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CORONO-RADICULAR GROOVES IN A LARGE SAMPLE OF HUMAN MAXILLARY INCISORS

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ABSTRACT Corono-radicular grooves (CRGs) are developmental anomalies on maxillary incisor teeth that have both anthropological and clinical significance. Their reported prevalence varies from around 2% in modern Caucasoid populations to 18% in Chinese, although methods of classification have differed between studies. The aim of this study was to determine the frequency of occurrence and configuration of these grooves in a large sample of Caucasoid extracted permanent maxillary incisors collected in South Australia during the early 1900s (The Ramsey Smith Collection). A total of 1481 permanent maxillary incisors was examined using a dissecting microscope and classified according to tooth type and side. CRGs were scored according to their location, length, and depth. They were observed in 78 teeth (5.3%), with three teeth displaying two grooves. No significant difference in frequency occurred between central (4.7%) and lateral (5.7%) incisors, nor between right and left sides. Most of the CRGs (51.8%) were located in the mid-palatal region of tooth crowns, originating from the cingulum and terminating on the root surface less than 5.0 mm from the cemento-enamel junction (CEJ). All CRGs were less than 1.0 mm in depth. A higher proportion of CRGs was observed on the distal surface of lateral incisors (28.6%) than central incisors (9.4%). The frequency of occurrence of CRGs recorded in this study was higher than that of some previous reports, although the possibility of sampling bias in collections of extracted teeth needs to be taken into account. The relatively high frequency of CRGs on the distal surface of maxillary lateral incisors has important clinical implications, as plaque accumulation and loss of gingival attachment in this region may lead to severe localized periodontal involvement.

INTRODUCTION

Corono-radicular grooves (CRGs) are developmental anomalies that begin on the crown of the tooth and terminate on the root surface at various distances from the cemento-enamel junction (CEJ). They differ from coronal grooves, whose origin and termination points lie entirely on the crown, and from radicular grooves, that are evident on the root only. These grooves probably form by a minor infolding of the enamel organ and Hertwig's epithelial root sheath (Lee et al., 1968), similar to the development of *dens invaginatus*.

Both anthropologists and clinicians have provided descriptions of developmental grooves in the cingulum region of incisor teeth that may continue along the root. Anthropological studies have tended to focus on the condition of the visible dental crown, given that observations are usually made on skeletal specimens in which the examination of the teeth outside of the alveolus may be difficult, or on dental models of

TABLE 1. Parameters for scoring the configuration of corono-radicular grooves adapted from Kogan (1986).

Location of the groove (on the lingual surface)	mesial midpalatal distal
Point of origin	lingual fossa cingulum
Termination point (mm from the cemento-enamel junction)	0.1-4.9 5.0-9.9 ≥10.0
Minimum depth (mm)	<1.0 ≥1.0
Groove form	open closed

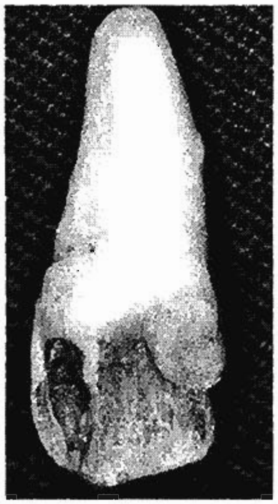

Fig 1. A midpalatal CRG on a maxillary right central incisor. The CRG originates in the lingual fossa and terminates 4.7 mm beyond the CEJ.

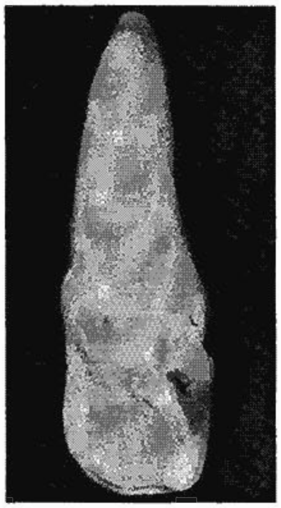

Fig. 2. A mesially located CRG on a maxillary left central incisor. The CRG originates in the lingual fossa and terminates 8.0 mm beyond the CEJ.

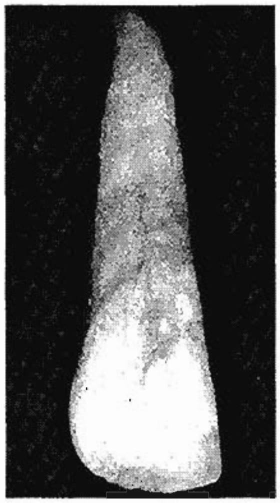

Fig. 3. A midpalatal CRG on a maxillary left lateral incisor. The CRG originates on the cingulum and terminates 4.6 mm beyond the CEJ.

Fig. 4. A mesially located CRG on a maxillary left central incisor. The CRG originates on the cingulum and terminates 6.8 mm beyond the CEJ.

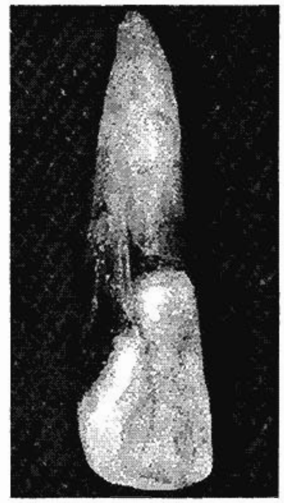

Fig 5. A distally located CRG on an upper left lateral incisor. The CRG originates in the lingual fossa and terminates 6.0 mm beyond the CEJ.

living populations. On the other hand, clinical investigations often include relatively more detailed descriptions of both coronal and radicular features due to their possible association with dental disease.

Campbell (1925) in his study of the dentition and palate of Australian Aborigines noted that a moderate amount of grooving could be seen passing over the cingulum region of maxillary incisor teeth but that the grooves were rarely deepened into marked fissures. Pedersen (1949) also illustrated grooving on the cingulum region of Eskimo maxillary incisors. Lukacs (1988) reported that 51% of maxillary lateral incisors from Neolithic Mehrgarh in Pakistan displayed "interruption grooves" but none were formed on central incisors. More recently, Turner et al. (1991) have described a scoring system for interruption grooves based on their location that was proposed initially by Turner (1967).

Pritchard (1965) was the first clinician to note that lingual grooves on maxillary incisor teeth could predispose individuals to severe localized periodontal destruction. Since then, a variety of names has been used to describe CRGs, including: palato-gingival (Lee et al., 1968; Withers et al., 1981), palato-radicular or palatal-radicular (Kogon, 1986; Mayne and Martin, 1990; Hou and Tsai, 1993), and disto-lingual (Everett and Kramer, 1972).

Reports indicate that CRGs are found usually on the lingual surfaces of maxillary incisors and occur more frequently in lateral incisors than in central incisors (Lee et al., 1968; Withers et al., 1981; Kogon, 1986; Bacic et al., 1990; Hou and Tsai, 1993). CRGs may occur occasionally on the labial surface of the crown, and more than one groove may be found on a single tooth. The presence of a CRG may also be associated with displacement of the CEJ (Kovacs, 1971). Associations have been reported between CRGs and periodontal pocket depth, plaque index, and gingival index (Withers et al., 1981; Bacic et al., 1990; Hou and Tsai, 1993).

Several papers, including that of Walker and Glyn Jones (1983), have reported an association between CRGs and inflammation of the dental pulp possibly resulting from lateral connections between the CRG and the radicular pulp canal. The difficulties associated with successful root canal treatment of teeth with CRGs have also been highlighted (Greenfield and Cambruzzi, 1986).

Although several scoring systems have been used to describe the configuration of CRGs (Kogon, 1986; Bacic et al., 1990; Turner et al., 1991; Hou and Tsai, 1993), none has provided a comprehensive description of the trait. The aim of this study was to determine the prevalence and configuration of CRGs in a large collection of Caucasoid dried extracted maxillary incisors and to compare our results with published data.

MATERIALS AND METHODS

A total of 1481 permanent maxillary incisors obtained from a large collection of Caucasoid dried extracted teeth (the Ramsey Smith Collection, gathered in South Australia during the early 1900s) were examined by one of us (SR).

The maxillary incisors were categorized as either central or lateral using the criteria proposed by Jordan and Abrams (1992).

With the use of a dissecting microscope the teeth were classified as showing a CRG or not. The configuration of the CRGs, all of which occurred on the lingual surface, was then recorded with a modified form of Kogon's (1986) scoring system (Table 1) using a stereo light microscope and digital calipers.

The location of the groove on the lingual surface was identified as being in the mesial, midpalatal, or distal third of the crown. CRGs were recorded as originating either in the lingual fossa or on the cingulum. The point of termination was recorded as the distance (measured to the nearest 0.1 mm) from the CEJ to the termination of the CRG on the root surface. Depth was judged to be shallow (<1.0 mm) or deep (≥1.0 mm), and grooves were assessed as being open or closed tubes.

Examiner reliability was determined by re-scoring 10.0% of the entire sample, and also by scoring all teeth recorded as displaying CRGs a second time. The percentage concordances for repeated scoring were then determined. Concordance for identification of teeth as non-grooved was 98.6%, and for grooved was 96.3%. For CRG location the concordance was found to be 95.1%, while concordances for the point of origin and the point of termination were 84.1% and 86.4%, respectively.

Chi-square analyses were used to compare frequencies of occurrence of CRGs between right and left sides, and between central and lateral incisors. Associations between CRG location and tooth type were also tested using chi-square analysis. Average lengths of CRGs were compared between central and lateral incisors using a t-test. Statistical significance was set at the 5% probability level.

RESULTS

CRGs were observed in 78 of the 1481 teeth (5.3%). Three of these teeth had two grooves each, giving a total of 81 grooves. Figures 1-5 provide examples of the different types of expression of CRGs observed. The sample also included 23 teeth with coronal grooves terminating at the CEJ and five teeth with radicular grooves originating from the CEJ. These were not included in the analysis as they did not represent true CRGs. Displacement of the CEJ associated with a CRG was observed occasionally.

The distribution of CRGs amongst the four groups of incisors is shown in Table 2. No significant differences in frequencies of CRGs were noted between

TABLE 2. Frequency and distribution of corono-radicular grooves.

Tooth	Number of teeth examined (N)	Number of teeth without grooves (n)		Number of teeth with grooves (n)	
	N	n	%	n	%
12	398	379	95.2	19	4.8
11	294	279	94.9	15	5.1
21	348	331	95.7	15	4.3
22	443	414	93.5	29	6.5
Sum	1481	1403	94.7	78	5.3

12 is maxillary right lateral incisor. 11 is maxillary right central incisor. 21 is maxillary left central incisor. 22 is maxillary left lateral incisor

TABLE 3. The number (n) and percentage (%) of corono-radicular grooves in each category.

Category	Parameter	n	%
Location of CRGs	Mesial	22	27.2
	Midpalatal	42	51.8
	Distal	17	21.0
Origin of CRGs	Lingual fossa	29	35.8
	Cingulum	52	64.2
Termination point (mm from CEJ)	0.1-4.9	58	71.6
	5.0-9.9	23	28.4
	≥10.0	0	0.0

TABLE 4. Means, standard deviations (SD), and ranges of the lengths of corono-radicular grooves from the cemento-enamel junction to the point of termination on the root surface (mm).

Tooth	$\bar{X}$±SD (mm)	Range (mm)
12	3.7±1.96	0.7-7.6
11	4.2±2.13	0.8-9.3
21	4.2±2.30	0.3-8.0
22	3.8±2.17	0.7-8.5

Abbreviations are the same as those in Table 2.

right and left central incisors (5.1% vs 4.3%), right and left lateral incisors (4.8% vs 6.5%), or lateral and central incisors (5.7% vs 4.7%). Most of the CRGs (51.8%) were located in the mid-palatal region of tooth crowns, with most (64.2%) originating on the cingulum and most (71.6%) terminating on the root surface less than 5 mm from the CEJ (Table 3).

A statistically significant association was found between CRG location mesiodistally and tooth type ($p<0.05$). A higher frequency of CRGs was observed in the distal region of the lingual surface of lateral incisors compared with central incisors (28.6% vs 9.4%), whereas a higher frequency of mesially located CRGs was observed in central incisors compared with lateral incisors (40.1% vs 18.4%).

The average length of CRGs from the CEJ was 4.1 mm (range 0.3 - 9.3 mm) with no significant difference between central and lateral incisors (Table 4). The depth of all CRGs was less than 1.0 mm. No closed tube CRGs were found.

DISCUSSION

The CRGs could be scored with high reliability on two separate occasions. However, differences were encountered in some instances when CRG expression was faint or in cases for which establishing origins and terminations (including CRGs originating midway between the cingulum or lingual fossa region and CRGs located at the mesial or distal borders of the cingulum) was difficult.

The presence of CRGs in modern populations has been reported to vary from 1.9% in Americans (Everett and Kramer, 1972) to 18.1% in Chinese (Hou and Tsai, 1993). Brabant (1971) reported the prevalence of CRGs to be 12% to 21% in a sample of maxillary incisors from the Megalithic period.

The observed prevalence of true CRGs in our study (5.3%) was higher than most previous findings in modern populations. Our results are, however, in agreement with previous studies (Withers et al., 1981; Kogon, 1986; Bacic et al., 1990; Hou and Tsai, 1993) that have noted a higher prevalence of CRGs in maxillary lateral incisors than in central incisors. The findings may reflect real differences in frequencies between different human populations. However, consideration of other factors that may account for the differences is important. Examples of such factors are sampling bias associated with scoring extracted teeth compared with direct intra-oral assessment, use of models or skeletal material, difficulty in observing faint CRGs, and variations in scoring methods between studies.

Scott and Turner (1997) have reported world variation in the occurrence of interruption grooves in maxillary lateral incisors. They comment on the paucity of comparative data available, noting low frequencies (10-20%) in Sub-Saharan African and Sahul-Pacific groups, intermediate frequencies (20-40%) in Western Eurasia and Sunda-Pacific groups, and high frequencies in Sino-Americans (45-65%). The estimated frequencies of CRGs in our sample of Caucasoid teeth are much lower than those of Scott and Turner, most probably because of differences in the scoring systems used. The classification system of Turner et al. (1991) may include interruption grooves that do not extend down the root, whereas we only scored true CRGs, i.e., those that began on the crown and terminated on the root at various distances from the CEJ. For this reason establishment of the precise basis for scoring grooves on incisor teeth before attempting to make comparisons of frequencies between different groups is important.

CRGs form a potential site for accumulation of dental plaque that is inaccessible to self-care. This favors the development of localized inflammation of gingiva and loss of the attachment of the periodontal ligament. However, not all grooves will cause periodontal breakdown (Withers et al., 1981; Kogon, 1986).

CRGs may also provide the dentist with diagnostic and treatment difficulties (August, 1978). Symptoms of irreversible inflammation of the dental pulp in seemingly healthy teeth may relate to the presence of deep CRGs and movement of bacterial products through small lateral canals (Walker and Glyn Jones, 1983). Deep CRGs or associated CEJ displacement may also create restorative problems for the dentist.

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DENTAL ANTHROPOLOGY OF THE NEOLITHIC RUSSIAN FAR EAST: I EURASIAN RUSSIA

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ABSTRACT Dental morphological trait frequencies of Neolithic Russian Far East burials are more similar to those of Neolithic Central and Western Siberia than to percentages found in contemporaneous European Russians and Ukrainians. Yet, archaeological evidence fails to indicate a close relationship between the Neolithic Russian Far East and Central and Western Siberia cultures. The Neolithic Far East sample is also dentally and culturally more like coastal prehistoric burials and present-day Eskimo and Chukchi samples from Chukotka than like non-coastal peoples of the Russian Far East.

INTRODUCTION

The oldest Russian Far East human remains found to date have been excavated from typologically Neolithic burials at Boisman 2, which is located south of Vladivostok (Fig. 1).

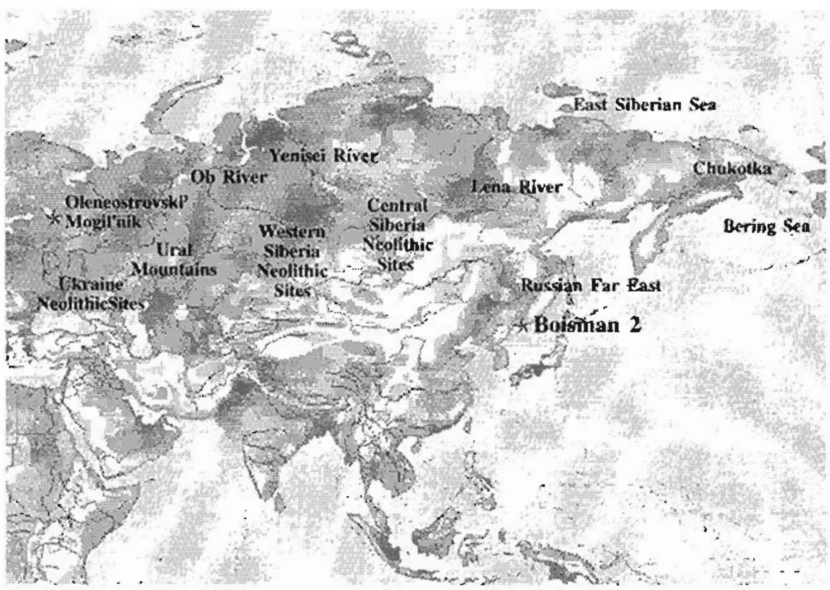

Fig. 1. Map showing the locations of Boisman 2 and the other Neolithic sites discussed in the text.

Boisman 2 is situated beside the Ryazanovka River and named after Boisman Cove on the coast of the Sea of Japan. The site contained a shell mound which covered a cemetery and the shallow foundation pit of a dwelling with a central hearth (Semin, personal communication, 1993).

I have used the dental morphological trait data from the Boisman burials to examine two temporal issues within Eurasian Russia: 1.) the relationship of the Neolithic people of Boisman 2 to the Neolithic population of Siberian and European Russia and Ukraine and 2.) the regional continuity in the Russian Far East and Chukotka during the past 6,000 years. Figure 1 has a map showing the locations discussed herein.

SAMPLES

The Boisman 2 sample consists of the permanent teeth from eight individuals. The best preserved skull and dentition came from burial 1A. (Figs. 2, 3, and 4). Comparative Neolithic dental samples represent Central Siberia, the region between the Yenisei and the Lena Rivers (18 Kitoi, three Isakovo, and ten Serovo culture cemeteries on the Angara and Upper Lena Rivers, Lake Baykal, and Trans-Baykal, which is south and southeast of Lake Baykal); Western Siberia, the land between the Ural Mountains and the Yenisei River (seven cemeteries and three kurgans west and southeast of Novosibirsk); Ukraine (nine cemeteries on the Dnieper River and three cemeteries in southern Ukraine); and Russia (Oleneostrovski' Mogil'nik, a typologically Mesolithic cemetery on Oleni' Ostrov in Lake Onega). A list with each comparative sample that I examined, its location, and the place of curation is given in Haeussler (1996).

The dates of the Neolithic comparative samples, except those of Kitoi Culture (7,610±210 BP in Trans-Baykal to 6,780±80 BP on the Angara River), fall within the temporal range of Boisman 2, which spans 6,010±220 BP to 5,160±140 BP (Popov, 1995:28). Isakovo stage specimens date from 5,320±160 to 5,000±70 BP on the Angara River. Serovo materials date between 5,170±180 BP on the Angara and 3,340±100 BP on the Lena rivers (Mamonova and Sulerzhitski', 1989:Table 3). The Western Siberia samples are materials from typologically Neolithic cemeteries and kurgans. Dates of Ukrainian Neolithic samples range from 8,065±20 BP to 5,245±30 BP (Potekhina and Telegin, 1995). In Russia the recent dates for Oleneostrovski' Mogil'nik (9,910±80 to 5,700±80 BP) (Mamonova and Sulerzhitski', 1990:Table 3; Price and Jacobs, 1990) correspond to dates for Boisman 2.

Fig. 2. Skull from burial 1A at Boisman 2 (AMH 60379.13).

Prehistoric coastal samples represent the Old Bering Sea Culture cemeteries of Ekven and Uelen on the Bering Sea in Chukotka. My frequencies differ slightly from those reported by others (Zubov, 1969; Turner, 1985) because they represent different collections. My data were obtained from observations on materials in the Museum of Anthropology, Moscow State University. Zubov's and Turner's observations were made on the collection at the Laboratory of Plastic Reconstruction in Moscow. Contemporary costal Eskimos and Chukchi from the Bering Sea in Chukotka are represented by published data (Dubova and Tegako, 1983:170-171, Figure 1, Tables 1-5,11-13,16). Contemporary non-coastal peoples from the Russian Far East are represented by published data (Khaldeyeva, 1979:Table 96) for indigenous inhabitants of Khabarovsk Kray. They are Nanay, Oroch, Nivkh, Orimif, Udegey, Ulch, and Evenk. Trait frequency data for contemporary Russians (Aksyanova et al., 1979:Tables 2-8) and Ukrainians (Segeda, 1979:Tables 11-19) have been included to provide a non-Asiatic dental morphological perspective to the trait frequency comparisons.

METHODS

For studying the dental morphological traits I use the Arizona State University and Dahlberg standard reference plaques. Descriptions of the traits and their rankings are given in Dahlberg (1956) and Turner et al. (1991). For evaluation of the dental morphological relationships between the Neolithic burials from

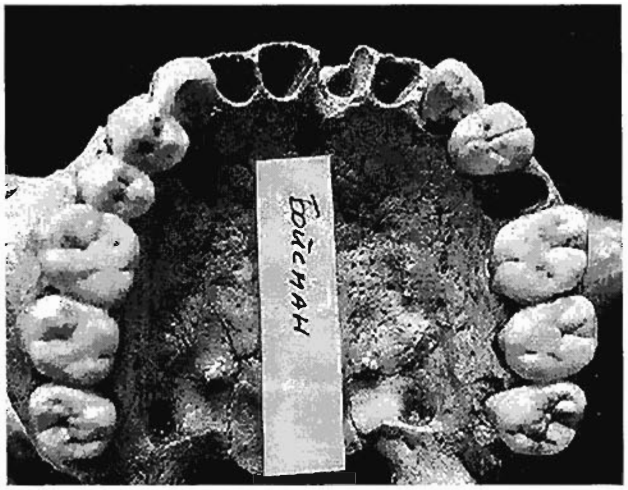

Fig. 3. Boisman 2 maxilla with teeth from burial 1A (AMH 60379.18). This dentition, like all of the Boisman II specimens, lacks canine distal accessory ridge, Bushman canine morphology, maxillary first molar cusp 5, Carabelli's trait (the left antimere has a pit which is barely visible), second molar hypocone reduction (grades 0 to 2), and third molar parastyle. The right canine has a marked (grade 4) *tuberculum dentale.* The third molars are present in this specimen, but are congenitally absent in 28.6% of the Boisman II dentitions. All of the teeth, including the left canine, are anchored in the sockets without preservative. The left canine (7.2 mm mesio-distal, 7.8 mm bucco-lingual dimensions) is smaller than the right antimere (7.9 mm mesio-distal, 8.4 mm bucco-lingual dimensions).

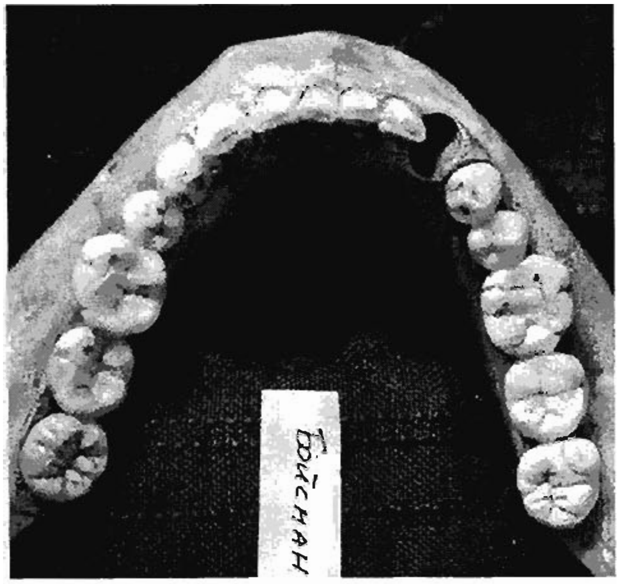

Fig. 4. Mandible with teeth from burial 1A at Boisman 2 (AMH 60379.32). This specimen is similar to the other Boisman dentitions in the presence of first molar distal trigonid crest and lack of congenitally absent central incisors, with presence of first molar deflecting wrinkle, and cusp 7.This specimen also has multiple lingual cusps on the right first premolar (barely visible in the photograph), protostylid pits (grade 1) on both first molars, five cusped first molars (lacking sixth cusp), and X-groove pattern on the left and Y-groove pattern on the right second molars, but lacks third molar congenital absence. The right third molar has well expressed (grade 3) cusp 7 and a large (grade 7) protostylid. All teeth are firmly set in their sockets and lack preservative. The left canine (7.0 mm mesio-distal and 6.5 mm bucco-lingual dimensions) is smaller than both maxillary canines shown in Figure 3.

Boisman 2 and other Neolithic samples I compared frequency data for the 31 dental morphological traits for which all of the samples have data (Table 1). For comparison of Boisman 2 with the prehistoric and contemporary samples, I used the seven traits for which all of the contemporary samples have data. Appendix 1 also gives the grades that I used to signify trait presence or absence. My percentages for traits whose data were taken from Russian publications were calculated using a system of rank matchings developed with A.A. Zubov (Haeussler et al., 1988; Haeussler and Turner, 1992; Haeussler, 1996).

Statistical analysis of the trait frequencies employed the MMD (Mean Measure of Divergence). Through angular transformation with adjustments for sample sizes and modification to determine probability the MMD evaluates frequencies of non-metric traits to determine the similarity of samples. The lower the MMD value, the greater the probability of a relationship between two groups being compared. With large samples and many traits the MMD is statistically significant (0.05 level) when the value the MMD is greater than twice the value of its standard deviation (Berry and Berry, 1967; Green and Suchey, 1976; Sjøvold, 1973).

RESULTS AND DISCUSSION
1. BOISMAN 2 AND THE NEOLITHIC SAMPLES
Dental Morphological Trait Frequency Comparisons

The results of the dental morphological trait frequency comparisons of the Neolithic samples show that the Boisman 2 sample is dentally more like the Central and Western Siberian samples than those from Russia and Ukraine. The order of Neolithic samples in increasing distance from Boisman 2 is Isakovo and Kitoi

TABLE 1. Morphological dental trait sample sizes (N) and percentages (%).

	Winging UI1		Shoveling UI1		Double Shovel UI1		Peg-shape UI2		Congenital Absence UI2		Interruption Groove UI2		*tuberculum dentale* UI2		Bushman Canine	
Samples	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Neolithic																
Far East																
Boisman 2	1	0.0	2	50.0	2	50.0	2	0.0	2	0.0	1	100.0	1	100.0	3	0.0
Central Siberia																
Kitoi Stage	5	0.0	25	76.0	27	77.8	26	0.0	34	0.0	24	16.7	24	100.0	20	5.0
Isakovo Stage	2	0.0	10	100.0	11	81.8	12	8.3	13	0.0	11	36.7	8	75.0	4	0.0
Serovo Stage	3	33.3	10	90.0	8	62.5	9	0.0	21	0.0	9	11.1	5	100.0	5	20.0
Western	3	0.0	9	55.5	12	66.7	12	0.0	24	0.0	9	44.4	5	100.1	10	10.0
Ukraine	26	3.8	51	9.8	55	41.8	59	1.7	100	0.0	35	8.6	33	67.7	57	3.5
Russia	3	0.0	15	0.0	13	7.7	21	0.0	26	0.0	13	0.0	10	100.0	13	0.0
Prehistoric																
Chukotka																
Ekven	2	0.0	2	100.0	2	50.0	3	0.0	15	6.7	3	33.3	2	50.0	1	0.0
Uelen	3	0.0	7	28.6	2	50.0	1	0.0	15	6.7	6	33.3	3	100.0	10	20.0
Contemporary																
Far East																
Nanay			108	51.1			108	7.4								
Oroch			53	62.3			60	5.0								
Ulch			85	61.3			100	5.0								
Nivkh			65	65.0			60	3.3								
Udegey			35	51.2			34	0.0								
Evenk			49	34.7			50	4.0								
Chukotka																
Chukchi			328	68.3			207	3.9								
Eskimos			82	63.4			77	3.9								
Russia			1130	2.7			711	1.0								
Ukraine			1489	1.6			61	1.6								
Trait Presence	Presence		2-6/0-6		1-6/0-6		Peg-shape		Absence		Presence		1-6/0-6		1-3/0-3	

	Distal Accessory Ridge UC		Uto-Aztecan Premolar UP1		1 Root UP1		Cusp 5 UM1		Carabelli's Trait UM1		Enamel Extension UM1		Hypocone Reduction UM2		3 Roots UM2	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Neolithic																
Far East																
Boisman 2	1	0.0	3	0.0			3	0.0	4	25.0	3	66.7	3	0.0	2	50.0
Central Siberia																
Kitoi Stage	17	17.6	31	0.0	1	100.0	14	7.1	29	13.8	23	56.5	26	3.8	3	33.3
Isakovo Stage	4	25.0	10	0.0			13	69.2	18	4.4	15	46.7	13	23.1	1	0.0
Serovo Stage	5	20.0	20	0.0	5	60.0	15	53.3	32	25.0	31	25.8	24	4.2	3	33.3
Western	8	0.0	14	0.0	5	60.0	15	53.3	4	25.0	3	66.7	3	0.0	2	50.0
Ukraine	40	27.5	69	0.0	15	60.0	52	59.6	117	8.5	82	4.9	87	24.1	16	37.5
Russia	11	0.0	10	0.0	1	0.0	15	0.0	4	25.5	19	0.0	18	44.4	4	100.0
Prehistoric																
Chukotka																
Ekven			7	0.0	4	75.0	1	0.0	13	7.7	13	30.8	7	42.9	2	50.0
Uelen	6	0.0	15	0.0	6	83.3	4	0.0	21	4.8	29	51.7	27	44.4	9	22.2
Contemporary																
Far East																
Nanay									74	27.0			38	89.5		
Oroch									47	23.0			24	66.7		
Ulch									76	23.3			39	89.7		
Nivkh									47	17.1			25	88.0		
Udegey									26	27.3			19	73.1		
Evenk									46	34.8			27	85.0		
Chukotka																
Chukchi									208	20.7			79	49.4		
Eskimos									50	18.0			38	28.9		
Russia									1277	23.8			569	46.9		
Ukraine									1395	43.0			1037	40.3		
Trait Presence	2-6/0-6		Presence		1 Root Only		1-5/0-5		2-7/0-7		2.0 mm or Longer		0-2/0-5		3 Roots	

TABLE 1. (continued)

Samples	Parastyle UM3 N	Parastyle UM3 %	Congenital Absence UM3 N	Congenital Absence UM3 %	Congenital Absence LI1 N	Congenital Absence LI1 %	1 Root LC N	1 Root LC %	Lingual Cusps LM2 N	Lingual Cusps LM2 %	Enamel Extension LM1 N	Enamel Extension LM1 %	Distal Trigonid Crest LM1 N	Distal Trigonid Crest LM1 %	Deflecting Wrinkle LM1 N	Deflecting Wrinkle LM1 %
Neolithic																
Far East																
Boisman 2	2	0.0	4	50.0	2	0.0	1	100.0	5	20.0	4	75.0	4	100.0	1	0.0
Central Siberia																
Kitoi Stage	17	5.9	33	9.1	32	0.0	4	100.0	17	0.0	43	29.5	12	33.3	9	44.4
Isakovo Stage	1	0.0	13	15.4	20	0.0	3	100.0	8	25.0	20	35.0	17	23.5	16	31.2
Serovo Stage	8	0.0	28	7.1	21	4.8	4	100.0	3	0.0	22	13.6	9	22.2	7	85.7
Western	19	0.0	28	10.7	31	0.0	6	100.0	14	35.9	39	35.9	12	8.3	13	7.7
Ukraine	84	1.2	115	0.9	110	0.9	8	75.6	52	17.3	109	10.1	35	0.0	43	13.9
Russia	19	0.0	27	3.7	26	0.0	5	100.0	11	45.4	30	10.0	14	0.0	16	12.5
Prehistoric																
Chukotka																
Ekven	8	0.0	20	5.0	14	0.0	6	100.0	18	0.0	14	71.4	2	0.0	1	0.0
Uelen	11	0.0	30	6.7	14	21.4	3	100.0	10	0.0	23	43.5	8	0.0	7	28.6
Contemporary																
Far East																
Nanay													60	31.7	60	21.0
Oroch													35	20.0	35	17.4
Ulch													50	17.5	50	38.4
Nivkh													41	22.2	41	9.0
Udegey													20	20.0	20	25.0
Evenk													30	13.3	30	33.3
Chukotka																
Chukchi													145	17.9	145	26.9
Eskimos													21	14.3	22	27.3
Russia													784	1.8	785	6.1
Ukraine													1769	2.40	1326	4.7
Trait Presence	1-6/0-6		Absence		Absence		1 Root Only		2-9/0-9		2.0 mm or Longer		Present		2-3/0-3	

Samples	Cusp 7 LM1 N	Cusp 7 LM1 %	Protostylid LM1 N	Protostylid LM1 %	3 roots LM1 N	3 roots LM1 %	6 cusps LM1 N	6 cusps LM1 %	4 cusps LM2 N	4 cusps LM2 %	Y-Groove LM2 N	Y-Groove LM2 %	1 Root LM2 N	1 Root LM2 %	Congenital Absence LM3 N	Congenital Absence LM3 %
Neolithic																
Far East																
Boisman 2	6	0.0	6	16.7	3	0.0	4	25.0	5	0.0	6	16.7	4	100.0	7	28.6
Central Siberia																
Kitoi Stage	27	3.7	21	81.3	4	50.0	25	28.0	22	36.4	30	33.3	4	25.0	46	17.4
Isakovo Stage	21	9.5	24	54.2	3	0.0	17	11.7	16	6.2	14	14.3	3	33.3	17	17.6
Serovo Stage	19	15.8	19	42.1	7	0.0	18	27.8	14	50.0	22	27.3	8	12.5	31	12.9
Western	29	0.0	32	71.9	4	0.0	20	20.0	24	33.3	35	25.7	5	80.0	46	13.0
Ukraine	104	5.8	122	34.4	5	0.0	47	19.1	77	64.9	118	35.6	8	37.5	157	2.5
Russia	17	0.0	31	45.2	1	0.0	17	5.9	18	77.2	274	45.1	6	50.0	33	0.0
Prehistoric																
Chukotka																
Ekven	8	0.0	11	27.3	5	20.0	6	0.0	6	0.0	10	30.0	3	0.0	19	31.6
Uelen	18	5.5	16	18.7	18	11.1	14	21.4	14	28.6	20	30.0	13	15.4	33	18.2
Contemporary																
Far East																
Nanay	60	3.3					57	18.0	32	0.0						
Oroch	35	0.0					35	8.6	35	8.6						
Ulch	50	0.0					53	26.3	31	6.4						
Nivkh	41	0.0					37	15.6								
Udegey	20	0.0					18	50.0								
Evenk	30	10.0					33	15.1	26	28.0						
Chukotka																
Chukchi	96	4.2	96	3.1			194	19.4	127	21.3	103	38.8				
Eskimos	23	26.1	21	0.0			36	41.7	16	18.8	15	13.3				
Russia	811	3.3					400	4.8	601	84.0	469	7.3				
Ukraine	1353	3.7					1456	1.7	1264	86.0	1264	6.9				
Trait Presence	2-4/0-4		1-7/0-7		3 Roots		6 Cusps		4 Cusps		Y/X,Y,+		1 Root		Absence	

TABLE 2. MMD values for Neolithic comparisons with Boisman 2 given in increasing order of magnitude.

	MMD	Standard Deviation	Significant
Central Siberia Isakovo	-0.160	0.145	no
Central Siberia Kitoi	-0.029	0.120	no
Western Siberia	-0.020	0.119	no
Central Siberia Serovo	-0.001	0.130	no
Russia	0.308	0.124	yes
Ukraine	0.324	0.107	yes

Based on 31 traits (all except 1 rooted maxillary first molar). Data are given in Table 1.

TABLE 3. MMD values for prehistoric and contemporary comparisons with Boisman 2 given in increasing order of magnitude.

	MMD	Standard Deviation	Significant
Ekven	-0.136	0.366	no
Eskimos	0.089	0.203	no
Chukchi	0.127	0.190	no
Oroch	0.186	0.202	no
Uelen	0.227	0.234	no
Udegey	0.252	0.209	no
Nanay	0.273	0.195	no
Evenk	0.369	0.203	no
Ulch	0.376	0.194	no
Nivkh	0.382	0.199	no
Russia	0.780	0.188	yes
Ukraine	0.825	0.187	yes

Based on seven traits: shoveling maxillary central incisor, Carabelli's trait on the maxillary first molar, hypocone reduction on the maxillary second molar; distal trigonid crest, deflecting wrinkle, cusp 7, and six cusps on the mandibular first molar. Data are given in Table 1.

cultures from Central Siberia, the pooled sample from Western Siberia, Serovo Culture from Central Siberia, Russia, and Ukraine (Table 1).

The major factor accounting for the greater similarity of Boisman 2 to the Siberian Russian than to the European Russian and Ukrainian samples is that Boisman 2 has moderate to high frequencies of traits reported in people with Asian physical features (Dahlberg, 1945, 1963; Hanihara, 1969; Zubov, 1979; Turner, 1983; Scott and Turner, 1997). Boisman 2 teeth have shovel-shape (50.0%) and double shovel-shape (50.0%) on the maxillary central incisor, no reduction of the maxillary lateral incisor (peg-shape) (0.0%), and a low percentage of reduction of the hypocone (0.0%) on the maxillary second molar (Table 1). In the mandible Boisman 2 teeth have the distal trigonid crest (100.0%), six cusps (20.0%), and the protostylid (16.7%) on the first molar; an absence of the four-cusped mandibular second molar; and a high percent of upper and lower jaws without the third molar (congenital absence) (50.0% in the maxilla, 28.6 % in the mandible) (Table 1).

Material Culture Comparisons

In spite of the biological relationship between Boisman 2 and Neolithic Siberia indicated by the MMD values, comparison of archaeological materials from the Neolithic burials fails to indicate a close cultural relationship. Each Neolithic culture, including Boisman 2, is unique. As can be seen in Table 3, not a single archaeological attribute, including, location, number and position of the skeleton, ocher, or type of grave goods, is common to Boisman 2 and all of the comparative cultures.

For example, Boisman 2 and the Central Siberian cemeteries were situated adjacent to a large body of water (Okladnikov, 1950:116-411:passim; Semin n.d.; Michael, 1958; Popov, 1995; Mamonova and Sulerzhtski', 1989:passim), whereas Western Siberian cemeteries and kurgans were not routinely near water (Polos'mak,1989a,b:passim). Boisman 2 cemetery is associated with the Boisman habitation site (Popov, 1995:passim; Semin n.d.). In contrast the Central Siberian Kitoi, Isakovo, and Serovo cemeteries lack evidence of a domestic site (Okladnikov, 1950:116-411:passim; Michael 1958), while Western Siberia cemeteries were sometimes located near a dwelling place (Molodin, 1977:passim).

The type of grave and the number and position of the skeletons also varied among the Neolithic cemeteries. Boisman 2 burials were in a shell midden (Popov, 1995:passim; Semin, n.d.), but Central and Western Siberian burials were in a pit or kurgan (Okladnikov, 1950:116-141:passim; Michael; 1958; Polos'mak, 1995a,b; Molodin, 1977:passim). At Boisman 2 one or two skeletons were found in a grave, yet Kitoi graves had one, two, three, and many skeletons. In contrast Western Siberian kurgans (Protoka) had many skeletons that were secondary burials, whereas cemeteries (Krutikha) had one skeleton to a grave (Molodin, 1977:passim; Polos'mak, 1995a,b:passim). The position of the Boisman 2 skeletons also differed from those of the other Siberian Neolithic burials. Males were situated on their sides with legs bent, and the females were face down with knees bent (Popov, 1995:passim; Semin, n.d.), while Central and Western Siberian cemeteries contained extended skeletons whose legs and spines were in various positions (Molodin, 1977:passim; Polos'mak, 1995a,b:passim).

All of the cemeteries had personal grave goods, but they differed from one culture to another. For example, Boisman 2 burials contained decorations (bracelets and pendants) made from bone and shells (Popov, 1995:25), whereas Kitoi burials contained pendants made from canine teeth, polished nephrite adzes, and calcite rings. Isakovo burials had characteristic ceramics, while Serovo burials had cylindrical shell beads and perforated elk teeth (Okladnikov, 1950:116-411; Michael, 1958). Western Siberia grave goods included pendants (a fox canine at Krutikha) (Molodin, 1977:26) as well as ceramic fragments (Protoka) (Polos'mak, 1989:15-16). Ocher was present in one grave (burial 4) at Boisman 2, while being usual in Central Siberia Kitoi burials, but seldom found in Isakovo and Serovo burials (Okladnikov, 1950:116-411 passim; Michael, 1958), and not in reported in Western Siberia cemeteries and kurgans (Molodin, 1977:passim; Polos'mak, 1989:passim).

Stone and bone tools also differed from one region to another and reflect coastal and riverine subsistence in the Far East and Central Siberia, respectively. For example, Boisman 2 burials had a quiver, arrows, fish hooks, harpoons, and bone needles (Popov, 1995; Semin, nd). Central Siberia Kitoi burials had composite fish hooks and harpoons in addition to daggers with inserts. Isakovo burials had a dagger (Okladnikov, 1950:116-411; Michael, 1958). However, Serovo burials contained a composite bow and polished adzes (Okladnikov, 1950:116-411; Michael, 1958). In contrast to the Far East and two of the Western Siberia cultures, Western Siberia burials (Krutikha) contained stone choppers, axes, knife-shaped blades, knives, scrapers, arrow heads, and stone and bone points (Molodin, 1977:26, Table 7; Polos'mak, 1989:15-16).

Boisman 2 had a non-utilitarian object, a crescent-shaped pendant thought to be a zoomorphic figure, which differed from the other Neolithic Siberian zoomorphic figures. For example, Central Siberia Kitoi burials had elk-head figures and Serovo graves had stone fish (Okladnikov, 1950:116-411 passim; Michael, 1958), yet only one Western Siberian cemetery (Krutikha) had a figure (a bone bird) (Molodin, 1977:Table 7).

The one cultural parallel between Boisman 2 and the Siberian Neolithic material remains is evidence of violence, which in turn may indicate some social stress. I found an unhealed 6.8 mm cut mark on the mandible inferior to the first and second molars of a subadult from burial 3B and one of many stone arrow points embedded in vertebrae in

Table 4. Comparison between Boisman 2 and Neolithic Central and Western Siberia Burials.

	Far East		Central Siberia		Western Siberia
	Boisman 2	Kitoi	Isakovo	Serovo	Pooled Sample
Proximity to water	Boisman Bay	Angara River, Upper Lena River, Lake Baykal, Selenga River	Angara River	Angara and Lena Rivers	None
Habitation site	Yes	None found	None found	None found	Sometimes
Pit	Shell midden	Oval or rectangular pit, without stone lining or covering			Kurgans (Protoka), Cemeteries (Krutikha) pit
Single/ multiple skeletons	Single & multiple	Single, double, triple, several			Kurgans multiple Cemeteries single
Body position	Males on side with knees bent, females face down with knees bent	Extended on back or on side with legs flexed, head to northeast or southwest	Extended, occasionally with flexed legs	Extended, occasionally with flexed legs.	Kurgans (Protoka) secondary burials. Cemeteries (Krutikha) extended on back.
Personal grave goods	Decorations made from bones and shells, quiver, arrows, fish hooks, harpoons, bone needles	Polished nephrite adzes, calcite rings, boar tusk pendants, daggers with inserts, harpoons, composite fishhooks with hole for a barb	Special ceramics, dagger	Composite bow, polished adzes, ceramic shards, cylindrical shell beads, perforated elk teeth	Fox canine pendant, ceramic fragments, stone choppers, axes, knife-shaped blades, knives, scrapers, arrow heads, and stone and bone points
Red Ocher	Burial 4	Yes	Rare	Rare	None
Zoomorphic figures in burial	Crescent-shaped pendant out of white stone	Elk head figures		Stone fish	Bone bird figure (Krutikha)
Additional features	Arrow in a vertebra, multiple arrows, cut mark in mandible as evidence of violent death	Lokomotiv: many skeletons without skulls, many with evidence of violent death			

Compiled from Okladnikov (1950: 116-411:*passim*), Michael (1958), Mamonova and Sulerzhitski' (1989, 1991:*passim*), Mamonova and Basili'ski' (1991: *passim*), (1977: *passim*), Polos'mak (1989a,b), Popov (1995:*passim*), Semin (n.d.).

Burial 1A. Violent deaths also occurred in the Central Siberian Kitoi Culture Lokomotiv cemetery (Mamonova and Bazali'ski', 1991:*passim*). Since Kitoi Culture predates Boisman 2, the explanation may lie in parallel social situations, such as those related to cultural and subsistence related stresses suggested (Nuzhnyi, 1990; Balakan and Nuzhnyi, 1995) in Mesolithic Ukraine refugia.

Conclusions

Analysis of dental morphological trait frequencies suggests that Neolithic Russian Far Eastern people at Boisman 2 and Central and Western Siberians were more closely related than were Boisman and contemporaneous people in Ukraine and European Russia. Differences in material culture remains fail to support close cultural relationships between Neolithic Russian Far East and Central and Western Siberian cultures. Therefore, the biological relationship among the Neolithic Russian Far East and Siberian peoples was likely through an ancient common biological ancestor.

2. BOISMAN 2 AND THE PREHISTORIC AND CONTEMPORARY SAMPLES

Dental Morphological Trait Frequencies

The results of the MMD comparisons of dental morphological trait frequencies show that the Boisman 2 sample is more similar to the prehistoric coastal Ekven and Uelen and contemporary Eskimo and Chukchi samples than to all of the non-coastal samples except Oroch (Table 2). The observation of the similarity with the Chukchi agrees with that of Chikisheva and Shpakova (1995:36), whose study was based on cranial measurements. The least like the Boisman 2 sample dentally are contemporary Russians and Ukrainians, whose high MMD values reflect the vast geographical, temporal, and dental morphological trait frequency differences (Table 1) between contemporary Russians, Ukrainians, and Neolithic Russian Far Easterners.

Material Culture Comparisons

The salient cultural feature that parallels the MMD values is the mode of subsistence. The Boisman 2 sample is dentally more similar to the maritime samples than to the non-maritime samples. For example, the coastal prehistoric Ekven and Uelen samples were excavated from Old Bering Sea Culture cemeteries, which contained artifactual remains indicating subsistence on sea mammals and a rich material culture that included artfully crafted objects for obtaining them (Arutiunov et al., 1964a,b; Arutiunov and Fitzhugh, 1988). Historically, Eskimos and coastal Chukchi inhabited Chukotka and lived a maritime subsistence, although Chukchi are also known to have herded reindeer (Batalden and Batalden, 1993; Kolga et al., nd).

None of the non-coastal peoples presently has a maritime lifeway. All six of the indigenous peoples (Evenk, Nanay, Oroch, Nivkh, Udegey, and Ulch) are historically semi-sedentary fishers and seasonally migrational hunters. The Ulch and the Nivkh have also been known to hunt sea animals along the coast. The Evenk, a mobile people who hunt and raise reindeer as well as fish, are the only peoples to live in mountainous sections of the taiga and tundra (Batalden and Batalden, 1993; Kolga et al., nd).

On the question of regional continuity in the Russian Far East, these observations on dental morphological frequencies and culture can be interpreted in one or all of three ways. First, the Neolithic maritime population may have remained in place over the last 6,000 years, with genetic drift accounting for the changes in dental trait frequencies. Second, non-maritime adapted Evenk, Nanay, Nivkh, Oroch, Udegey, and Ulch with Asian dental traits, but with frequencies dissimilar to those of the Neolithic coastal people, could have moved into the Russian Far East and replaced some of the descendants of the aboriginal marine-adapted people. Third, sampling error may be leading to an over-interpretation of the data, because some of the broad ranges in frequencies result from small sample sizes.

Conclusions

The Neolithic peoples who were buried at Boisman 2 are dentally more similar to people buried in the prehistoric sites of Ekven and Uelen and to present day Eskimos and Chukchi than to contemporary people living in the Russian Far East. The people buried at Boisman 2, Ekven, and Uelen, and contemporary Eskimos and Chukchi all had a maritime cultural adaptations, suggesting some continuity of the maritime peoples through time.

SUMMARY and CONCLUSIONS

Dentally, the Russian Far East Boisman 2 sample is the most like Neolithic Central and Western Siberia samples. The cultural uniqueness of Boisman 2 and the dental anthropological similarity suggest the possibility that they and the Neolithic Central and Western Siberians were descended in a parallel manner from a common biological, but not cultural, ancestor. The Boisman 2 sample is dentally and culturally more similar to prehistoric marine-adapted inhabitants of the Bering Sea coast and present day Eskimos and Chukchi than to contemporary non-maritime peoples of the Russian Far East. This finding indicates both biological and cultural continuity of the maritime peoples over the past 6,000 years.

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BOOK REVIEWS

ODONTOLOGISCHE VERWANDTSCHAFTSANALYSE (in German) [ODONTOLOGICAL KINSHIP ANALYSIS]. By Kurt W. Alt. Stuttgart, Ulm: Gustav-Fischer-Verlag, 1997. 331 pp. ISBN 3-437-25248-8. $52.00, Dm 98.

Teeth are, next to bone, usually the best preserved remains in prehistoric anthropological material and in any other type of macerated contemporary human material. Due to their morphology on macroscopical and microscopical levels, as well as their molecular structure, teeth store an abundance of information useful for detailed anthropological research. So, to search for details to enable us to perform kinship analysis using dental material was necessary and rewarding.

Kurt W. Alt has recently presented a well written book densely packed with valuable facts, morphometrical data, schematic drawings, and practical examples covering the topic of odontological kinship analysis. The author begins with a treatise dealing with the meaning of kinship analysis. He also discusses the difficulty in defining the term kinship. Kinship analysis cannot not simply be done by study of biological relationship. Realized social relations must be regarded as well. A separate chapter covers general formal genetics and special dental genetics. Four other chapters give a catalog of characteristic features of teeth and deal with variable characteristics within the normal range and with anomalies of the teeth. In addition, dentally aberrant features in conjunction with craniofacial dysplasia syndromes and epigenetic odontological marks are described.

After the prerequisites have been extensively described, an extra chapter deals with the odontological kinship analysis, itself. Here, the meaning of each single finding and factor, evaluated regarding its probability within the web of analytical statistics, leads to a probable kinship relation. Kurt W. Alt gives several examples of his method applied to real prehistoric populations in an extra chapter. Finally, he discusses the potentials and limits of this method.

Kurt W. Alt has established a comprehensive system of kinship analysis which makes use of the abundance of odontologically recordable features. This is useful for prehistorical analysis of biological and sociological reconstructions of populations as well as for contemporary forensic medical evaluations. I only wish that this valuable book were available in English, and not only in German, because it deserves to be read by a worldwide population of researchers in anthropology and forensic medicine.

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DIE EVOLUTIONE DER ZÄHNE: PHYLOGENIE, ONTOGENIE, VARIATION (in German). Edited by Kurt W. Alt and Jens C. Türp. Berlin, Chicago, London/Sao Paulo, Tokyo, Moscow, Prague, Warsaw: Quintessenz Verlags-GmbH paperback, 1997. 764 pp. ISBN 3-876-5259-0X. $110.00, Dm 198 (paper).

This voluminous and comprehensive book, written in the German language, covers a wide field of odontology by dealing with the complex subject of the evolution of the teeth with particular emphasis on phylogenetic, ontogenetic, and morphological variations. Not including the introduction, the text is arranged in seven major parts: 1) theoretical fundamentals of evolution, 2) phylogeny, 3) functional and constructional morphology, 4) odontogenesis, 5) phylogenesis and ontogenesis of the mandibular joint, 6) population studies and dental anthropology, and 7) archaeozoology. Each part contains several articles written by different authors. The profundity of these articles varies.

The first part contains four articles. K.W. Alt and J.C Türp report on comparative odontology and dental anthropology. Their article gives a general overview of the international research in this field and provides information on important new literature. The second article deals with the historic development of odontology and dental anthropology (K.W. Alt), and gives perspectives for further scientific research. In the third article U. Wolf informs the readers about the interactions between ontogenesis and phylogenesis. However, although this contribution takes a very serious approach and is an important contribution to the field, the information is not very specific to the evolution of the teeth. W.F. Gutmann, who wrote the fourth article, gives us the theory of the Frankfurt Model. The principles of the construction of the organism are discussed and explained according to the current views of evolution. The drawings in this article are very clear and informative.

The second part has four articles. T. Bollinger describes the development of the mammals on the basis of the fossil record. The next three articles are closely connected. M. Morlo reports on the phylogenesis of the teeth in vertebrates. In two articles W. Henke and H. Rothe deal with the phylogenesis of the non-human primates and the hominids. Both articles have been diligently and thoroughly researched and include results of recent work. However, the quality of some line drawings (e.g. fig. 3, page 283; fig. 35, page 338) could be improved.

The third part, which deals with functional and constructional morphology, contains four contributions. Using very clearly arranged, impressive line drawings, W.F. Gutmann shows how the evolution of some of the morphological constructions (e.g. branchia, central nervous system, jaws, and teeth) took place in different chordata. H.-U. Pfretzschner discusses the biomechanics of the dental enamel. This relatively short, but important, contribution is very well presented. T. Martin conscientiously describes the microstructure of the dental enamel in mammals. This article is illustrated by line drawings and very good quality black and white photographs which clearly represent the different structures of the dental enamel. The last article of this part is another contribution from H.-U. Pfretzschner. It deals with the adaptation of dental morphology to nutrition in recent and fossil mammals. This instructive article gives a reliable view on the different kinds of dentitions, but includes only a few citations.

The fourth part, whose subject is odontogenesis, contains the most contributions in this volume. J.C. Türp and K.W. Alt review well known methods and features and report on the basic knowledge of odontogenesis with emphasis on topography, terminology, and classification. G.-H. Schumacher describes the macroscopic morphology of human teeth and R.J. Radlanski presents the micromorphological aspects in human teeth. Both articles summarize well known results. However, R.J. Radlanski presents his creative theory on the structure of the enamel, which is convincingly demonstrated by excellent scanning electron microscopic photographs. Structure, shape, size, and number of the human teeth influenced by genetics are outlined by W.R. Harzer. The development of human teeth in the fetus age is summed up by R.J. Radlanski. The last article of this part, written by H.S. Duterloo, deals with the development of human teeth after birth and describes their eruption and the secondary dentition.

The fifth part, which contains information on the phylogenesis and ontogenesis of the mandibular joint, consists of only two articles. J.C. Türp, K.W. Alt, and G.-H. Schumacher report on the phylogenetic development of the mandibular joint, whereas J.C. Türp, A. Obrez, and R.J. Radlanski discuss the anatomy and the odontogenesis of the human mandibular joint.

Three articles, all written by K.W. Alt, make up the sixth part of this volume, whose subject is population studies and dental anthropology. The first of these articles, which only cut into the subject, deals with categories and concepts of dental anthropological studies. The second article gives a general and relatively brief view on odontological analyses in populations. The third article is rather theoretical. It represents an attempt to combine theory with practical use and emphasis on the differentiation between human populations through the use of dental characteristics.

The last part of this book, entitled Archaeozoology, could be regarded as an addendum. It consists of only one article, which was written by S. Pichler. This contribution is a very brief, but worthwhile, introduction into dental remains excavated at archaeological sites.

This comprehensive book is helpful for students and scholars of anthropology and anatomy. All articles are accompanied by comprehensive literature. The printing of the book is more or less fine, but the quality of the binding is poor. In summary, this is a very useful book. It combines all features dealing with dental anthropology and contains much interesting information and specific details. The editors carried out a careful selection among the various topics of dental anthropology.

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SOUTH ASIA: INDIA AND SRI LANKA. HOMINID REMAINS, AN UP-DATE N°8. Edited by Kenneth A.R. Kennedy and Alison A. Elgart. General editors Rosine Orban and Patrick Semal. Bruxelles, Belgium: Royal Belgium Institute of Natural Sciences and Direction de l'Enseignement supérieur et de la Recerche Scientifique de la Communauté Française de Belgique, 1998. 96 pp. ISBN 2-87047-021-5 (paper).

This volume is the latest addition to the updating of CATALOGUE OF FOSSIL HOMINIDS (Oakely and Campbell 1967; Oakley et al., 1971, 1975). For the most part the book has new information that builds on that originally reported by Kennedy et al. (1975a,b) in Part III of the original series (Oakley et al., 1975).

This book contains data for eight sites in India and four sites in Sri Lanka versus information for 13 sites in India and five in Sri Lanka in Kennedy et al. (1995). The reason given for the differential is that the purpose of the book is an update. Sites which lack new data and whose remains are no longer thought to be hominid have been omitted. In contrast sites with recently discovered Middle Pleistocene (Hathnora in the Narmada Valley) and early Holocene materials (Damdama and Mahadaha in Uttar Pradesh) have been added. Especially interesting to dental anthropologists is the number of teeth and their provenance, institutes of curation, and bibliographic references that are given for six sites in India and four sites in Sri Lanka.

The textual format of the book is similar to that set out for the original series (Oakley and Campbell, 1967). Under each site catalogued is a listing of information, such as location, hominid remains, and bibliographic references. SOUTH ASIA: INDIA AND SRI LANKA and the preceding seven books in the updated series have a major improvement over the three volumes of the original series: a textual heading for each item in the outline of data for each site. The headings for the data in the books of the original series were numerically coded, with the codes explained in the introduction. In the updated series the reader no longer has to remember the meanings of 18 codes in order to decipher the information.

Although SOUTH ASIA: INDIA AND SRI LANKA is a small book (14.5 cm by 20.5 cm, 96 pages) and is bound in paper, I heartily recommend it to Dental Anthropology Association members for their own libraries. I also suggest that members encourage their university and institute libraries to purchase this book. Interested individuals may contact Rosine Orban at the Laboratory of Anthropology, Belgian Academy of Natural Sciences, 29 rue Vautier, B-1000 Brussels, Belgium.

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DENTAL ANTHROPOLOGY AT ARIZONA STATE UNIVERSITY

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Dental anthropology at Arizona State University (ASU) has a long history. In addition to the Arizona State University Dental Anthropology System (ASUDAS) having been largely developed here, the editor of *Dental Anthropology* and secretary-treasurer of the Dental Anthropology Association work at Arizona State. Students and faculty also have the advantage of being able to use the Dahlberg Pima casts which are curated in the department. Many prominent dental anthropologists have or have had some affiliation with ASU in that past. Numerous ASU faculty and students still have interest in the field.

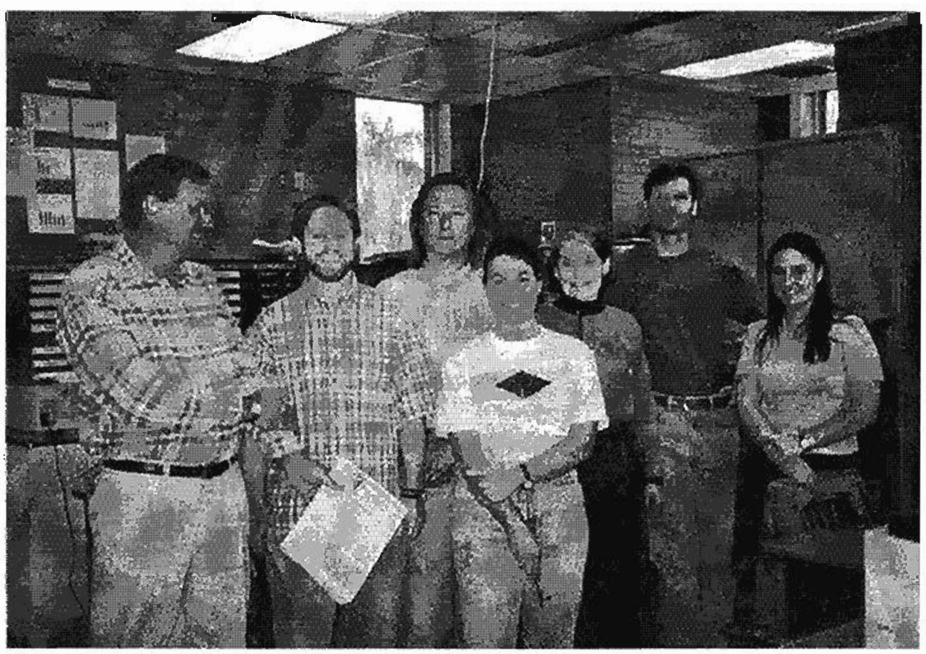

Fig. 1. From left to right Christy G. Turner II, Joshua Lipschultz, Stephen Reichardt, Anna Konstantatos, A.M. Haeussler, Scott Burnett, and Alma Adler gather in front of the A.A. Dahlberg Collection of Pima Indian Dental Casts.

Christy G. Turner II has worked for three decades studying dental morphology, variation, and genetic relationships around the world. He is currently a Regents' Professor at ASU and a member of the editorial board of *Dental Anthropology*. His main research interests lie in the peopling of the world and population migrations. He is presently working on many projects including analysis of the ancient Indians of Nevada from Wizard Beach and Shaman Cave and new finds of human remains in Siberia.

Donald Morris is now a retired professor emeritus at ASU. His work and contributions to dental morphology include research on the Uto-Aztecan premolar, canine mesial ridge (Bushman canine), and angular measurements of teeth.

G. Richard Scott is retired from the University of Alaska Fairbanks and is now an adjunct professor at ASU. His main interests concern dental morphology, genetics, and population studies. The populations in which he has been the most interested include the Southwestern United States, the Arctic, and the Norse in the North Atlantic. He is an editor of *Dental Anthropology*.

A.M. Haeussler deals with the dental anthropology of prehistoric Russian, Ukrainian, Caucasus, and Central Asian populations relative to intra- and inter-regional relationships, including those pertaining to the peopling of the New World. She is an adjunct professor of anthropology at ASU and has been the editor of *Dental Anthropology* for the past ten years.

Diane Hawkey has returned from a position as a visiting assistant professor of biological anthropology at SUNY-Binghamton for the 1998-99 academic year and continues to maintain research ties with Binghamton as an adjunct assistant professor of biological anthropology. Her current interests in dental anthropology include dental morphological variation of South Asians with an emphasis on clarifying the role played by early populations of India, Sri Lanka and Southeast Asia in the peopling of the world and forensic anthropology. One of the founding members of the Dental Anthropology Association, in past years she has been secretary-treasurer of the Dental Anthropology Association and an editor of *Dental Anthropology*.

Salah Al-Abbasi focuses his research on materials from cemeteries in Jordan. His interests lie in oral pathology and determination of archaeological questions about diet.

Alma Adler's interests are in the dental morphology of the Finns. Her research concentrates on determining genetic affinities. She is currently an editor of *Dental Anthropology*.

Shara Bailey works with Middle and Late Pleistocene human dental discrete morphology. She uses the ASUDAS and expands it to deal with phylogenetic problems in the later Pleistocene. She has also been secretary-treasurer of the Dental Anthropology Association and an editor of *Dental Anthropology*.

Scott Burnett wrote his thesis on maxillary premolar accessory ridges (MxPAR). He continues to work on rare dental morphological variants and congenital defects of the dentition and skeleton. He also is interested in the effects of dental wear on morphological trait scoring and analysis.

Anna Konstantatos' current project deals with dental pathology. She is investigating a Roman-era burial ground on the island of Cepalonia, Greece.

Christine Lee is working on a paper in conjunction with Scott Burnett and Christy Turner. It deals with a systematic study of a feature called the facial talon cusp. This trait has been reported for years and is sporadically distributed around the world, but has never been systematically described before.

Lorrie Lincoln-Babb has been analyzing the teeth of different prehistoric burial populations for contract archaeology firms in Arizona for over five years and is presently involved with the dental analysis of burials being excavated from Hohokam sites in Arizona. She is completing a dental morphological analysis of Yaqui dentitions from casts she collected in Sonora, Mexico.

Joshua Lipschultz is writing a paper with Christy Turner on the debate over Nubian continuity. This project, for the first time, brings geographically and temporally relevant extra-African Southern Levantine data to this debate.

Stephen Reichardt's interests concern the dental morphology and genetic relationships of Iroquoian Woodland populations of Southern Ontario, as well as the dental morphology of Polynesian and Melanesian populations. He is beginning his third year as the secretary-treasurer of the Dental Anthropology Association.

Much research is being done in dental anthropology at Arizona State University. It covers many topics from the effects of dental wear to pathology to determining genetic relationships. Students and faculty are studying several areas of the world including Europe, Asia, Central Asia, India, North America, and the Middle East. ASU would also like to thank Thelma Dahlberg for her continuing help and contributions concerning the Dahlberg casts.

REPORT FROM THE EDITOR OF DENTAL ANTHROPOLOGY

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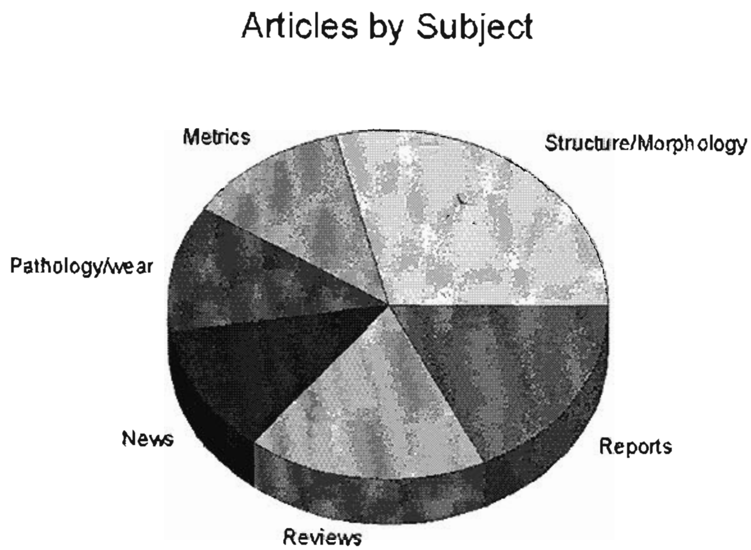

Fig. 1. Topics of articles published in Dental Anthropology during the past year.

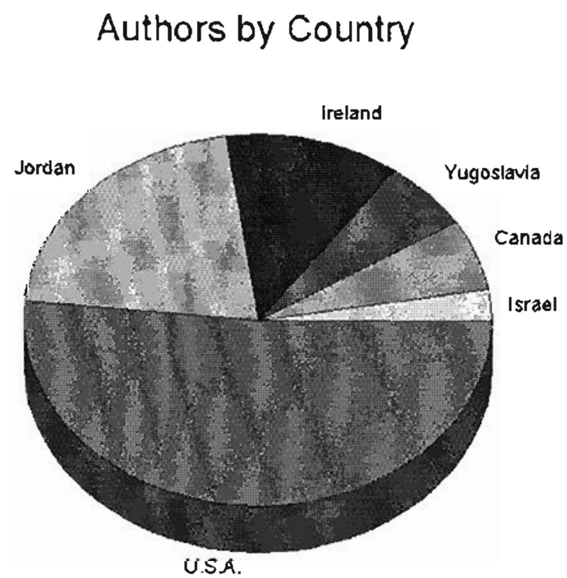

Fig. 2. Geographic distribution of authors whose work has been published in *Dental Anthropology* within the last year.

RETROSPECT

In order to have an answer when asked about the types of materials that *Dental Anthropology* publishes, I have reviewed some data that represent the journal during this past year. Four issues of *Dental Anthropology* were published during the preceding twelve months. These are Volume 12:2-3, a double issue, and numbers 1 and 2 of Volume 13

Articles ranged from one to ten pages in length, with the average being 4.5 pages. Articles dealing with structure and morphology predominated (27.8%), followed by news, reviews, and reports (16.7% for each) (Fig. 1). Articles on dental metrics and pathology/tooth wear were the least frequent (11.1%) of all. Authors represent six countries in the Americas (U.S.A. 51.5%, Canada 6.1%), Europe (Ireland 12.1%, Yugoslavia 6.1%), and the Middle East (Jordan 21.2%, Israel 3.0%) (Fig. 2).

During this year C. Loring Brace, Kazuro Hanihara, John Lukacs, Daris Swindler, Grant Townsend, and Christy G. Turner II have made up the Editorial Board, which reviews manuscripts prior to publication. David Gantt prepared the lists of recent publications of interest to dental anthropologists. Alma Adler and G. Richard Scott were assistant editors, who proofread each issue before it was sent to the printer. Adler also assisted in preparing the issues for mailing and in contacting current and potential DAA members. Throughout the preparation of each issue Stephen Reichardt updated the membership/mailing list and monitored the amount of funds available for printing.

During the past year, the Department of Anthropology at Arizona State University has continued to be a vital element in our work. The department has paid for mailing of copies to members within the U.S.A., when we have used bulk mail. It has also provided the mailing envelopes and a place for both the editor and secretary-treasurer to work.

PROSPECT

For the upcoming year Dental Anthropology has expanded the list of editors to include Deborah Guatelli-Steinberg, University of Oregon, as book review editor. The Editorial Board has also been increased so that every manuscript will be read by at least two reviewers. The new board members are Edward Harris of the University of Tennessee, Simon Hillson of the University of London, Kenneth A.R. Kennedy of Cornell University, Richard Koritzer of the Smithsonian Institution, John Mayhall of the University of Toronto, and Phillip Walker of the University of California Santa Barbara. The journal also plans to increase in length. Association members are invited to submit manuscripts and to encourage colleagues and students to do so.

GUIDELINES FOR CONTRIBUTORS TO *Dental Anthropology*

Dental Anthropology uses the following guidelines:

1. Manuscripts of articles and other correspondence should be sent to the editor, A.M. Haeussler, Department of Anthropology, Arizona State University Box 872402, Tempe, Arizona 85287-2402, U.S.A. Books for review and book reviews should be sent to Debbie Guatelli-Steinberg, Department of Anthropology, University of Oregon, Eugene, Oregon, 97403, U.S.A.
2. Dental Anthropology follows a style that is similar to that used in the *American Journal of Physical Anthropology* and published in Volume 108, Number 1, pages 131-135 (1999). Abbreviations of journal names follow those found in *Index Medicus*, although unusual and non-English language titles are spelled out. The complete names of journals are also given in the section on recent publications. Individuals who do not have access to the journal can obtain a reprint of the guide by requesting one from the publisher, Wiley-Liss, Inc., 605 Third Avenue, New York, New York 10158-0012, U.S.A. Answers to individual questions about manuscripts can be obtained by contacting the editor of *Dental Anthropology*. The current issue of Dental Anthropology follows the approved style and has examples of many cases of format, especially those of tables, figures, and textual and bibliographic citations.
3. Each manuscript should typed or printed with a laser printer and be submitted as an original and two additional copies for review. The copies, including those of the illustrations, can be xeroxes if they are clear.
4. Manuscripts, except those dealing with reviews and news, should have a title page listing the title and the running title, the name(s) of the author(s), and the name(s) of their institute(s). The remainder of the manuscripts should consist of an abstract, text (usually with an introduction, materials and methods, results, discussion, conclusion, summary), and a bibliography. Tables, figures, figure legends, and appendices should occupy separate pages.
5. Copies of manuscripts on diskette are welcomed, although manuscripts, including illustrations, must still be submitted as printed copy. Dental Anthropology uses *Word Perfect 6.1*© on a DOS platform that can run on Windows 95©.
6. Manuscripts are reviewed by members of the editorial board. In cases of specialized topics, manuscripts are reviewed by a specialist in the subject of the manuscript.

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