950	2750	2010	15,63	447		10	
1001	4730	380	880	3730	480	2770	90,13	347464	3720	210	8,76	309			
1001 B	5150	160	1310	1870	180	2520	89,70	344836	3830	350	9,72	226		3	
1005	48780	890	11320	5920	250	3330	69,52	261650	3890	4020	20,28	446		17	
1208	2620	160	650	1090	30	2150	83,19	320364	2360	240	16,23	144		1	
1217	61010	1310	27850	13670	280	4070	64,14	239921	2790	9310	15,54	412		19	
1219	22020	520	8810	4280	80	2860	79,70	304029	2880	2930	14,15	264		8	
1220	13520	480	4930	3330	240	2500	79,91	307150	2540	1410	16,31	382		8	
1222	11340	440	4090	2680	130	2590	81,71	314021	2830	1240	15,53	359		14	
2059	28290	630	8480	4310	130	2650	73,74	280664	3040	2870	19,46	362		14	
2063	26980	690	10730	5480	500	3030	75,95	289893	2730	3450	16,54	549		14	
2102	2760	180	750	3380	260	1950	84,67	326143	2790	240	13,74	119		1	
2103	3030	190	630	1050	50	2230	83,35	320986	2590	230	15,91	153		1	0
4096	4080	190	1150	1770	40	3220	81,08	311686	3170	380	18,37	186		3	15
4098	560	160	10	1140	20	3780	84,45	325114	2790	50	16,41	393		7	
4209	15670	370	4880	4790	300	2880	75,34	288329	4030	1500	19,48	248		2	
6005	8690	290	3250	2100	40	2470	85,48	327821	2440	1000	13,58	390		3	
6007	29290	670	10620	5250	160	3010	78,09	297043	2500	3580	14,14	489		11	

Table 13: Results of the trace element analyses.

Rb (PPM)	Sr (ppm)	V (ppm)	Y (ppm)	Zn (ppm)	Zr (ppm)	Ce (ppm)	Eu (ppm)	La (ppm)	Nb (ppm)	Nd (ppm)	Sm (ppm)	Yb (ppm)	Sum without oxides (%)
3	401	15		198	13		0,9			12			99,04
13	454	19		196	21		1,0			6			100,50
14	472	28		197	25		1,1	32		20			96,28
25	458	34		91	37		1,0			20			95,30
7	606	13		85	19		1,3			15			100,50
	582	18		87	13		1,3			13			100,10
21	441	31		34	28		1,0	22		17			96,79
54	517	44	15	224	84	55	1,5	28		31	3,6	0,7	89,37
3	624	11		116	14		1,4			6			99,91
	612	8		61	11		1,3			15			102,80
11	652	15		64	26		1,6			14			99,75
	384			243	18		0,9			40		0,3	100,70
	352	9		135	16		0,8			8			101,00
20	440	13		60	55		1,2	16		22		0,3	97,75
2	464	13		74	10		1,0			8			100,40
52	511	54	11	185	45	51	1,1	27		20		0,3	91,85
16	537	23		139	28		1,2			14			98,39
9	716	16		134	23		1,6			25			99,25
8	702	9		49	19		1,5			24			99,90
15	589	21		58	50		1,3			22			98,35
19	724	22		110	33		1,6	35		18			98,00
3	413	9		70	11		0,9			17			99,70
2	548	12		33	13		1,4			16			100,30
2	429	8		26	13		0,9			13			100,90
	625			109	11		1,4			15			101,80
10	358	20		23	24		0,8			11			98,33
6	622	12		98	16		1,3			9			101,20
21	620	22		193	32		1,4			20			97,87

ID	Piece	Sex	N _{os} (%)	C _{os} (%)	qu. coll (mg/g)	rend (mg/g)	C _{coll} (%)	N _{coll} (%)	N _{rend} (%)	C/N _{coll}	d ¹³ C _{coll} (‰)	d ¹⁵ N _{coll} (‰)
921	femur	M	1,1	5,4	14,7	39,8	40,8	14,6	52,9	3,3	-12,4	9,2
1001	long bone	M	0,5	3,8	6,8	14,9	30,6	11,1	33,0	3,2	-10,7	8,3
1005	ribs	M	2,1	7,6	23,0	74,7	42,1	14,7	52,4	3,3	-9,1	9,6
912	skull	W	0,9	3,9	9,5	23,4	29,5	9,7	25,3	3,5	-11,2	8,3
925	femur	M	1,5	5,9	17,3	45,5	40,2	14,2	43,1	3,3	-10,0	8,5
236	radius R	W	1,3	5,6	16,4	45,4	41,8	14,7	51,5	3,3	-11,6	8,5
6007	tibia	M	1,0	4,7	13,5	32,6	36,8	13,0	42,3	3,3	-13,2	9,4
2059	phalanx	W	1,7	6,5	16,7	54,4	39,7	13,9	44,6	3,3	-11,9	8,1
6005	femur R	W	0,9	4,4	11,8	29,2	33,0	11,6	37,6	3,3	-12,6	8,9
4098	humerus R	M	1,3	5,5	16,9	47,9	43,2	14,9	54,8	3,4	-11,0	10,1
18a	rib	M	1,2	5,5	13,5	37,3	41,3	14,6	45,4	3,3	-11,8	8,3
11	femur	M	0,4	2,8	3,0	6,3	32,3	10,8	17,1	3,5	-13,9	7,8
506	femur R	M?	1,3	5,3	11,3	28,6	41,8	14,5	31,8	3,4	-12,6	7,6
4096	tibia	M	2,2	7,4	22,4	84,2	42,2	15,4	59,0	3,2	-13,2	7,8
97	skull	M?	1,5	5,7	15,6	42,2	41,4	14,5	40,9	3,3	-12,4	7,9
1219a	tibia	W	1,0	4,5	15,7	39,2	40,0	14,7	57,7	3,2	-13,7	8,2
2103	humerus	M	1,6	6,1	18,3	59,6	42,4	15,0	56,0	3,3	-13,0	7,8
19	radius	M	0,5	3,4	4,6	11,3	30,6	9,8	22,1	3,7	-14,2	8,1
4209	humerus	M	2,1	7,4	23,1	92,0	41,1	15,3	67,1	3,1	-11,9	10,2
1208	femur	W	1,4	5,3	24,2	63,7	43,5	16,0	72,6	3,2	-12,7	8,7
910	skull	M	2,3	7,5	21,8	82,9	43,4	14,9	53,5	3,4	-8,7	9,1
913	tibia	M	0,8	4,0	10,1	24,7	35,9	19,7	60,8	2,1	-11,1	8,1
1217	femur	?	nd	nd	9,1	44,0	40,8	14,0	nd	3,4	-14,9	8,6
1217	femur	?	nd	nd	12,0	31,9	31,6	11,1	nd	3,3	-16,5	8,9
1220	femur	M?	nd	nd	21,4	53,6	39,8	14,1	nd	3,3	-13,2	10,6
1220	femur	M?	nd	nd	12,1	53,3	41,1	15,0	nd	3,2	-14,0	12,0
1222	femur	W	nd	nd	18,0	52,2	39,3	13,8	nd	3,3	-12,8	9,9
1222	femur	W	nd	nd	11,1	35,6	37,9	13,3	nd	3,3	-14,6	11,3
2063	ribs	W	1,6	6,1	14,0	44,4	40,4	14,2	39,5	3,3	-7,6	12,6
2063	humerus	W	nd	nd	4,7	42,0	36,9	13,6	nd	3,2	-8,2	12,4
2063	humerus	W	nd	nd	7,2	72,5	32,9	13,1	nd	2,9	-8,0	13,0
2102	femur	M	1,4	4,9	17,2	48,3	40,8	14,8	51,1	3,2	-12,4	8,5

Table 14: Results of C and N isotopy.

Ind.No.	Type and condition of the sample	Sample preparation	^{87/86} Sr	dSr(2s)
11	one complete molar crown; very good preserved; enamel homogeneous white, thick, hard, not chalky, no microcracks in sampled area	Powder	0,725416	9
18a	Pieces of tooth enamel after sampling for DNA analysis; very good preserved; enamel homogeneous white, thick, hard, not chalky, no microcracks in sampled area	Piece cleaned completely	0,725597	10
19	Pieces of tooth enamel after sampling for DNA analysis; very good preserved; enamel homogeneous white, thick, hard, not chalky, no microcracks in sampled area	Piece cleaned completely	0,725672	9
97	one complete molar crown; very good preserved; enamel homogeneous white, thick, hard, not chalky, no microcracks in sampled area	Piece broken out during sampling, cleaned	0,725642	9
236	one complete molar crown; very good preserved; enamel homogeneous white, thick, hard, not chalky, no microcracks in sampled area	2 pieces broken out during sampling, cleaned	0,726038	9
506	one complete molar crown; very good preserved; enamel homogeneous white, thick, hard, not chalky, no microcracks in sampled area	Powder	0,725248	8
912	Pieces of tooth enamel after sampling for DNA analysis; very good preserved; enamel homogeneous white, thick, hard, not chalky, no microcracks in sampled area	2 pieces	0,726302	11
1001	one complete molar crown; preservation good-very good; enamel surface inhomogeneously beige discolored before sampling; lightest area sampled and after surface removal homogeneously white, hard, not chalky, no microcracks	Powder?	0,724970	9
2059	Pieces of tooth enamel after sampling for DNA analysis; very good preserved; enamel homogeneous white, thick, hard, not chalky, no microcracks in sampled area	various small pieces	0,725143	10
4098	one complete molar crown; very good preserved; enamel homogeneous white, thick, hard, not chalky, no microcracks in sampled area	Powder	0,726726	10
6007	one complete molar crown; very good preserved; enamel homogeneous white, thick, hard, not chalky, no microcracks in sampled area	Powder	0,724724	10

Charge 1 (2008)

Sr-Standard: NBS 987 0.710231 ±10 (certified value: 0.710248)

NBS 987 0.710214 ±10 (certified value: 0.710248). The Sr ratio is not corrected!

Table 15: Results of Sr isotope analysis.

Ind.No.	Type and condition of the sample	Sample preparation	^{87/86} Sr	dSr(2s)
1005	one complete molar crown; preservation good-very good; enamel surface inhomogeneously beige discolored before sampling; lightest area sampled and after surface removal homogeneously white, hard, not chalky, no microcracks	Powder	0,724542	9
1208	one complete molar crown; very good preserved; enamel homogeneous white, thick, hard, not chalky, no microcracks in sampled area	Powder	0,726841	7
2103	Pieces of tooth enamel after sampling for DNA analysis; very good preserved; enamel homogeneous white, thick, hard, not chalky, no microcracks in sampled area	Piece cleaned completely	0,725566	9
4096	one complete molar crown; very good preserved; enamel homogeneous white, thick, hard, not chalky, no microcracks in sampled area	Piece cleaned completely	0,725296	9
4209	one complete molar crown; preservation good-very good; enamel surface inhomogeneously beige discolored before sampling; lightest area sampled and after surface removal homogeneously white, hard, not chalky, no microcracks	Piece broken out during sampling, cleaned	0,725866	9
925.1	one complete molar crown; very good preserved; enamel homogeneous white, thick, hard, not chalky, no microcracks in sampled area	Powder	0,725182	9
925.2	one complete molar crown; very good preserved; enamel homogeneous white, thick, hard, not chalky, no microcracks in sampled area	Powder	0,725029	9

Charge 2 (2009)

Sr-Standard: NBS 987 0.710256 ± 10 (certified value: 0.710248). The Sr ratios are not corrected yet for NBS 987 (+0,000008)

No valid data could be obtained for individuals 921, 1219a, and 6005.

Table 15 (Continuation).

Appendix 3: Data on the dental status of the Salvatierra individuals

Abbreviations:

+	=	present in the tooth compartment	0	=	postmortem loss
(+)	=	present in the tooth compartment but not erupted	?	=	not assessable
L	=	loose tooth	oc	=	occlusal
(L)	=	loose tooth, not erupted	ap	=	approximal
x	=	intravital lost tooth	cej	=	cementoenamel junction
			nd	=	not developed

Ind.No. 10

Abrasion	-	4														
Caries	-	2 oc														
Calculus	-	0														
Status	0	+														
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Status	0	+		x	x	+										
Calculus	-	2		-	-	?										
Caries	-	0		-	-	?										
Abrasion	-	5		-	-	?										

Ind.No. 11

Abrasion			-	-	-	3		4	4		4	3	3	4	3	
Caries			-	-	-	-		0	0		0	0	0	0	0	
Calculus			0	0	0	0		0	0		0	0	0	0	0	
Status			+	+	+	+		L	L		+	+	+	+	+	
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Status		+	+	+	L	L	L	L	L	L	L	L	+	+	+	+
Calculus		0	0	0	0	0	0	0	0	0	1	o	o	o	o	o
Caries		-	-	0							0	0	-	-	-	-
Abrasion		-	4	3	4	3	3	4	4	3	3	3	2	4	3	

Ind.No. 12

Abrasion			-	-	-	3		4	4		4	3	3	4	3	
Caries			-	-	-	-		0	0		0	0	0	0	0	
Calculus			0	0	0	0		0	0		0	0	0	0	0	
Status			+	+	+	+		L	L		+	+	+	+	+	
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Status		+	+	+	L	L	L	L	L	L	L	L	+	+	+	+
Calculus		0	0	0	0	0	0	0	0	0	1	o	o	o	o	o
Caries		-	-	0							0	0	-	-	-	-
Abrasion		-	4	3	4	3	3	4	4	3	3	3	2	4	3	

Ind. No. 15A

Abrasion																	4.5
Caries																	2 cej
Calculus																	1
Status																	L
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28	
Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38	
Status		+										L	L				
Calculus		0										0	1				
Caries		2 cej										0	0				
Abrasion		6										4.5	4.5				

Ind. No. 15B

Abrasion	-	-	-	-	-	6	6	-	-	-	6	5	-	6	-	-	
Caries	-	-	-	-	3 oc	1 ap	0	-	-	-	0	0	-	1 ap	-	-	
Calculus	-	-	-	-	0	1	1	-	-	-	1	1	-	0	1	1	
Status	?	?	x	x	+	+	+	?	L	?	L	L	?	L	?	?	
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28	
Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38	
Status	?	x	+	+	+	+	0	0	+	+	+	+	+	x	x	nd	
Calculus	-	-	1	0	1	0	-	-	1	1	0	0	1	-	-	-	
Caries	-	-	1 cej	3 cej	0	0	-	-	0	0	0	0	0	-	-	-	
Abrasion	-	-	7	6	5	5	-	-	5.5	5.5	5	6	5	-	-	-	

Ind. No. 18a

Abrasion						6			7		5	5					
Caries						0			0		0	0					
Calculus						0			0		0	0					
Status					x	L			+		+	+					
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28	
Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38	
Status	0	x	L	L	L	+	+	0	0	+	+	+	+				
Calculus			0	0	0	1	1	-	-	1	1	0	0				
Caries			1 oc	0	0	0	0	-	-	0	0	0	0				
Abrasion			4	3	3	5	5	-	-	5	4	3	3				

Ind. No. 18b

Abrasion																	
Caries																	
Calculus																	
Status																	
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28	
Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38	
Status														+	+	+	
Calculus														-	-	-	
Caries														-	-	-	
Abrasion														-	-	-	

* only root preserved

Ind. No. 97

Abrasion	1	3	3	3	3	3	1	2	2	2	2	2	3	4	3	1
Caries	1 oc	0	0	0	0	0	0	0								
Calculus	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
Status	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	L
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28

Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Status	+	+	+	+	+	+	+	L	L	L	+	+	+	+	+	+
Calculus	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0
Caries	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Abrasion	2	2	3	2	2	1	2	2	2	2	2	2	2	2	5	4

Ind. No. 202

Only tooth 28; abrasion 1-2, with caries.

Ind. No. 209

Abrasion	1	1.5	3	-	-	5	4	4	3	3
Caries	0	0	0	-	-	0	0	0	0	0
Calculus	0	0	0	-	-	0	0	0	0	0
Status	+	+	+	-	-	+	+	+	+	+
Tooth	55	54	53	52	51	61	62	63	64	65

Tooth	85	84	83	82	81	71	72	73	74	75
Status	L	L	L	L	L	+	+	+	L	+
Calculus	0	0	0	1	0	1	0	0	0	0
Caries	1 oc	2 oc	0	0	0	0	0	0	2 oc	1 oc
Abrasion	2	2	3	4	5	5	4	3	2	2

Additionally, some not erupted permanent teeth were found. In the alveoli: 14, 13, 31, 36. Loose: 32, 15, 16, 17, 27, 26, 41, 46.

Ind. No. 213

Abrasion	1	2	2	3	4	4	4	-	2	
Caries	0	0	1 lab	0	0	0	0	-	0	
Calculus	0	0	0	0	0	0	0	-	0	
Status	+	+	+	L	L	L	L	0	L	
Tooth	55	54	53	52	51	61	62	63	64	65

Tooth	85	84	83	82	81	71	72	73	74	75
Status	+	+	+							
Calculus	0	0	0							
Caries	0	0	1 oc							
Abrasion	2	2	1							

Additionally, the following loose permanent teeth were found: 16, 13, 11, 21, 23.

Ind. No. 225

Abrasion	1	2	2	1	3	3	1	2	2	1
Caries	0	0	0	0	0	0	0	0	0	0
Calculus	0	0	0	0	0	0	0	0	0	0
Status	+	+	+	+	+	L	L	L	L	L
Tooth	55	54	53	52	51	61	62	63	64	65

Tooth	85	84	83	82	81	71	72	73	74	75
Status	+	+	+	+	+	+	+	+	L	+
Calculus	0	0	0	0	0	0	0	0	0	0
Caries	0	0	0	0	0	0	0	0	0	0
Abrasion	1	2	2	2	3	3	2	2	1	1

Ind. No. 230

Abrasion		0	0	0	0	0.5	0.5	0	0	0	0	
Caries		0	0	0	0	0	0	0	0	0	0	
Calculus		0	0	0	0	0	0	0	0	0	0	
Status		(L)	(L)	(L)	(L)	L	L	(L)	(L)	(L)	(L)	
Tooth	16	55	54	53	52	51	61	62	63	64	65	26
Tooth	46	85	84	83	82	81	71	72	73	74	75	36
Status	(+)	(+)	(+)	(+)	-	L	L	(L)	(+)	(+)	(+)	(+)
Calculus	0	0	0	0	-	0	0	0	0	0	0	0
Caries	0	0	0	0	-	0	0	0	0	0	0	0
Abrasion	0	0	0	0	-	1	1	0	0	0	0	0

Ind. No. 236

Abrasion	-	-	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	1 ap	-	3 oc	-	-	-	-	-	-	-	-	-	-	-	-
Calculus	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Status	-	-	L	0	+	x	x	x	-	-	-	-	-	-	-	-	-
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28	
Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38	
Status	x	+	x	x	+	x	x	x	x	x	x	+	+	x	x	+	
Calculus	-	1	-	-	0	-	-	-	-	-	-	1	1	-	-	1	
Caries	-	2 cej	-	-	3 cej	-	-	-	-	-	-	1 cej	0	-	-	1	
Abrasion	-	5.5	-	-	4	-	-	-	-	-	-	3	6	-	-	4	

Ind. No. 238

Abrasion		0	2	0	0	0	1	2	2	1	0	0	3	2	0	
Caries		0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Calculus		0	0	0	0	0	0	0	0	0	0	0	0	0	0	?
Status		(L)	L	(L)	L	L	L	L	L	L	L	L	L	+	(+)	-
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Status	(+)	(+)	+	(+)	(+)	0	L	+	+	+	+	+	(+)	+	(L)	(+)
Calculus	0	0	0	-	-	-	1	1	1	1	0	0	0	0	0	0
Caries	0	0	0	-	-	-	0	0	0	0	0	0	0	0	0	0
Abrasion	0	0	2	-	-	-	1	2	2	2	0	0	0	2	0	0

Ind. No. 30

Ind. No. 301-1: Tooth 27, no caries, abrasion 2; tooth 48, no caries, abrasion 1-2.

Ind. No. 301-2: Tooth 26, no caries, abrasion 2; tooth 46, no caries, abrasion 4; tooth 12, no caries, abrasion 3.

Ind. No. 301-3: Tooth 26 or 27; no caries, abrasion 6; tooth 47, no caries, abrasion 5.

Ind. No. 304

Teeth 27, 28 distally keine IP Fläche, abrasion 1.

Ind. No. 308

Ind. No. 308-1: Tooth 44, no caries, abrasion 2.+

Ind. No. 308-2: Tooth 13, no caries, abrasion 3.

Ind. No. 312

Tooth 46, no caries, abrasion 4.

Ind. No. 506

Abrasion		6														
Caries		3 oc														
Calculus		0														
Status		L														
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Status	L	L											L			
Calculus	0	1											0			
Caries	0	0											0			
Abrasion	3	6											5			

Ind. No. 910

Abrasion					1	1				
Caries					0	0				
Calculus					0	0				
Status	(L)	(L)			L	L		(L)	(L)	(L)
Tooth	55	54	53	52	51	61	62	63	64	65
Tooth	85	84	83	82	81	71	72	73	74	75
Status	(L)	(L)	(L)	(L)	L	L	(L)	(L)	(L)	(L)
Calculus					-	-				
Caries					-	-				
Abrasion					1	1				

Ind. No. 911

Abrasion	-	1		0	0	0	0		1	-
Caries	-	-		0	0	0	0		-	-
Calculus	-	-		0	0	0	0		-	-
Status	(L)	L		L	L	L	L		L	(L)
Tooth	55	54	53	52	51	61	62	63	64	65
Tooth	85	84	83	82	81	71	72	73	74	75
Status	(+)	+	(+)	?	+	+	+	(+)		
Calculus	-	0	-	-	0	0	0	-		
Caries	-	0	-	-	0	0	0	-		
Abrasion	-	0	-	-	0	0	0	-		

Ind. No. 912

Abrasion	-	-	6	6	7	5	1	5	5	-	5	-	4	-	-	-
Caries	-	-	1 cej	0	0	0	0	0	0	-	0	3	3 cej	-	-	-
Calculus	-	-	0	0	0	0	1	1	0	-	0	-	0	-	-	-
Status	?	?	+	+	+	+	+	+	+	x	+	+	+	0	?	?
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Status	x	+	+	+	+	+	x	?	?	?	L	L	L	+	+	+
Calculus	-	-	0	1	0	1	-				1	0	0	0	0	0
Caries	-	3	2 cej	2 cej	0	0	-				0	0	0	1 cej	1 oc	2 oc
Abrasion	-	-	6	6	5	2	-				1	3	4	4	6	4

Ind. No. 913

Abrasion	-	0	2	0	0	1	1	2	2	-	0	1	1	2	1	-
Caries	-	0	0	0	0	0	0	0	0	-	0	0	0	0	2	-
Calculus	-	0	0	0	0	0	1	1	1	-	0	0	0	0	2	0
Status	(L)	+	+	L	L	L	L	L	L	?	L	+	+	+	+	(L)
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28

Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Status	(L)	L	L	L	L	L	L	L	L	L	+	+	+	+	+	(+)
Calculus	-	0	0	0	0	1	1	2	1	1	1	0	0	0	0	0
Caries	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Abrasion	-	0	1	0	0	0	1	1	1	1	0	0	0	0	0	0

Ind. No. 915

Abrasion			8	5	5	8	8	7	-	8	6	8	8	-	-	4
Caries			0	0	0	-	0	0	-	-	0	0	0	-	-	1 cej
Calculus			3	2	2	-	0	3	-	-	1	1	1	-	-	0
Status	?	?	L?	L	L	L?	L	L	?	?	+	+	+	?	?	L
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28

Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Status	x	x	x	x	+	+	L?				+	+	L?	L?	L	?
Calculus	-	-	-	-	-	2	1				3	2	-	1	1	-
Caries	-	-	-	-	-	0	0				0	0	-	0	0	-
Abrasion	-	-	-	-	8	6	5				4	5	8	6	5	-

Ind. No. 916

Abrasion				1	1	1	1			
Caries				0	0	0	0			
Calculus				0	0	0	0			
Status	(L)	(L)		L	L	L	L		(L)	
Tooth	55	54	53	52	51	61	62	63	64	65

Tooth	85	84	83	82	81	71	72	73	74	75
Status	(L)	(L)							(L)	(L)
Calculus										
Caries										
Abrasion										

Ind. No. 917

Abrasion	2	3	1		1		1	-		
Caries	-	-	-		0		-	-	-	-
Calculus	-	-	-		0		-	-	1	1
Status	+	+	+	L	L		L	L	+	L
Tooth	55	54	53	52	51	61	62	63	64	65

Tooth	85	84	83	82	81	71	72	73	74	75
Status	+	+	x	x	x	x	L	+	+	+
Calculus	-	-					-	-	1	-
Caries	-	-					-	-	-	-
Abrasion	1	3					1	1	2	1

Ind. No. 919

Abrasion	1	2	1	3	1	4	-	-	3	1	2	1
Caries	0	0	0	0	0	0	-	-	0	0	0	0
Calculus	0	0	0	0	0	0	-	-	0	0	0	0
Status	L	L	L	L	L	L	?	?	L	L	L	+
Tooth	16	55	54	53	52	51	61	62	63	64	65	26
Tooth	46	85	84	83	82	81	71	72	73	74	75	36
Status	+	+	+	L	L	L	L	L	L	L	L	L
Calculus	0	0	0	0	0	0	0	0	0	0	0	0
Caries	0	0	1 oc	0	0	0	0	1ling	0	1 oc	0	0
Abrasion	1	2	1	2	3	2	2	2	2	1	1	1

Additionally, permanent teeth were found. Loose: 41 ?, 31, 32, 33, 34, 15, 14, 13, 11, 21, 22, 24, 25, 27. Developed but not erupted: 42 (+), 17 (+).

Ind. No. 921

Abrasion	-	6	7	6	6	6	7	7	7	6	6	6	6	7	7	-
Caries	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
Calculus	-	2	1	2	2	2	2	2	2	2	3	2	2	2	2	-
Status	?	+	+	+	+	+	+	+	+	+	+	+	+	+	+	?
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Status	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Calculus	0	0	0	0	0	2	2	3	3	2	3	1	0	0	1	1
Caries	2 oc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2 oc
Abrasion	3	5	6	4	4	5	6	6	6	6	5	4	4	6	5	3

Ind. No. 925

Abrasion	3	4	7	5	4	4	4	5	4	4	3	2	4	6	5	3
Caries	2 ap	0	0	0	0	0	0	0	0	0	0	0	0	0	1 cej	0
Calculus	2	3	2	2	2	2	3	2	3	3	3	1	2	2	1	1
Status	L	+	+	+	+	+	+	+	+	L	L	L	+	+	+	+
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Status	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Calculus																
Caries																
Abrasion																

Ind. No. 926

Abrasion	-	3	6	1	2	1	2	2	3	2	1	1	1	3	2	1
Caries	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
Calculus	-	0	0	0	0	0	1	0	1	0	0	0	0	0	0	-
Status	(L)	L	L	+	L	L	L	L	L	L	L	L	L	L	L	(L)
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Status	?	L	L	L	L	L	L	L	L	L	L	L	L	L	L	?
Calculus	-	0	0	0	0	1	0	1	1	0	0	1	1	0	0	-
Caries	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
Abrasion	-	1	3	5	1	1	1	2	2	1	2	2	2	3	2	-

Ind. No. 927

Abrasion				6	8											6
Caries				-	0											3 ap
Calculus				-												1
Status	a	a	x?	L?	+											L?
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Status	+	+	+	+	+		L?	x	L	L?	L	L	L	L	L	L
Calculus	1	-	-	1	1		-		1	-	0	0	1	1	1	-
Caries	-	-	-	-	-		-		0	-	1 cej	0	-	-	-	min6
Abrasion	5	5	5	3	3		8		4	8	4	3.5	4	4	4	3

Ind. No. 928

Abrasion		1	2	1	1	1	2	2	3	2	1	1	1	2	1	
Caries		-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Calculus		-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Status	(+)	+	+	+	+	L	+	L	+	+	L	L	+	+	+	(+)
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Status	(L)	+	+	+	+	L	+	L	L	L	L	+	+	+	+	(+)
Calculus		-	-	-	-	-	-	-	1	-	-	-	-	-	-	
Caries		-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Abrasion		1	2	1	1	2	1	2	2	1	2	1	1	2	1	

Ind. No. 931

Abrasion	7	6	8	6	8	7	-		8		5	8	7	7	6	
Caries	-	-	-	-	-	-	-		-		-	-	-	-	-	
Calculus	-	1	-	-	-	-	-		-		1	-	-	-	1	
Status	L	+	L	L	+	+	+	a	L	a	+	+	+	L	+	a
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Status	+	+	+	+	+	+	L	L	L	L	L	L	+	+	+	+
Calculus	1	1	1	2	2	1	1	1	1	1	1	-	-	1	1	1
Caries	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Abrasion	8	7	7	6	6	6	5	5	5	5	5	5	?	7	7	8

Ind. No. 933

Abrasion	5	-	-	-	3	4	4	4	4	4	4	4	4	-	-	-
Caries	3 cej	-	-	3	0	0	0	0	0	0	0	0	0	-	-	-
Calculus	1	-	-	-	1	2	2	1	1	1	1	1	1	-	-	-
Status	+	x	x	+	+	+	+	+	+	+	+	+	+	x	x	x
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Status	+	+	+	+	+	+	L	x	x	x			+	+	+	+
Calculus	2	2	3	2	3	3	0	-	-	-			1	1	1	1
Caries	0	2 oc					0	-	-	-			0	0	3 ap	0
Abrasion	5	4	5	4	4	4	special	-	-	-			4	5	4	3

Ind. No. 934

Abrasion	2	3					1	1	3	
Caries	0	0					0	0	0	
Calculus	0	0					0	0	0	
Status	+	L					L	L	L	
Tooth	55	54	53	52	51	61	62	63	64	65

Tooth	85	84	83	82	81	71	72	73	74	75
Status										
Calculus										
Caries										
Abrasion										

Ind. No. 935

Abrasion			6	4	5	3	2				4			5		
Caries			-	-	-	-	0				-			3		
Calculus			2	2	2	1	2				1			2		
Status	?	?	+	+	L	L	L		?	x	+	a	a	+	?	
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28

Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Status	+	+	x	x	x	L	L	L	L	L	L	L	L	+	+	L
Calculus	-	-				1	2	1	1	2	1	2	1	1	1	-
Caries	2	2				-	-	-	-	-	0	0	-	-	2	-
Abrasion	1	3				3	2	2	2	2	4	7	4	6	3	2

Ind. No. 1001

Abrasion	2	2	4	3	2	4	3	3	3	3	4	2	2	5	3	2
Caries	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1 oc	0
Calculus	0	2	1	1	1	1	1	1	1	1	2	2	2	3	1	0
Status	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28

Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Status	0	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Calculus	-	0	0	0	1	0	2	2	2	2	2	2	1	0	0	0
Caries	-	2 oc	0	0	0	0	0	0	0	0	0	0	0	0	3 oc	0
Abrasion	-	3	4	3	2	3	3	4	4	3	3	2	3	4	3	2

Ind. No. 1005

Abrasion	1	4	5	4	3	3	3	4	4	3	2	3	4	6	5	?
Caries	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	?
Calculus	1	1	3	2	2	2	1	1	1	2	2	2	2	1	1	?
Status	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	?
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28

Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Status	nd	d	+	+	+	+	+	+	+	+	+	+	+	+	+	nd
Calculus	-	?	1	1	2	3	3	3	3	3	3	2	2	1	1	-
Caries	-	?	0	0	0	0	1 f?	0	0	0	0	0	0	0	0	-
Abrasion	-	?	4	2	3	2	2	4	4	2	3	3	4	5	4	-

Ind. No. 1102

Abrasion																
Caries																
Calculus																
Status																
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Status											L(?)					
Calculus											1					
Caries											1 cej					
Abrasion											4					

Ind. No. 1103

Abrasion	2	8	8	8	8	-	-	6	-	-	-	7	6	7	8	0
Caries	1 oc	1 oc	0	0	0	-	-	0	-	-	-	0	0	0	0	0
Calculus	1	1	1	0	0	-	-	1	-	-	-	0	0	0	0	0
Status	L	L	L	+	+	x	?	L	?	?	?	+	+	L	L	L
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Status	0	0	0	0	0	0	0	x	x	L	L	L	0	0	0	?
Calculus										1	1	1				
Caries										0	0	0				
Abrasion										7	1	8				

Ind. No. 1115

Abrasion		5														
Caries		1 cej														
Calculus		1														
Status		L?														
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Status	L	L	x	x	0	0	0	x	x	0	?	?	?	x	0	0
Calculus	1	1														
Caries	1 cej	2 ap														
Abrasion	3	5														

Ind. No. 1121

Abrasion	-	5	4	5	1	1	sp	sp	-	sp	2	3	3	6	4	1
Caries		0	0	0	0	0	-	0	-	0	0	0	0	0	0	1 oc
Calculus		3	3	3	3	3	-	0	-	0	1	1	1	1	1	1
Status	0	+	+	+	+	+	?	L	?	L	+	+	+	+	+	+
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Status	+	+	+	+	+	o	o	1	1	1	+	+	+	+	+	L
Calculus	3	3	3	3	3	-	-	4	3	3	1	1	0	0	0	0
Caries	0	2 oc	3 oc	0	0	-	-	0	0	0	0	0	0	0	0	1 oc
Abrasion	3	3	3	2	2	-	-	1*	1*	1*	1	2	2	6	5	1

Ind. No. 1127

Abrasion	5	5	6	6	5	4	3	5	5	4	4	4	4	5	6	-
Caries	0	0	0	0	0	0	0	0	0	0	0	0	0	3 ap	3 ap	-
Calculus	2	2	2	2	2	2	3	1	1	2	3	2	2	2	2	-
Status	+	+	+	+	+	+	L	L	L	L	+	+	L	L	+	nd
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Status	+	+	+	L	?	L	L	L	L	?	L	+	+	+	+	L
Calculus	1	1	1	1	-	2	2	2	2	-	3	2	2	2	1	1
Caries	0	0	0	0	-	0	0	0	0	-	0	0	0	0	1li	1 oc
Abrasion	6	6	5	3	-	2	2	3	3	-	1	3	2	5	6	2

Ind. No. 1154

Abrasion		4	-	-	-	6		5	5	6	5	4	3	6		1
Caries		3 cej	3	3	3	2 cej		0	0	1 oc	0	0	0	0		1 oc
Calculus		3	-	-	-	0		1	0	0	1	3	3	3		2
Status		+	L	L	L	+	?	L	L	L	L	L	L	L		L
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Status	+	x	x	?	?	L	L	L	L	L	L	L	?	L	x	x
Calculus	0	-	-	-	-	1	2	2	2	2	1	1	-	3	-	-
Caries	1 oc	-	-	-	-	0	0	0	0	0	0	0	-	3 cej	-	-
Abrasion	3	-	-	-	-	4	4	5	5	4	4	5	-	6	-	-

Ind. No. 1208

Abrasion	1	6	6	4	4	4	5	6	6	5	3	4	4	4	4	-
Caries	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
Calculus	1	2	1	0	1	1	1	1	1	1	1	1	0	1	0	-
Status	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	nd
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Status	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Calculus	2	2	2	2	2	2	2	2	2	2	1	1	0	0	0	0
Caries	1 oc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1 oc
Abrasion	1	3	4	3	3	3	4	4	4	4	2	3	3	4	3	1

Ind. No. 1209

Abrasion	2	3	6	5	5	4		4	4	4	4	4	4	6	5	3
Caries	-	-	-	-	-	-		-	-	-	-	-	-	-	1 oc	1 oc
Calculus	1	1	2	1	1	1		2	2	2	1	1	1	2	1	1
Status	+	+	+	+	+	+	a	+	+	+	+	+	+	+	+	+
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Status	+	+	+	a	L	L	a	?	+	+	+	+	+	+	+	+
Calculus	1	1	1		2	2			3	3	3	3	3	1	1	1
Caries	-	-	-		0	-			-	-	-	-	-	-	-	2 oc
Abrasion	3	3	5		3	4			5	4	4	3	3	5	5	3

Ind. No. 1211

Abrasion	0	2	3	3	2	3	3		3	3	2	0	0
Caries	0	0	0	0	0	0	0		0	0	0	0	-
Calculus	0	2	1	0	0	0	0		0	1	1	0	-
Status	L	L	+	L	L	L	L		L	+	L	L	(L)
Tooth	16	55	54	53	52	51	61	62	63	64	65	26	27
Tooth	46	85	84	83	82	81	71	72	73	74	75	36	
Status	+	+	+	+			L	L	L	+	+	+	
Calculus	0	1	1	1			1	1	1	1	1	1	
Caries	0	0	0	0			0	0	0	0	0	0	
Abrasion	0	1	1	3			-	3	3	2	1	0	

Additionally, some not erupted permanent teeth were found. In the alveoli: 33, 32, 31, 42, 21, 23, 24, 25, 11, 13, 14. Loose: 47, 43.

Ind. No. 1212a

Abrasion					-								
Caries					-								
Calculus					-								
Status	(L)		(L)	L									
Tooth	55	54	53	52	51	61	62	63	64	65			
Tooth	85	84	83	82	81	71	72	73	74	75			
Status	(L)	(L)											
Calculus													
Caries													
Abrasion													

Ind. No. 1212b

Abrasion	-	-		-			1		-		-	
Caries	-	-		-			0		-		-	
Calculus	-	-		-			0		-		-	
Status	(L)	(L)		(L)			L		(L)		(L)	
Tooth	16	55	54	53	52	51	61	62	63	64	65	
Tooth	46	85	84	83	82	81	71	72	73	74	75	
Status			L							L	(L)	
Calculus			0							0	-	
Caries			0							0	-	
Abrasion			1							1	-	

Additionally, unerupted permanent tooth 41 was found.

Ind. No. 1213

Abrasion	1	2	2	2	3	3	2	1	1	1		
Caries	-	-	-	-	-	-	-	-	-	-	-	-
Calculus	-	-	-	-	-	-	-	-	-	-	-	-
Status	L	L	L	L	L	L	+	+	+	L		
Tooth	55	54	53	52	51	61	62	63	64	65		
Tooth	85	84	83	82	81	71	72	73	74	75		
Status	L	L	L	L	L	L	L	L	+	+		
Calculus	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-
Abrasion	1	2	1	2	3	3	2	2	1	1		

Ind. No. 1214

Abrasion	1	2	2	2		2		2	2	1
Caries	-	-	-	-		-		-	-	-
Calculus	-	-	-	-		-		-	-	-
Status	L	L	L	L		L		L	L	L
Tooth	55	54	53	52	51	61	62	63	64	65

Tooth	85	84	83	82	81	71	72	73	74	75
Status	L			L				L	L	L
Calculus	-			-				-	-	-
Caries	-			-				-	-	-
Abrasion	1			2				2	2	1

Additionally, the following loose, not erupted, permanent teeth were found: 11, 12, 13, 16, 21, 23, 26, 36, 46.

Ind. No. 1215

Abrasion	3	2	1	1	2	2	-	1	2	3
Caries	0	0	0	0	0	0	-	0	0	0
Calculus	1	1	1	0	0	0	-	0	1	1
Status	L	L	L	L	L	L	?	L	L	L
Tooth	55	54	53	52	51	61	62	63	64	65

Tooth	85	84	83	82	81	71	72	73	74	75
Status	L	L	L	L	L	L	L	L	L	L
Calculus	1	1	1	0	0	0	0	0	1	1
Caries	0	0	0	0	0	0	0	0	0	0
Abrasion	1	1	1	1	2	2	1	1	2	1

Additionally, the following loose, not erupted, permanent teeth were found: 11, 13, 16, 21, 22, 23, 31, 32, 33, 36, 41, 42, 43, 46.

Ind. No. 1216

Abrasion		-	-	-	1	1	-	-	-	-	-	-
Caries		-	0	-	0	0	-	-	-	-	-	-
Calculus		-	0	-	0	0	-	-	-	-	-	-
Status		(L)	L	(L)	L	L	?	L	(L)	?	(L)	(L)
Tooth		55	54	53	52	51	61	62	63	64	65	26

Tooth	46	85	84	83	82	81	71	72	73	74	75	
Status	(L)	(L)	L	(L)	L	+	+	+	(+)	L	(L)	
Calculus	-	-	0	-	0	0	0	0	-	0	-	
Caries	-	-	0	-	0	0	0	0	-	0	-	
Abrasion	-	-	1	-	1	1	1	1	-	1	-	

Ind. No. 1219

Abrasion							8	8	8	8	8	8				
Caries							3	3	0	1 cej	0	0	0			
Calculus							-	-	-	-	-	-				
Status							+	+	+	+	L?	L?	L?			
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28

Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Status																
Calculus																
Caries																
Abrasion																

Ind. No. 1220

Abrasion				0	0			0	0	-
Caries				0	0			0	0	-
Calculus				0	0			0	0	-
Status				(L)	(L)			(L)	(L)	(L)
Tooth	55	54	53	52	51	61	62	63	64	65

Tooth	85	84	83	82	81	71	72	73	74	75
Status	(L)		(L)				(L)	(L)		(L)
Calculus							0	-		-
Caries							0	-		-
Abrasion							0	-		-

Ind. No. 1222

Abrasion										
Caries										
Calculus										
Status	(L)	(L)	(L)	(L)	(L)	0	(L)	(L)	(L)	(L)
Tooth	55	54	53	52	51	61	62	63	64	65

Tooth	85	84	83	82	81	71	72	73	74	75
Status	(+)	(L)	(L)	(L)	0	(L)	(L)	(L)	(L)	(L)
Calculus										
Caries										
Abrasion										

Ind. No. 2038-1

Only one loose deciduous tooth (63) preserved.

Ind. No. 2049

Abrasion	-	-	-		-					-
Caries	-	-	-		-					-
Calculus	-	-	-		-					-
Status	(L)	(L)	(L)		(L)					(L)
Tooth	55	54	53	52	51	61	62	63	64	65

Tooth	85	84	83	82	81	71	72	73	74	75
Status	(L)	(L)	(L)	(L)			(L)	(L)	(L)	(L)
Calculus	-	-	-	-			-	-	-	-
Caries	-	-	-	-			-	-	-	-
Abrasion	-	-	-	-			-	-	-	-

Ind. No. 2053

Abrasion										
Caries										
Calculus										
Status		(L)			(L)					
Tooth	55	54	53	52	51	61	62	63	64	65

Tooth	85	84	83	82	81	71	72	73	74	75
Status									(L)	
Calculus										
Caries										
Abrasion										

Ind. No. 2059

Abrasion				7	8		8				7	8	7	6	3	1
Caries				-	-		-				-	-	-	2-3	3 oc	-
Calculus				-	-		-				1	1	1	2	3	-
Status				L	+		L				L	L	L	L	L	L
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28

Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Status	x	x	x	x	?	L	?	?	x	x	x	+	a	x	x	x
Calculus						-						-				
Caries						-						-				
Abrasion						8						8				

Ind. No. 2063

Abrasion				0	0	0	0			
Caries										
Calculus										
Status	(L)	(L)	(L)	L	L	L	L	(L)	(L)	(L)
Tooth	55	54	53	52	51	61	62	63	64	65

Tooth	85	84	83	82	81	71	72	73	74	75
Status		(L)	(L)	L			L	(L)	(L)	
Calculus										
Caries										
Abrasion				0			0			

Ind. No. 2066

Abrasion	0	0	0	0	0	0	0	0	0	0
Caries	0	0	0	0	0	0	0	0	0	0
Calculus	0	0	0	0	0	0	0	0	0	0
Status	(L)	(L)	(L)	(L)	(L)	(L)	(L)	(L)	(L)	(L)
Tooth	55	54	53	52	51	61	62	63	64	65

Tooth	85	84	83	82	81	71	72	73	74	75
Status	(L)	(L)	(L)	(L)	(L)	(L)	(L)	(L)	(L)	(L)
Calculus										
Caries										
Abrasion										

Ind. No. 2067

Abrasion		0	0	0	0	-	0	0		
Caries		0	0	0	0	-	0	0		
Calculus		0	0	0	0	-	0	0		
Status		(L)	(L)	(L)	(L)	(L)	(L)	(L)		
Tooth	55	54	53	52	51	61	62	63	64	65

Tooth	85	84	83	82	81	71	72	73	74	75
Status										
Calculus										
Caries										
Abrasion										

Ind. No. 2103

Abrasion	3	4	4	3	3	4	4	4	4	4	3	5	4	6	-	-	
Caries	3 ap	3 oc	2 cej	0	0	0	0	0	0	0	0	0	0	1 cej	3	-	
Calculus	0	0	1	0	0	0	0	0	0	1	1	0	0	1	-	-	
Status	L	L	L	L	+	+	+	+	+	+	+	+	+	+	L	x	
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28	
Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38	
Status	+	+	x	+	+	+	+	+	+	+	+	+	+	+	+	+	
Calculus	0	0	-	0	0	0	0	0	0	0	0	0	0	0	0	0	
Caries	1 oc	1 oc	-	0	0	0	0	0	0	0	0	0	0	0	3 oc	1 oc	3
Abrasion	3	3	-	3	3	4	3	4	4	3	4	3	3	3	-	4	-

Ind. No. 2104

Abrasion																
Caries																
Calculus																
Status	?	x	x	x	x	x	x	x	x	x	x	x	x	x	x	?
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Status	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Calculus																
Caries																
Abrasion																

Ind. No. 4028

Abrasion				5	5						5	5	5	7	6	4
Caries				0	0						0	0	0	0	0	1 oc
Calculus				0	0						0	0	0	0	0	0
Status				L	L						+	+	+	+	+	+
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Status											+	+	+	+	+	+
Calculus											0	0	0	0	0	0
Caries											0	0	0	0	0	3 oc
Abrasion											5	4	5	6.5	5	4

Ind. No. 4096

Abrasion	2	-	5	5	5	5	5	6	6	5	5	5	5	-	-	4
Caries	2 oc	3	3	0	0	0	0	0	0	0	0	0	0	3	3	2 ap
Calculus	0	-	-	0	0	0	1	1	1	1	0	0	1	-	-	-
Status	L	?	L	+	+	+	+	+	+	+	+	+	+	+	L	+
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Status	?	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Calculus		0	0	0	0	1	1	2	2	1	1	1	0	0	?	?
Caries		0	0	0	0	0	0	0	0	0	0	0	0	0	3	3
Abrasion		6	7	4	4	4	5	6	5	5	5	4	4	5	?	?

Ind. No. 4098

Abrasion	-	3	6	6	5	6	-	4	4	6	-	4	4	-	2	-
Caries	-	0	0	0	0	0	-	0	0	0	-	0	0	-	0	-
Calculus	-	1	1	2	2	1	-	2	2	2	-	2	1	-	3	-
Status	nd	+	+	+	+	+	x	+	+	+	0	+	+	x	+	nd
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Status	+	+	+	+	0	+	+	x	x	x	+	0	+	+	+	x
Calculus	1.5	1	1	1	-	1	3	-	-	-	3	-	1	2	2	-
Caries	1 oc	3 ap	0	0	-	0	2.5	-	-	-	2.5	-	0	0	0	-
Abrasion	0	5	5.5	5	-	4.5	4.5	-	-	-	4	-	2.5	3.5	3	-

Ind. No. 4099

Abrasion	-	-	6	6	-	-	8	8	8	8	8	-	6	-	7	-
Caries	-	-	0	0	-	-	0	0	0	2 cej	2 cej	-	0	3	2 cej	-
Calculus	-	-	3	2	-	-	1	1	1	1	1	?	1	-	1?	?
Status	?	?	+	+	x	0	+	+	+	+	+	+	+	L	L	?
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Status	x	x	x	x	+	+	+	+	+	0	+	+	+	+	+	x
Calculus	-	-	-	-	2	2	2	2	1	-	1	1	0	0	0	-
Caries	-	-	-	-	0	0	0	0	0	-	0	0	0	3	3 cej	-
Abrasion	-	-	-	-	5	4	5	6	6	-	6	5	4	5	3	-

Ind. No. 4171

Abrasion																
Caries																
Calculus																
Status		(L)						(L)								
Tooth	55	54	53	52	51	61	62	63	64	65						
Tooth	85	84	83	82	81	71	72	73	74	75						
Status	(L)		(L)			(L)			(L)							
Calculus																
Caries																
Abrasion																

Ind. No. 4195

Abrasion	1	2	4		3	3		5	5	4	4	3	3	4	2	1
Caries	-	-	-		-	-		-	-	-	-	-	-	-	-	-
Calculus	-	1	2		-	-		1	-	-	-	-	-	1	-	-
Status	L	L	L	?	L	L		L	L	+	+	+	L	L	L	L
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Status	L	L	L	L	L	?	L	L	L	L	+	L	L	L	L	
Calculus	-	-	1	-	-		-	1	1	-	-	-	-	-	-	
Caries	-	-	-	-	-		-	-	-	-	-	-	-	-	-	
Abrasion	1	3	4	3	3		2	3	5	5	4	3	3	4	2	

Ind. No. 4200

Abrasion	4							4								
Caries	0							0								
Calculus	0							0								
Status	L(?)							L(?)								
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Status	+	+	+	L?	L?	0	0	L	0	0	L?	L?	+	+	+	0
Calculus	0	0	0	0	0	-	-	0	-	-	0	0	0	0	0	-
Caries	0	0	0	0	0	-	-	0	-	-	0	0	0	0	0	-
Abrasion	4	6	6	5	5	-	-	4	-	-	5	6	6	6	6	-

Ind. No. 4201a

Abrasion										2						
Caries																
Calculus																
Status									L	L		L				
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Status		L	L			L								L	L	
Calculus																
Caries																
Abrasion																

Ind. No. 4202

Abrasion	4	5	7	4	3	4	5	5	5	5	4	-	5	7	5	4
Caries	3 oc	0	0	0	0	0	0	0	0	0	0	3 oc	0	0	0	3 oc
Calculus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Status	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Status	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Calculus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Caries	0	1 oc	3 oc	0	0	0	0	0	0	0	0	0	0	0	0	1 oc
Abrasion	3	4	6	5	4	4	3	4	4	3	4	4	5	6	5	3

Ind. No. 4203

Abrasion	2	2	4	3	3	4	2	3.5	3.5	2	4	3	3	-	-	-
Caries	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-
Calculus	1	2	2	1	1	1	1	1	1	1	1	1	1	-	-	-
Status	L	+	+	+	+	L	L	L	L	L	+	+	+	?	?	?
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Status	+	+	L	+	+	+	L	L	L	L	L	+	+	+	+	0
Calculus	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	-
Caries	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
Abrasion	2	3	4	3	3	4	3	4	4	3	4	2.5	2.5	4	3	-

Ind. No. 4209

Abrasion		7	7	7.5	8	8	8	8	8	8	8	8	-	-	7	4.5
Caries		1 cej	3 oc	0	0	0	0	0	0	0	0	0	-	-	0	1 oc
Calculus		1	2	0	0	0	0	0	0	0	0	0	-	-	3	1
Status		L	L	+	+	+	+	+	+	+	+	+	0	x	L	L
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Status	x	x	x	+	+	+	+	x	L	+	+	L	+	x	L	+
Calculus														-	0	3
Caries														-	1 cej	
Abrasion														-	7	

Ind. No. 6005

Abrasion																
Caries																
Calculus																
Status																
Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Status									x	x	x	x	x	x		
Calculus																
Caries																
Abrasion																

Ind. No. 6006

Abrasion										
Caries										
Calculus										
Status	(L)	(L)	(L)	(L)	L				(L)	(L)
Tooth	55	54	53	52	51	61	62	63	64	65
Tooth	85	84	83	82	81	71	72	73	74	75
Status		(L)		L			L			
Calculus										
Caries										
Abrasion										

Ind. No. 6007

Abrasion	2	2.5	4	3	4	-	1-2	4	2	2
Caries	0	0	0	0	0	-	0	0	0	0
Calculus	0	0	0	0	0	-	0	0	0	0
Status	+	L	L	L	L	x	L	+	L	+
Tooth	55	54	53	52	51	61	62	63	64	65
Tooth	85	84	83	82	81	71	72	73	74	75
Status	+	L	L	L	L	L	L	+	+	+
Calculus	0	0	0	0	0	0	0	0	0	0
Caries	0	0	0	0	0	0	0	0	0	0
Abrasion	2	2	4	3	3	4	3	4	2	2

Additionally, some not erupted permanent teeth were found. In the alveoli: 31, 36, 41, 46. Loose: 11-14, 16, 17, 21-27, 33, 34, 37, 42, 43, 44.

Ind. No. 6011

Abrasion			-	-	-				-	-
Caries			-	-	-				-	-
Calculus			-	-	-				-	-
Status			(L)	(L)	(L)				(L)	(L)
Tooth	55	54	53	52	51	61	62	63	64	65

Tooth	85	84	83	82	81	71	72	73	74	75
Status										
Calculus										
Caries										
Abrasion										

Ind. No. 6014

Abrasion										
Caries										
Calculus										
Status				(L)		(L)				
Tooth	55	54	53	52	51	61	62	63	64	65

Tooth	85	84	83	82	81	71	72	73	74	75
Status										
Calculus										
Caries										
Abrasion										

Ind. No. 6021

Abrasion										
Caries										
Calculus										
Status	(L)	(L)	-	(L)	-	-	(L)	(L)	(L)	(L)
Tooth	55	54	53	52	51	61	62	63	64	65

Tooth	85	84	83	82	81	71	72	73	74	75
Status	(+)	(L)	(L)	(+)	(L)	(L)	(L)	(L)	(L)	(L)
Calculus										
Caries										
Abrasion										

Ind. No. 6022a (Fig. 136)

Abrasion	0	0	0	0	1	2	-	1	0	0	0	0
Caries	0	0	0	0	0	0	-	0	0	0	0	0
Calculus	0	0	0	0	0	0	-	0	0	0	0	0
Status	(L)	(L)	L	(L)	L	+	-	L	L	+	(L)	(L)
Tooth	16	55	54	53	52	51	61	62	63	64	65	26

Tooth	46	85	84	83	82	81	71	72	73	74	75	36
Status	(L)	(L)	L	-	L	L	+	+	+	+	(+)	(L)
Calculus	0	0	0	-	0	0	0	0	0	0	0	0
Caries	0	0	0	-	0	0	0	0	0	0	0	0
Abrasion	0	0	0	-	1	2	2	1	0	0	0	0

Ind. No. 6022b

Abrasion											
Caries											
Calculus											
Status		(L)	(L)	(L)	(L)	(L)	(L)	(L)	(L)	(L)	
Tooth	55	54	53	52	51	61	62	63	64	65	
Tooth	85	84	83	82	81	71	72	73	74	75	
Status			(L)	(L)	(L)	(L)	(L)				
Calculus											
Caries											
Abrasion											

Ind. No. 6023

Abrasion												
Caries												
Calculus												
Status	(L)	(L)	(L)	L	L	L	L	(L)	-	(L)	(L)	
Tooth	55	54	53	52	51	61	62	63	64	65	26	
Tooth	85	84	83	82	81	71	72	73	74	75	36	
Status	(L)	(L)	(L)	(L)	(L)	(L)	(L)	(+)	(+)	(+)	(L)	
Calculus												
Caries												
Abrasion												

Ind. No. 7007

Abrasion	-	0	1	1	1	1	1	1	1	1	0	
Caries	-	0	0	0	0	0	0	0	0	0	0	
Calculus	-	0	0	0	0	0	0	0	0	0	0	
Status	(+)	+	+	+	+	+	+	+	+	+	+	
Tooth	16	55	54	53	52	51	61	62	63	64	65	26
Tooth	46	85	84	83	82	81	71	72	73	74	75	36
Status		+	+	+	+	+	+	+	+	+	+	(+)
Calculus		0	0	0	0	0	0	0	0	0	0	-
Caries		0	0	0	0	0	0	0	0	0	0	-
Abrasion		1	1	1	1	1	1	1	1	1	1	-

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ZUSAMMENFASSUNG

Pre-Hispanic human remains from Salvatierra, Llanos de Mojos, Bolivia

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Studien zu vorspanischen Populationen des Amazonasgebietes sind rar und konzentrieren sich zu meist auf die Reste der frühesten Menschen in der Großregion. Für den Südwesten Amazoniens fehlen entsprechende Studien bislang vollständig. In dieser Studie präsentieren wir die Ergebnisse einer multi-disziplinären Untersuchung der Skelettreste von 125 Individuen aus der vorspanischen Siedlung Salvatierra, die zur Casarabe Kultur gehört. Die Casarabe Kultur entwickelte sich zwischen 500 – 1400 n.Chr. im Südosten der Llanos de Mojos, im Amazonastiefland Boliviens. Befestigte Siedlungen, in deren Zentrum sich auf einer künstlichen Terrasse errichtete Plattformbauten befinden, sind charakteristisch für diese Kultur. Die Bestattung der Toten in diesen erhöhten Bereichen sowie die fast luftdichte Abdeckung durch lehmig-tonige Sedimente, führte zu einer ungewöhnlich guten Erhaltung der Skelettreste. Diese wurden bereits in den Jahren 2007 und 2008 untersucht, wobei neben klassischen osteologischen Untersuchungen auch Untersuchungen zur aDNA, Isotopen und Spurenelementen durchgeführt wurden.

SCHLAGWORTE

Amazonian archaeology, bio-anthropology, anthropometry, human remains, treponematosi, Casarabe culture, Bolivia

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Cover: H. Prümers
Fig. 1: H. Prümers
Fig. 2: H. Prümers
Fig. 3: H. Prümers
Fig. 4: H. Prümers
Fig. 5: M. Trautmann
Fig. 6: M. Trautmann
Fig. 7: M. Trautmann
Fig. 8: M. Trautmann
Fig. 9: M. Trautmann
Fig. 10: M. Trautmann
Fig. 11: M. Trautmann
Fig. 12: M. Trautmann
Fig. 13: H. Prümers
Fig. 14: M. Trautmann
Fig. 15: M. Trautmann
Fig. 16: H. Prümers
Fig. 17: H. Prümers
Fig. 18: M. Trautmann
Fig. 19: M. Trautmann
Fig. 20: H. Prümers
Fig. 21: H. Prümers
Fig. 22: M. Trautmann
Fig. 23: H. Prümers
Fig. 24: M. Trautmann
Fig. 25: M. Trautmann
Fig. 26: M. Trautmann
Fig. 27: H. Prümers
Fig. 28: M. Trautmann
Fig. 29: M. Trautmann
Fig. 30: M. Trautmann
Fig. 31: M. Trautmann
Fig. 32: M. Trautmann
Fig. 33: H. Prümers
Fig. 34: M. Trautmann
Fig. 35: M. Trautmann
Fig. 36: M. Trautmann
Fig. 37: M. Trautmann
Fig. 38: M. Trautmann
Fig. 39: M. Trautmann
Fig. 40: H. Prümers
Fig. 41: M. Trautmann
Fig. 42: H. Prümers

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