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Limits and Regularity of Morphological Variations in Our Species: Ecological Correlations between Craniofacial Measurements and Environmental Variables

Yuji Mizoguchi
Physical Anthropologist
E-mail: y-mzgc@asahi.email.ne.jp

Abstract The main purposes are to confirm the limits and regularity of among-group variations in the craniofacial morphology of *Homo sapiens sapiens*, and, if possible, to determine some of the causes for the regularity. As regards the among-group variation limits, it was found that the principal component (PC) scores for the mean vectors of craniofacial measurements in almost all the samples were located within the ±2 standard deviation ranges of the within-group PC scores based on a single sample. This finding suggests some complicated system or factors controlling the coordination between substructures of the skull (or the body). The principal component analyses (PCAs) of among-group correlations between craniofacial measurements clearly indicate the existence of significant common factors, namely, the robust evidence for regularity in the inter-population variations of craniofacial morphology. In the PCAs of among-group correlations between craniofacial measurements and environmental variables, it was found that cranial breadth, upper facial height, bizygomatic breadth, and nasal height tended to be larger in colder regions of higher latitudes; that basi-bregmatic height and nasal breadth tended to be larger and, inversely, minimum frontal breadth tended to be smaller in the regions more distant from Ethiopia and of lower latitudes where average precipitation was higher and average temperature was also relatively high; and that cranial length and cranial base length tended to be larger in ancient times (for the past 7,000 years). These findings, especially on temperature, precipitation and humidity, were interpreted as the results of our evolutionary adaptation to environments. Path analyses, together with PCAs, suggest the existence of unknown factors for every craniofacial measurement dealt with here. In conclusion, the purposes of the present study were partly achieved. But we must still collect more data of various environmental factors, natural and artificial (cultural, social, etc.) and ancient and modern, to clarify the causality for the formation process of our morphology.

Key words: *Homo sapiens*, Skull, Adaptation, Genetic drift, Limb bones, Temperature, Precipitation, Humidity, Chronological age, Latitude, Great circle distance, Principal component analysis, Bootstrap method, Rank correlation, Path analysis

Contents

Introduction

We can judge whether it is human or not by glancing at its morphology. This is probably because there are limits and some regularity in the morphological variations of the animal called human being. The ultimate aim of the present author is to understand the mechanism of evolutionary formation of our body structure. As a step to achieve the ultimate aim, it is attempted in the present study to confirm the limits and regularity of among-group variations in the craniofacial morphology of *Homo sapiens sapiens*, and, if possible, to determine some of the causes for the regularity of among-group variations, i.e., for the among-group covariations between craniofacial measurements.

As regards the within-group covariations of morphological traits, a lot of studies have been carried out. For example, Howells (1957, 1972, 1973), Kanda and Kurisu (1967, 1968), Kanda (1968), and Brown (1973), using multivariate statistical methods, found that there are some common factors controlling the craniofacial morphology. Furthermore, Mizoguchi (1992, 1994, 1995b, 1996, 1997, 1998a, d, 1999, 2000a, 2001, 2002, 2003a, b, 2004a, b, 2005, 2007a, b, 2008, 2009, 2013a) carried out a series of principal component analyses (PCAs) of within-group correlations between cranial and postcranial measurements mainly to elucidate the causes of brachycephalization on the premise that population differences are extensions of individual differences, as stated by Howells (1973). As a result, he found several common factors suggesting that, while cranial breadth has no consistent associations with any postcranial measurements, cranial length is significantly associated with many postcranial measurements, such as vertebral body size, costal chord, pelvic widths, and limb bone lengths and thicknesses; and considered that the variation in cranial length may, in part, be related to the degree of development of skeletal muscles or body size and, besides, that the form of the maternal pelvic inlet may be another important determinant of neurocranial form.

Common factors extracted from PCAs or factor analyses are, however, usually interpreted as, for example, a cranial length factor, a lower face factor, etc. according to the properties of the original variables which are strongly correlated with the common factors in question. Such analyses do not inform us whether the common factors extracted are pleiotropic genes, common environmental factors, or a composite of them unless any candidates of causes for the variations of biological characters under consideration are included in the data sets to be analyzed.

Recently, however, from another angle, molecular biology made it possible for us to know the correspondence of some morphological characters with gene loci on chromosomes. Dorus et al. (2004) compiled a list of 27 genes demonstrated to play important roles in the nervous system including the brain, and discussed the evolution of the human brain. Coussens and van Daal (2005) found that a single-nucleotide polymorphism (htSNP g.8592931G->C) in the gene *FGFR1* (fibroblast growth factor receptor 1) had a significant negative correlation with the cephalic index for all of four populations, i.e., so-called Caucasian, Asian, Australian Aboriginal, and African American populations. Evans et al. (2005) maintain that the gene *Microcephalin* (*MCPH1*) regulates brain size and has evolved under strong positive selection in the human evolutionary lineage. Mekel-Bobrov et al. (2005) state that the gene *ASPM* (abnormal spindle-like microcephaly associated) is a specific regulator of brain size, and that its evolution was also driven by strong positive selection in the lineage leading to *Homo sapiens*. Liu et al. (2012), using almost ten thousand individuals of European descent, identified five independent genetic loci (at 1p36.23-p33, 2q35, 3q28, 5q35.1, and 10q24.3) associated with different facial phenotypes. The candidate genes involved with these five loci are *PRDM16* (PR domain containing 16), *PAX3* (paired box 3), *TP63* (tumor protein p63), *C5orf50* (chromosome 5 open reading frame 50), *COL17A1* (collagen, type XVII, alpha 1). Liu et al. contend that their finding at *PAX3* influencing the position of the nasion replicates a genome-wide association study of facial features independently performed by Paternoster and others in 2012. Shaffer et al. (2016) observed genome-wide significant associations for cranial base width at 14q21.1 and 20q12, for intercanthal width at 1p13.3 and Xq13.2, for nasal width at 20p11.22, for nasal ala length at 14q11.2, and for upper facial depth at 11q22.1 on the basis of European data. They also tested genotype-phenotype associations reported in two previous genome-wide studies and found evidence of replication for nasal ala length and SNPs in *CACNA2D3* and *PRDM16*. Roosenboom et al. (2018) performed a genome-wide association study on three vault measures (maximum cranial width, maximum cranial length, and cephalic index) in a sample of 4419 healthy individuals of European ancestry, and observed significant associations at two loci: 15p11.2 for maximum cranial width and 17q11.2 for maximum cranial length.

In the near future, genome-wide association studies will identify all loci for morphological characters. And the correspondence of all genes to their functions will also be clarified in molecular biology or related fields. However, there remain other questions to be answered, as was pointed out by Mizoguchi (2000b, 2006, 2013b): when, where, and how did such genes appear and become fixed in ancestral populations? It would be impossible to determine the causes and mechanisms of their appearance and fixation if we only explore genes in living human populations or if we analyze only within-population variations of genes or morphological characters. To elucidate the causes and mechanisms, we must collect data not only on morphological characters or their associated genes in ancient populations but also on ancient environments where morphological characters first came into existence. At present, however, we do not have sufficient paleoecological data for this purpose. It is our task for the future.

Hence, the use of data on environmental factors in the present day may be recognized as the next best alternative to search for the causes for the appearance of morphological characters in human evolutionary processes. In practice, some researchers have already examined ecological correlations (Yasuda, 1969; a.k.a. among-group or inter-population correlations) between morphological characters and climatic factors in modern times. For example, Beals (1972), Guglielmino-Matessi et al. (1979), Beals et al. (1983, 1984), Mizoguchi (1985), and Kouchi (1986) show that cephalic index is higher in colder regions or in higher latitudes. Weiner (1954), Wolpoff (1968), Yamaguchi (1970), Carey and Steegmann (1981), and Mizoguchi (1985) state that nasal breadth is smaller, or nasal index is lower, in higher latitudes or colder and drier regions. Crognier's (1979, 1981), using European, North African and Near/Middle Eastern samples, quantitatively showed that not only head and face dimensions but also body size were significantly correlated with temperature and precipitation.

Mizoguchi (1998b, c) also performed among-group analyses of craniofacial measurements on the basis of 308 male and 200 female Asian samples from the past 10000 years, and found that, while cranial breadth, bizygomatic breadth, upper facial height, and nasal height always varied in parallel with one another, cranial length and nasal breadth varied independently of each other and of the above four measurements. Later, Mizoguchi (2007a) preliminarily estimated ecological correlations between neurocranial and limb bone measurements simply using Spearman's rank correlation coefficient on the basis of 24 male and 23 female samples from prehistoric, protohistoric, medieval, early modern, and modern populations in Japan. The results pointed to significant associations between cranial length and the thickness measurements of the radius, ulna, femur, and tibia in both males and females.

For the above associations, various causes can be considered. Namely, pleiotropic genes, linkage of genes, the state of two characters being elements in the same ontogenetic process, physiological cycle or biomechanical causation, etc. may cause both intra- and inter-group correlations between characters. Further, an ecological correlation between a character and an environmental factor or between two genetically/ontogenetically independent characters may result from one or more of three basic evolutionary causes, i.e., adaptation to local environments through natural selection, random genetic drift, and gene flow (i.e., migration and/or hybridization with other populations), as suggested by many authors (e.g., Stern, 1960; Dobzhansky, 1963; Mettler and Gregg, 1969; Harrison at al., 1977; Molnar, 1992; Frisancho, 1993; Marks, 1995; Mizoguchi, 2013b).

Mizoguchi (2014), keeping differential contributions of such possible causes in mind, performed a preliminary PCA of among-group correlations between three cranial and four postcranial measurements as well as latitude and chronological age. But the data used there are of only 14 male samples from the Japanese archipelago of the Jomon period to modern times. The present study is an extended version of it. After many more data were collected, the same analyses were performed here to achieve the aim mentioned at the beginning.

Materials

Sample means and sample sizes of craniofacial and postcranial measurements have been collected from the literature for *Homo sapiens sapiens* populations of the Neolithic to modern times in various regions of the world. The data collected are of 687 samples for males (Appendix 1) and 340 for females (Appendix 2). Some of these samples were combined to increase their sample sizes for more exact statistical analyses, resulting in 527 male pooled samples and 206 female pooled samples.

Besides the above samples, the craniofacial measurements of two special individuals, i.e., a male specimen, BOU-VP-16/1, of *Homo sapiens idaltu* from Herto, Ethiopia [160,000-154,000 years old] (White et al., 2003), and Iyeyoshi Tokugawa [1793-1853], the 12th

Shogun of the Edo period in Japan (Suzuki, 1967, 1981), were used to examine the distances from the limits of craniofacial variation of *Homo sapiens sapiens*. The Herto skull is the most intact among the known earliest *Homo sapiens* fossils, and that of Iyeyoshi Tokugawa has ultramodern features.

Methods

Preparation of craniofacial and limb bone data

To clarify the limits and regularity of craniofacial variations and, if possible, to determine the causes of the variations, 156 craniofacial and 78 limb bone measurement items were chosen, and sample means and sample sizes for these measurement items have been collected from the literature for many *Homo sapiens sapiens* populations of the Neolithic to modern times in various regions of the world (Appendices 1 and 2).

As well known, however, some measurement items have been frequently used, analyzed, or reported, but others have not so often. In the present study, the measurement items frequently reported were first searched using 235 male samples from modern human populations (because the number of the samples collected is larger for males than for females). As a result, it was confirmed that the craniofacial measurement items for which the sample size, or the number of individuals, was 10,000 or more in a pooled sample consisting of the 235 samples were as follows (the number in parentheses is a measurement item No. in Martin and Saller [1957]): cranial length (1), cranial base length (5), minimum frontal breadth (9), cranial breadth (8), basi-bregmatic height (17), upper facial height (48), bizygomatic breadth (45), orbital breadth (51), orbital height (52), nasal breadth (54), and nasal height (55). And the craniofacial measurement items for which the sample size is 2,000 or more in the pooled sample are as follows (only Martin's Nos. [Martin and Saller, 1957]): 1, 5, 7, 9, 11, 8, 12, 16, 17, 23, 24, 25, 26, 27, 28, 29, 30, 31, 40, 48, 45, 43, 46, 51, 52, 54, 55, 57, 60, 61, 62, 63, 65, 66, 32, 72, and 73. In the present study, the former is called "the first variable set of the skull," and the latter, "the second variable set of the skull" (Table 1). Similarly, the postcranial measurement items for which the sample size is 750 or more in the pooled sample are as follows: maximum length (1), maximum diameter of the midshaft (5), and minimum diameter of the midshaft (6) for the humerus; maximum length (1) for the ulna; maximum length (1) for the radius; maximum length (1), bicondylar length (2), sagittal diameter at midshaft (6), transverse diameter at midshaft (7), circumference at midshaft (8), and epicondylar breadth (21) for the femur; maximum length (1a) for the tibia; and maximum length (1) for the fibula. This is called "the first variable set of postcranial bones" (Table 1). The postcranial measurement items for which the number of individuals is 500 or more in the pooled sample are as follows: 1, 7, 9, 5, 6, and 7a for the humerus; 1, 12, and 11 for the ulna; 1, 4, and 5 for the radius; 1, 2, 6, 7, 8, 18, and 21 for the femur; 1a, 8, 8a, 10, and 10a for the tibia; and 1, 2, and 3 for the fibula. This is "the second variable set of postcranial bones" (Table 1).

To confirm the limits of among-group variation in each measurement, the second variable sets were used for both the skull and postcranial bones (Table 2). The minimum and maximum values were sought across 527 male and 206 female samples of the Neolithic to modern times from various regions in the world. The data were separately processed for males and females.

As shown in Table 2, the standard deviations (SDs) in Japanese male and female samples (sample size is about 30 for males and 20 for females) seem relatively similar to those in Egyptian samples (sample size is about 900 for males and 600 for females) for at least 20 craniofacial measurement items common to both populations, though no significance tests are carried out. In the present study, therefore, the SDs in the Japanese samples were used as representative within-group SDs for a given local population of *Homo s. s.* because the number of measurement items is much larger in the Japanese samples than in the Egyptian.

In the succeeding analyses, orbital breadth (Martin's No. 51) is excluded because of its extremely large measurement error variance compared to those for other craniofacial measurements (Sakura and Mizoguchi, 1983).

The variables for which the number of male samples of the Neolithic to modern times totaled up to 350 or more (in the case of "Sample size of 20 or more" in Table 2) were, furthermore, selected from the second variable set of the skull for the succeeding multivariate analyses. They are Nos. 1, 9, 8, 17, 48, 45, 52, 54, and 55. This set is called "the third variable set of the skull" (Table 1). Similarly, "the third variable set of postcranial bones" was made up on the basis of the male samples. This consists of Nos. 1, 7, 5, and 6 of the humerus and Nos. 1, 6, 7, and 8 of the femur (Table 1). However, the number of samples for these postcranial variables (in the case of "Sample size of 20 or more" in Table 2) is as small as about 40 or 50.

In addition to the above variable sets, the fourth variable set of the skull (Table 1) was made up to confirm the differences in cranial morphology between *Homo sapiens sapiens* and Herto [*Homo sapiens idaltu*] (White et al., 2003) by excluding minimum frontal breadth (No. 9) from the third variable set. Namely, it consists of Martin's Nos. 1, 8, 17, 48, 45, 52, 54, and 55. Using this fourth variable set, the ultramodern skull of Iyeyoshi Tokugawa (Suzuki, 1967, 1981) was also compared with various samples from all over the world.

Finally, it was checked whether or not samples were practically usable in among-group multivariate analyses. The conditions for selection of samples are the following three: 1) both average sample size and minimum sample size across variables are equal to or more than 25 (Class

Table 1. Variable sets and the quality of the data sets used in the present study.[1)]

Variable set	Skull: Variable Nos.[2)]	Skull: Quality of data set: Class	Skull: Quality of data set: Sample size (n) across variables in each sample	Limb bones: Variable Nos.[2)]	Limb bones: Quality of data set: Class	Limb bones: Quality of data set: Sample size (n) across variables in each sample
First variable set	Nos. 1, 5, 9, 8, 17, 48, 45, 51, 52, 54, and 55	A	Av. $n \geqq 25$, Min. $n \geqq 25$	Humerus: Nos. 1, 5, and 6 Ulna: No. 1 Radius: No. 1 Femur: Nos. 1, 2, 6, 7, 8, and 21 Tibia: No. 1a Fibula: No. 1	A	Av. $n \geqq 25$, Min. $n \geqq 25$
		B	Av. $n \geqq 25$, Min. $n \geqq 10$		B	Av. $n \geqq 25$, Min. $n \geqq 10$
		C	Av. $n \geqq 20$, Min. $n \geqq 5$		C	Av. $n \geqq 20$, Min. $n \geqq 5$
Second variable set	Nos. 1, 5, 7, 9, 11, 8, 12, 16, 17, 23, 24, 25, 26, 27, 28, 29, 30, 31, 40, 48, 45, 43, 46, 51, 52, 54, 55, 57, 60, 61, 62, 63, 65, 66, 32, 72, and 73	A	Av. $n \geqq 25$, Min. $n \geqq 25$	Humerus: Nos. 1, 7, 9, 5, 6, and 7a Ulna: Nos. 1, 12, and 11 Radius: Nos. 1, 4, and 5 Femur: Nos. 1, 2, 6, 7, 8, 18, and 21 Tibia: Nos. 1a, 8, 8a, 10, and 10a Fibula: Nos. 1, 2, and 3	A	Av. $n \geqq 25$, Min. $n \geqq 25$
		B	Av. $n \geqq 25$, Min. $n \geqq 10$		B	Av. $n \geqq 25$, Min. $n \geqq 10$
		C	Av. $n \geqq 20$, Min. $n \geqq 5$		C	Av. $n \geqq 20$, Min. $n \geqq 5$
Third variable set	Nos. 1, 9, 8, 17, 48, 45, 52, 54, and 55	A	Av. $n \geqq 25$, Min. $n \geqq 25$	Humerus: Nos. 1, 7, 5, and 6 Femur: Nos. 1, 6, 7, and 8	A	Av. $n \geqq 25$, Min. $n \geqq 25$
		B	Av. $n \geqq 25$, Min. $n \geqq 10$		B	Av. $n \geqq 25$, Min. $n \geqq 10$
		C	Av. $n \geqq 20$, Min. $n \geqq 5$		C	Av. $n \geqq 20$, Min. $n \geqq 5$
Fourth variable set	Nos. 1, 8, 17, 48, 45, 52, 54, and 55	A	Av. $n \geqq 25$, Min. $n \geqq 25$			
		B	Av. $n \geqq 25$, Min. $n \geqq 10$			
		C	Av. $n \geqq 20$, Min. $n \geqq 5$			

[1)]See text for the conditions under which each variable set was made up.

[2)]Variable number according to Martin and Saller (1957). In most analyses, orbital breadth (Martin's No. 51) is excluded because the measurement error variance is extremely large (Sakura and Mizoguchi, 1983).

A in Table 1); 2) the average sample size is 25 or more and the minimum sample size is 10 or more (Class B in Table 1); and 3) the average sample size is 20 or more and the minimum sample size is 5 or more (Class C in Table 1).

Preparation of environmental data

For each sample of craniofacial and postcranial measurements, data on average annual temperature (degree Celsius), average annual precipitation (mm), average annual relative humidity (%), chronological age (years before 2000 A.D.), latitude (degree), and longitude (degree) were also collected from other sources. As regards the temperature, precipitation, and relative humidity in the site from which each sample was derived, the data were mainly obtained from CantyMedia (2017). For latitude and longitude, the data were acquired from MY NASA DATA (2016-2017) and www.Latlong.net (2016-2017). The data on these variables are, however, not so strict because of the rough assignment to samples by the present author. But the most serious problem on these data is the fact that they are all modern data. This should always be kept in mind.

The data of chronological age is also not so strict. The starting point for count is A.D. 2000. Therefore, 5000 B.P., for example, is converted to 5050 years before 2000 A.D. When the date of a modern sample is not described or unknown, the year of publication is used as the chronological age. If the date is younger than or equal to A.D. 2000, the chronological age is set to zero.

In addition to the above, the great circle distance (km) from Kamoya's hominid site (Omo-Kibish I), Ethiopia (Shea, 2008) to a site under consideration was also calculated according to the following formula:

$$D_{12} = R \cos^{-1} \{\sin lat_1 \sin lat_2 + \cos lat_1 \cos lat_2 \cos (long_1 - long_2)\},$$

where D_{12} is a great circle distance in km; R (km) is equivalent to one degree of the great circle distance in degrees based on the average of the equatorial and polar radii of the earth (National Astronomical Observatory of Japan, 2017), i.e., 111.13287 km; lat_1 and $long_1$ as well as lat_2 and $long_2$ are the latitude and longitude in degrees for Site 1 as well as for Site 2, respectively. This formula is equivalent to that shown in Spuhler (1972).

As a starting point for great circle distances, the latitude and longitude (5.40N, 35.93E) of Kamoya's hominid site (Omo-Kibish I), Ethiopia (Shea, 2008) was preliminarily chosen because Omo-Kibish I (Omo I) has been said to be the oldest (196±5 ka) anatomically modern *Homo sapiens* (Hammond et al., 2017), although a much older date, about 300,000 years ago, was very recently reported for the newly discovered fossils of *Homo sapiens* from Jebel Irhoud, Morocco (Richter et al., 2017; Hublin et al., 2017). To a site in the Americas, the total of two great circle distances was assigned: the distance from Kamoya's hominid site to Naukan (66.03N, 169.70W), Chukchi Peninsula, Russia, plus the distance from Naukan to the site in question.

To sum up, six variables, i.e., average annual temperature, average annual precipitation, average

Table 2. Minimum and maximum values of sample means in cranial and postcranial measurements across *Homo sapiens sapiens* samples of the Neolithic to modern times from all over the world.[1)]

		Within-group variation				Among-group variation															
		Japanese[3)]		Egyptians[4)]		Samples with the size (*n*) of 20 or more								Samples with the size (*n*) of 25 or more							
Variable[2)]	Sex	*n*	SD	*n*	SD	No. of samples	Minumum	Average	Maximum	Skewness	*P*(skew.)	Kurtosis	*P*(kurt.)	No. of samples	Minumum	Average	Maximum	Skewness	*P*(skew.)	Kurtosis	*P*(kurt.)
SKULL																					
1 Cranial length	M	30	5.6	895	5.7	441	165.8	183.34	194.9	-0.40	0.0005	0.82	0.0004	407	165.8	183.32	194.7	-0.40	0.0008	0.79	0.0010
	F	20	4.9	589	4.7	119	159.7	175.52	186.4	-0.34	0.1224	1.26	0.0043	103	163.7	175.74	183.5	-0.25	0.2915	0.27	0.5688
5 Cranial base length	M	30	3.5	896	4.0	206	92.6	101.45	108.3	0.17	0.3183	0.77	0.0225	184	92.6	101.34	108.3	0.24	0.1848	1.00	0.0048
	F	20	3.6	595	3.5	99	91.7	96.91	102.7	0.47	0.0513	0.43	0.3729	82	91.7	96.87	101.1	0.27	0.3174	-0.10	0.8487
7 Foramen magnum length	M	30	2.9	894	2.5	75	32.6	35.90	39.0	-0.25	0.3605	0.66	0.2298	64	32.6	35.86	37.7	-0.61	0.0412	0.52	0.3747
	F	20	1.7	602	2.2	27	32.6	34.47	36.7	0.54	0.2245	-0.69	0.4288	18	32.9	34.51	36.6	0.57	0.2863	-0.24	0.8145
9 Minimum frontal breadth	M	30	5.2	935	4.1	360	87.0	96.00	101.7	-0.40	0.0018	0.14	0.5918	332	87.0	96.04	101.6	-0.48	0.0003	0.28	0.2951
	F	20	3.0	628	3.8	96	87.0	92.13	97.1	0.25	0.3027	-0.58	0.2337	85	87.0	92.19	97.1	0.20	0.4345	-0.64	0.2172
11 Biauricular breadth	M	30	4.9			51	114.3	124.56	130.4	-0.84	0.0122	0.58	0.3787	45	114.3	124.58	130.4	-0.86	0.0145	0.78	0.2597
	F	20	3.3			38	108.4	119.24	125.2	-0.90	0.0193	1.61	0.0316	31	108.4	119.16	125.2	-0.75	0.0735	1.87	0.0224
8 Cranial breadth	M	30	4.7	896	4.8	439	123.0	140.77	154.6	-0.13	0.2826	0.47	0.0425	404	123.0	140.84	154.6	-0.14	0.2661	0.53	0.0290
	F	20	4.1	587	4.5	120	126.3	136.57	147.5	0.02	0.9376	-0.28	0.5186	102	126.3	136.33	147.5	0.07	0.7654	-0.32	0.5022
12 Biasterionic breadth	M	30	5.0			44	105.0	109.46	115.0	0.42	0.2376	-0.13	0.8551	39	105.0	109.55	115.0	0.35	0.3571	-0.27	0.7107
	F	20	4.0			38	102.9	106.03	111.6	0.76	0.0461	0.12	0.8693	29	102.9	106.27	111.6	0.55	0.2043	-0.42	0.6185
16 Foramen magnum breadth	M	30	2.5	905	2.2	74	27.2	29.99	32.6	-0.25	0.3711	1.17	0.0333	65	27.7	30.01	31.8	-0.45	0.1284	0.62	0.2892
	F	20	1.7	607	2.0	27	26.4	28.49	30.5	0.11	0.8095	0.94	0.2792	19	26.9	28.66	30.5	0.49	0.3513	1.15	0.2579
17 Basi-bregmatic height	M	30	5.8	884	5.0	403	125.1	134.70	146.6	0.15	0.2145	0.85	0.0005	361	125.1	134.55	146.6	0.07	0.6033	0.73	0.0046
	F	20	3.8	582	4.4	108	120.6	129.26	139.1	-0.08	0.7365	0.17	0.7130	91	122.2	129.13	139.1	0.07	0.7788	0.10	0.8429
23 Horizontal circumference (g)	M	30	13.9			86	483.0	517.96	538.9	-0.59	0.0226	0.69	0.1801	77	492.3	517.92	538.9	-0.23	0.4058	-0.20	0.7127
	F	19	7.8			35	475.6	501.40	525.7	-0.04	0.9183	0.35	0.6542	29	475.6	501.01	525.7	-0.02	0.9678	0.56	0.5058
24 Transverse arc	M	30	11.1			79	296.3	314.63	333.5	-0.44	0.1056	0.52	0.3308	67	297.1	315.18	333.5	-0.41	0.1569	0.65	0.2572
	F	20	10.4			37	290.8	305.20	318.2	-0.38	0.3324	0.06	0.9416	32	290.8	305.12	318.2	-0.44	0.2931	0.26	0.7453
25 Nasion-opisthion arc	M	30	11.9	884	12.5	106	349.0	372.05	389.0	-0.27	0.2467	0.34	0.4606	98	349.0	371.75	389.0	-0.18	0.4482	0.30	0.5306
	F	20	8.2	583	10.5	35	330.9	360.45	376.0	-1.62	0.0000	4.38	0.0000	30	330.9	360.06	376.0	-1.60	0.0002	3.87	0.0000
26 Frontal arc	M	30	6.0	928	6.2	111	120.9	127.76	135.6	0.55	0.0165	1.91	0.0000	96	123.5	127.86	135.6	0.93	0.0002	1.69	0.0005
	F	20	5.0	617	5.7	40	119.6	123.41	129.8	0.92	0.0134	1.26	0.0851	34	119.6	123.71	129.8	0.91	0.0235	1.14	0.1479
27 Parietal arc	M	30	9.1	908	7.4	107	120.7	127.63	134.9	-0.03	0.8935	-0.06	0.8958	95	120.7	127.59	134.9	0.02	0.9382	0.03	0.9515
	F	20	5.3	606	6.4	42	118.9	124.19	131.0	0.44	0.2280	0.05	0.9397	36	118.9	124.41	131.0	0.28	0.4680	-0.18	0.8176
28 Occipital arc	M	30	7.9	889	6.8	110	106.0	116.67	124.1	-0.38	0.1024	-0.25	0.5796	94	106.8	116.38	122.9	-0.29	0.2435	-0.55	0.2646
	F	20	5.7	593	6.8	37	110.0	114.83	118.0	-0.80	0.0401	-0.13	0.8668	30	110.0	114.70	118.0	-0.63	0.1376	-0.60	0.4721
29 Frontal chord	M	30	5.4			73	104.6	112.26	119.3	0.11	0.6950	3.56	0.0000	62	109.3	112.44	119.3	0.99	0.0011	1.83	0.0023
	F	20	3.9			45	105.2	108.24	113.3	0.93	0.0087	1.00	0.1515	40	105.5	108.42	113.3	0.93	0.0132	0.89	0.2227
30 Parietal chord	M	30	6.4			73	104.2	114.36	119.2	-1.05	0.0002	3.01	0.0000	63	104.2	114.35	119.2	-1.22	0.0001	3.31	0.0000
	F	20	5.1			48	102.2	110.69	116.4	-0.54	0.1154	0.91	0.1768	39	105.2	111.01	116.4	-0.19	0.6114	-0.34	0.6499
31 Occipital chord	M	30	5.7	885	4.8	94	89.4	97.73	103.4	-0.34	0.1779	-0.17	0.7374	81	92.2	97.66	103.4	-0.10	0.7141	-0.70	0.1850
	F	20	3.8	594	4.8	41	89.4	96.33	100.7	-0.84	0.0229	1.27	0.0789	34	89.4	96.22	100.7	-0.72	0.0729	0.91	0.2485

Table 2. (Cont'd--2)

		Within-group variation				Among-group variation															
		Japanese[3)]		Egyptians[4)]		Samples with the size (*n*) of 20 or more								Samples with the size (*n*) of 25 or more							
Variable[2)]	Sex	*n*	SD	*n*	SD	No. of samples	Minumum	Average	Maximum	Skewness	*P*(skew.)	Kurtosis	*P*(kurt.)	No. of samples	Minumum	Average	Maximum	Skewness	*P*(skew.)	Kurtosis	*P*(kurt.)
40 Facial length	M	29	4.0			133	92.9	99.26	107.1	0.34	0.1094	-0.71	0.0895	116	92.9	99.14	107.1	0.40	0.0750	-0.63	0.1584
	F	19	4.7			74	90.7	95.88	102.5	0.35	0.2087	-0.95	0.0835	60	90.7	95.55	102.0	0.44	0.1534	-0.73	0.2300
48 Upper facial height	M	28	4.3	845	4.2	380	60.5	70.88	79.8	0.50	0.0001	0.88	0.0004	344	60.5	70.92	79.6	0.42	0.0015	0.85	0.0011
	F	19	3.1	567	3.8	96	62.1	67.85	74.2	0.29	0.2417	-1.00	0.0408	81	62.1	67.73	74.2	0.31	0.2487	-0.97	0.0676
45 Bizygomatic breadth	M	30	5.3	785	4.6	378	121.0	133.57	146.2	0.31	0.0122	0.08	0.7347	331	121.2	133.55	146.2	0.35	0.0096	-0.03	0.9071
	F	20	3.8	500	4.4	91	117.0	126.47	134.3	-0.28	0.2654	-1.11	0.0273	80	117.0	126.42	134.3	-0.29	0.2887	-1.15	0.0312
43 Upper facial breadth	M	30	3.9			41	101.8	105.71	109.3	0.20	0.5869	-0.68	0.3445	35	101.8	105.66	109.0	0.17	0.6628	-0.76	0.3272
	F	20	3.2			32	97.3	101.40	106.8	0.49	0.2324	-0.54	0.5058	26	97.3	101.41	106.8	0.46	0.3117	-0.49	0.5789
46 Bimaxillary breadth	M	30	4.0	877	4.7	118	89.7	97.81	104.6	0.00	0.9848	-0.87	0.0493	107	89.7	97.75	104.6	0.04	0.8645	-0.89	0.0558
	F	20	3.9	581	4.4	41	89.2	94.27	100.4	0.49	0.1848	-0.28	0.7030	32	89.2	94.35	100.4	0.51	0.2164	-0.24	0.7647
51 Orbital breadth	M	30	1.9			315	37.9	41.88	45.1	-0.43	0.0017	0.06	0.8220	284	37.9	41.88	44.7	-0.51	0.0005	0.07	0.8098
	F	20	1.7			67	36.4	40.93	42.4	-2.08	0.0000	7.09	0.0000	51	36.4	40.89	42.3	-2.18	0.0000	6.85	0.0000
52 Orbital height	M	30	2.1	888	1.9	392	30.1	33.54	37.0	0.33	0.0072	0.01	0.9536	352	30.1	33.56	36.9	0.30	0.0206	-0.12	0.6552
	F	20	1.7	595	1.8	97	31.1	33.87	36.1	-0.27	0.2740	-0.36	0.4635	76	31.3	33.91	36.1	-0.24	0.3884	-0.46	0.3982
54 Nasal breadth	M	30	1.8	893	1.8	403	22.7	25.36	29.5	0.37	0.0022	0.32	0.1878	363	22.7	25.33	29.5	0.38	0.0027	0.36	0.1535
	F	20	1.7	591	1.6	111	21.8	24.66	27.0	-0.03	0.9088	-0.27	0.5592	95	21.8	24.62	27.0	0.04	0.8829	-0.19	0.6955
55 Nasal height	M	30	2.9	898	2.9	388	43.4	51.78	58.5	-0.04	0.7170	1.18	0.0000	351	43.4	51.80	58.5	0.03	0.8455	1.08	0.0000
	F	20	2.5	593	2.6	92	45.7	49.58	52.8	-0.04	0.8876	-0.48	0.3390	79	45.7	49.63	52.8	-0.06	0.8125	-0.49	0.3629
57 Minimum nasal bone width	M	30	1.9			58	6.5	8.01	10.2	0.71	0.0238	0.22	0.7276	50	6.5	7.96	10.2	0.83	0.0140	0.27	0.6857
	F	20	1.3			36	6.8	7.91	9.7	0.84	0.0330	-0.52	0.4996	28	6.8	7.94	9.4	0.80	0.0690	-0.49	0.5695
60 Maxillo-alveolar length	M	29	2.9			48	50.6	54.59	64.2	1.44	0.0000	4.30	0.0000	43	50.6	54.53	64.2	1.50	0.0000	4.39	0.0000
	F	19	2.5			36	48.7	52.50	59.8	0.94	0.0171	1.95	0.0111	30	48.7	52.35	59.8	1.16	0.0068	2.40	0.0040
61 Maxillo-alveolar breadth	M	28	3.2			65	61.7	65.49	69.3	-0.02	0.9470	-0.19	0.7514	51	61.7	65.54	69.3	-0.07	0.8348	-0.23	0.7235
	F	18	2.9			43	57.7	62.15	65.3	-0.40	0.2683	0.57	0.4223	30	58.1	62.19	65.1	-0.41	0.3385	0.86	0.3030
62 Palatal length (ol-sta)	M	29	3.0	821	3.1	51	43.0	46.07	51.5	1.05	0.0016	1.18	0.0718	46	43.3	46.07	51.5	1.13	0.0012	1.46	0.0342
	F	20	2.3	560	2.7	26	42.1	44.32	47.5	0.91	0.0448	0.15	0.8679	19	42.1	44.41	47.5	0.82	0.1155	0.00	0.9974
63 Palatal breadth	M	24	2.7	703	2.6	64	33.2	39.51	43.0	-0.81	0.0066	0.88	0.1340	56	33.2	39.48	43.0	-0.82	0.0097	1.00	0.1105
	F	14	2.8	462	2.5	26	34.5	37.39	39.6	-0.51	0.2589	-0.76	0.3941	21	34.8	37.58	39.6	-0.60	0.2338	-0.58	0.5504
65 Bicondylar breadth	M	30	6.9			41	109.9	122.12	132.7	0.01	0.9681	-0.10	0.8943	37	109.9	121.91	132.7	0.10	0.7925	-0.22	0.7755
	F	20	5.2			21	108.6	116.03	126.4	0.55	0.2700	0.17	0.8593	18	108.6	115.67	126.4	0.71	0.1864	0.48	0.6428
66 Bigonial breadth	M	30	5.0			104	89.7	101.31	115.4	-0.39	0.0979	1.01	0.0311	90	89.7	101.49	115.4	-0.45	0.0781	1.12	0.0267
	F	20	3.9			37	82.9	93.73	105.7	-0.04	0.9247	0.75	0.3219	26	82.9	92.81	102.0	-0.41	0.3676	0.32	0.7140
32 Frontal profile angle	M	30	4.2			44	76.4	82.46	89.8	0.18	0.6064	0.23	0.7407	40	76.4	82.36	89.8	0.05	0.8835	0.30	0.6792
	F	20	3.8			35	77.4	84.56	88.2	-0.74	0.0613	0.54	0.4849	25	77.4	84.32	88.2	-0.58	0.2140	-0.12	0.8970
72 Facial profile angle	M	29	3.0			84	78.8	84.93	90.2	0.00	0.9983	-0.15	0.7776	75	81.5	85.10	90.2	0.26	0.3527	-0.71	0.1924
	F	19	2.5			43	80.1	84.92	88.8	-0.10	0.7918	-0.72	0.3129	33	81.5	84.99	88.5	-0.01	0.9886	-1.28	0.1100
73 Nasal profile angle (n-ns-FH)	M	30	2.7			44	79.3	87.79	91.5	-1.11	0.0018	2.37	0.0007	40	79.3	87.76	91.5	-1.14	0.0023	2.33	0.0015
	F	20	2.9			33	82.6	87.98	92.2	-0.69	0.0929	0.88	0.2680	22	84.0	88.08	90.7	-0.71	0.1500	0.65	0.4956

(To be continued.)

annual relative humidity, chronological age, absolute value of latitude, and great circle distance from Kamoya's hominid site are conveniently dealt with as environmental variables in the present study, though, strictly speaking, the latter three are not environmental factors.

Multivariate Statistical analysis

To elucidate the limits of the multivariate distribution of sample means from world human populations, principal component analysis (Lawley and Maxwell, 1963; Okuno et al., 1971, 1976; Takeuchi and Yanai, 1972) was first applied to the within-group correlation matrices of two different samples available at hand: a Japanese male sample from the Kinai district (Miyamoto, 1924) and an Australian Aboriginal male sample of 4000-100 B.P. from Murray River Valley (Brown, 2001). From these principal component analyses (PCAs), the coefficients of the simultaneous linear equations for prediction of principal component

Table 2. (Cont'd--3)

		Within-group variation				Among-group variation															
		Japanese[3)]		Egyptians[4)]		Samples with the size (n) of 20 or more								Samples with the size (n) of 25 or more							
Variable[2)]	Sex	n	SD	n	SD	No. of samples	Minumum	Average	Maximum	Skewness	P(skew.)	Kurtosis	P(kurt.)	No. of samples	Minumum	Average	Maximum	Skewness	P(skew.)	Kurtosis	P(kurt.)
HUMERUS																					
1 Maximum length	M	30	15.6			40	282.9	308.19	338.3	0.36	0.3341	-1.29	0.0782	34	282.9	308.50	338.3	0.33	0.4184	-1.21	0.1247
	F	20	12.7			27	270.1	287.80	315.5	0.25	0.5820	-1.40	0.1091	24	270.1	287.63	315.5	0.30	0.5242	-1.39	0.1303
7 Min. circum. of the shaft	M	30	4.0			40	58.6	64.14	74.7	1.65	0.0000	4.74	0.0000	35	58.6	64.17	74.7	1.56	0.0001	3.95	0.0000
	F	20	2.4			36	48.5	55.85	65.2	0.86	0.0289	4.13	0.0000	30	48.5	55.64	65.2	1.03	0.0161	5.34	0.0000
9 Max. trans. diam. of the head	M	30	2.2			17	39.7	42.18	44.6	0.01	0.9853	-1.16	0.2743	14	39.7	42.09	44.6	0.16	0.7841	-1.17	0.3113
	F	20	2.3			13	34.2	37.13	39.4	-0.07	0.9118	-0.56	0.6364	10	34.2	37.00	39.2	-0.15	0.8287	-0.37	0.7791
5 Max. diameter of the midshaft	M	30	1.4			45	20.7	22.95	26.3	0.50	0.1616	2.32	0.0008	39	20.7	22.91	26.3	0.59	0.1198	2.23	0.0026
	F	20	0.9			32	17.3	20.10	21.6	-0.82	0.0470	1.13	0.1645	26	17.3	20.19	21.6	-1.12	0.0144	1.80	0.0428
6 Min. diameter of the midshaft	M	30	1.5			44	16.1	17.56	20.7	1.28	0.0003	3.09	0.0000	38	16.1	17.54	20.7	1.42	0.0002	3.45	0.0000
	F	20	0.9			31	12.9	15.07	17.0	0.26	0.5387	0.97	0.2364	25	12.9	15.05	17.0	0.19	0.6749	1.07	0.2346
7a Circum. of the midshaft	M	30	4.3			29	61.2	66.92	71.2	-0.47	0.2825	0.80	0.3462	26	61.2	66.77	71.2	-0.39	0.3905	0.79	0.3755
	F	20	2.6			24	51.7	58.66	63.7	-0.68	0.1516	0.85	0.3538	22	51.7	58.82	63.7	-0.85	0.0845	1.03	0.2811
ULNA																					
1 Maximum length	M	30	12.6			28	236.7	254.52	284.8	0.46	0.2935	-0.97	0.2592	25	236.7	254.18	284.8	0.52	0.2648	-1.03	0.2519
	F	20	9.2			20	214.2	232.58	256.3	0.31	0.5448	-0.96	0.3326	15	214.2	233.36	254.7	0.03	0.9529	-0.97	0.3878
12 Transverse diameter	M	30	1.2			33	12.3	16.45	18.7	-1.47	0.0003	2.76	0.0005	29	12.3	16.33	18.7	-1.43	0.0009	2.50	0.0031
	F	20	0.9			26	10.3	14.54	16.7	-1.44	0.0016	2.88	0.0012	20	10.3	14.78	16.7	-1.71	0.0008	5.37	0.0000
11 Dorso-volar diameter	M	30	1.2			33	12.8	13.63	16.7	1.60	0.0001	1.94	0.0152	29	12.8	13.66	16.7	1.55	0.0004	1.60	0.0584
	F	20	0.8			26	10.5	11.61	14.1	1.11	0.0152	0.64	0.4704	19	10.6	11.50	13.3	1.15	0.0288	0.40	0.6937
RADIUS																					
1 Maximum length	M	30	11.6			33	215.8	234.64	256.2	0.38	0.3507	-1.15	0.1489	33	215.8	234.64	256.2	0.38	0.3507	-1.15	0.1489
	F	20	8.8			23	197.1	215.49	237.0	0.13	0.7923	-1.05	0.2627	18	197.1	216.06	234.5	-0.13	0.8045	-0.99	0.3382
4 Transverse diameter of the shaft	M	30	1.4			32	14.7	16.78	19.2	0.16	0.6943	1.83	0.0241	28	14.7	16.77	19.2	0.22	0.6158	1.68	0.0497
	F	20	1.3			25	13.0	15.03	16.1	-0.97	0.0357	0.62	0.4942	21	13.0	15.13	16.1	-1.36	0.0067	2.49	0.0105
5 Sagittal diameter of the shaft	M	30	0.9			33	11.4	12.08	14.7	2.77	0.0000	10.40	0.0000	28	11.4	12.07	14.7	2.92	0.0000	11.19	0.0000
	F	20	0.9			25	9.6	10.34	11.7	0.98	0.0346	1.50	0.0966	21	9.7	10.33	11.0	0.31	0.5361	-0.90	0.3536
FEMUR																					
1 Maximum length	M	30	24.0			45	395.4	431.48	474.8	0.30	0.3899	-1.13	0.1040	40	395.4	432.67	474.8	0.22	0.5527	-1.25	0.0890
	F	20	20.6			32	373.7	404.25	441.1	-0.07	0.8639	-1.00	0.2146	24	373.7	403.75	430.2	-0.23	0.6285	-1.30	0.1582
2 Bicondylar length	M	30	24.2			39	400.7	431.44	471.8	-0.07	0.8621	-1.31	0.0767	36	400.7	432.58	471.8	-0.09	0.8154	-1.22	0.1109
	F	20	19.9			31	370.7	403.56	438.0	-0.32	0.4432	-0.95	0.2496	22	370.7	405.40	438.0	-0.48	0.3302	-0.65	0.4963
6 Sagittal diameter at midshaft	M	30	2.3			53	25.8	28.63	31.6	-0.03	0.9150	-0.80	0.2156	46	25.8	28.59	31.6	0.00	0.9968	-0.82	0.2337
	F	20	1.8			41	22.1	24.89	28.0	-0.10	0.7952	-0.52	0.4712	33	22.1	24.94	28.0	-0.21	0.6153	-0.12	0.8796
7 Transverse diameter at midshaft	M	30	2.1			53	24.4	26.48	30.0	0.87	0.0076	0.65	0.3103	47	24.4	26.35	29.6	0.74	0.0339	0.60	0.3814
	F	20	2.1			41	22.2	24.14	26.5	0.30	0.4245	-0.66	0.3624	33	22.2	24.22	26.5	0.10	0.7988	-0.95	0.2340
8 Circumference at midshaft	M	30	5.8			48	79.5	87.56	96.2	0.25	0.4608	-0.29	0.6702	42	79.5	87.48	96.2	0.26	0.4739	-0.30	0.6733
	F	20	4.7			41	72.4	78.31	85.7	0.15	0.6906	-0.51	0.4838	34	72.4	78.51	85.7	0.10	0.8089	-0.56	0.4791
18 Vertical diameter of the head	M	30	2.2			23	43.1	45.19	47.9	0.10	0.8292	2.19	0.0190	20	43.1	45.33	47.9	0.28	0.5829	2.91	0.0034
	F	20	2.8			17	38.2	40.21	41.4	-0.81	0.1404	1.51	0.1561	13	38.2	40.05	41.2	-1.00	0.1053	1.74	0.1436
21 Epicondylar breadth	M	29	3.7			18	69.9	77.96	80.5	-2.11	0.0001	4.99	0.0000	17	69.9	77.97	80.5	-2.08	0.0001	4.69	0.0000
	F	20	4.0			15	61.3	69.59	72.6	-1.52	0.0088	2.91	0.0095	12	61.3	69.39	72.6	-1.45	0.0229	2.27	0.0658

Table 2. (Cont'd--4)

		Within-group variation				Among-group variation															
		Japanese[3)]		Egyptians[4)]		Samples with the size (n) of 20 or more								Samples with the size (n) of 25 or more							
Variable[2)]	Sex	n	SD	n	SD	No. of samples	Minumum	Average	Maximum	Skewness	P(skew.)	Kurtosis	P(kurt.)	No. of samples	Minumum	Average	Maximum	Skewness	P(skew.)	Kurtosis	P(kurt.)
TIBIA																					
1a Maximum length	M	30	20.5			24	328.1	343.69	381.9	1.11	0.0190	0.40	0.6618	20	328.1	343.69	381.9	1.17	0.0223	0.42	0.6736
	F	20	17.2			14	302.7	319.61	344.5	0.51	0.3894	-1.33	0.2483	10	302.7	320.15	344.5	0.54	0.4293	-1.62	0.2249
8 Maximum diameter at midshaft	M	30	2.2			31	26.3	29.96	32.7	-0.11	0.7899	-0.76	0.3567	25	26.3	29.85	32.7	-0.02	0.9718	-0.80	0.3775
	F	20	1.8			25	22.7	25.94	28.6	-0.50	0.2839	-0.57	0.5306	20	22.7	26.10	28.6	-0.55	0.2803	-0.28	0.7760
8a Sagit. diam. at nutrient foramen	M	30	2.3			39	29.8	34.24	37.3	-0.29	0.4458	-0.52	0.4837	31	29.8	34.08	37.3	-0.17	0.6851	-0.67	0.4120
	F	20	1.9			28	26.0	29.82	33.0	-0.39	0.3755	-0.09	0.9152	19	26.0	29.62	32.3	-0.44	0.3969	-0.22	0.8290
10 Circumference at midshaft	M	30	5.7			29	72.4	81.70	91.5	-0.21	0.6343	0.45	0.5905	22	72.4	81.36	91.5	-0.01	0.9797	0.19	0.8448
	F	20	3.7			22	65.6	71.58	77.2	-0.19	0.7041	-1.43	0.1343	16	65.6	71.41	76.2	-0.19	0.7424	-1.50	0.1696
10a Circumference at nutrient foramen	M	30	6.4			30	87.1	92.21	101.6	0.64	0.1354	0.13	0.8770	23	87.1	92.13	101.6	0.74	0.1257	0.06	0.9492
	F	20	4.6			23	75.4	80.70	88.7	0.27	0.5727	-0.30	0.7508	17	75.4	80.83	88.7	0.32	0.5658	0.01	0.9908
FIBULA																					
1 Maximum length	M	30	19.2			19	304.4	340.33	378.3	0.56	0.2839	-0.37	0.7175	18	304.4	340.73	378.3	0.49	0.3580	-0.53	0.6098
	F	20	16.1			13	298.5	320.59	353.2	0.56	0.3679	-1.28	0.2831	10	298.5	320.45	353.0	0.50	0.4688	-1.19	0.3737
2 Maximum diameter at midshaft	M	30	1.6			23	13.2	15.65	18.9	0.85	0.0775	0.14	0.8805	22	13.2	15.53	18.9	0.99	0.0447	0.88	0.3545
	F	20	1.6			17	12.4	13.98	15.3	-0.12	0.8204	-1.32	0.2150	11	12.4	13.86	15.3	0.02	0.9808	-1.62	0.2044
3 Minimum diameter at midshaft	M	30	1.2			22	9.3	11.05	12.2	-0.37	0.4488	1.08	0.2569	21	9.3	11.00	12.2	-0.50	0.3190	1.54	0.1122
	F	20	1.2			16	9.0	9.63	10.4	0.10	0.8592	-1.31	0.2313	11	9.0	9.55	10.4	0.79	0.2325	-0.37	0.7697

[1)]The sample means used here are those published by previous authors. The details of the samples are shown in Appendices 1 and 2.

[2)]Variable number according to Martin and Saller (1957). The variables examined are those of the second variable sets of the skull and limb bones (Table 1).

[3)]Modern Japanese from the Kinai district. Their standard deviations were recalculated by the present author on the basis of the raw data published by Miyamoto (1924, 1925) and Hirai and Tabata (1928). When measurements were available for both sides, only those from the right side were used.

[4)]Egyptians from Gizeh of the 26th to 30th Dynasties [664 to 343 B.C.] (Pearson and Davin, 1924). When measurements were available for both sides, only those from the right side were used.

scores (PC scores) were obtained. The number of principal components (PCs) was so determined that the cumulative proportion of the variances of the PCs exceeded 85%. The PC score vector for a sample mean vector was calculated on the basis of the world average vector, i.e., the grand mean vector of all sample mean vectors used (Table 2), and the SDs of original variables as well as the coefficients of the simultaneous linear equations from either of the above two samples.

The significance of factor loadings was tested by the bootstrap method (Efron, 1979a, b, 1982; Diaconis and Efron, 1983; Mizoguchi, 1993). To estimate the bootstrap standard deviation of a factor loading, 1,000 bootstrap replications, including the observed sample, were used. The bootstrap standard deviation was estimated by directly counting the cumulative frequency for the standard deviation in the bootstrap distribution. As noted by Diaconis and Efron (1983), however, when a statistic like correlation coefficient has an extreme value, e.g. 1, in an observed sample, most bootstrap values of the statistic would be nearly equal to 1, and, therefore, the width of the interval associated with 68% [within ± 1 SD in a normal distribution] of the bootstrap samples would be approximately zero. In such a case, the bootstrap SD is incorrect. This is a point to be cautioned.

Also for among-group analyses, PCA was used. The PCs obtained were further transformed by Kaiser's normal varimax rotation method (Asano, 1971; Okuno et al., 1971) into different factors to reveal other possible

Table 3. Possible limits of the among-group variations of main craniofacial measurements (males).[1)]

Variable[2)]	Within-group variation: Japanese[3)] *n*	Within-group variation: Japanese[3)] SD	Among-group variation (across the samples with the size of 20 or more): No. of samples	Minimum	Standard-ized minimum[4)]	Minimum - 2SD	Standard-ized (Min. - 2SD)	Average	Maximum	Standard-ized maximum[5)]	Maximum + 2SD	Standard-ized (Max. + 2SD)	Japanese (Mean)[3)]	Standard-ized Japanese	The 12th Shogun, Iyeyoshi Tokugawa[6)]	Standard-ized Iyeyoshi Tokugawa	Herto[7)]	Standard-ized Herto
1 Cranial length	30	5.6	441	165.8	-3.13	154.6	-5.13	183.34	194.9	2.06	206.1	4.06	178.4	-0.88	192	1.55	219.5	6.46
9 Minimum frontal breadth	30	5.2	360	87.0	-1.73	76.6	-3.73	96.00	101.7	1.10	112.1	3.10	93.1	-0.56	99	0.58	-	-
8 Cranial breadth	30	4.7	439	123.0	-3.78	113.6	-5.78	140.77	154.6	2.94	164.0	4.94	141.0	0.05	156	3.24	155.0	3.03
17 Basi-bregmatic height	30	5.8	403	125.1	-1.66	113.5	-3.66	134.70	146.6	2.05	158.2	4.05	139.8	0.88	150	2.64	147.5	2.21
48 Upper facial height	28	4.3	380	60.5	-2.41	51.9	-4.41	70.88	79.8	2.07	88.4	4.07	72.9	0.47	82	2.59	79.0	1.89
45 Bizygomatic breadth	30	5.3	378	121.0	-2.37	110.4	-4.37	133.57	146.2	2.38	156.8	4.38	133.4	-0.03	126	-1.43	142.0	1.59
52 Orbital height	30	2.1	392	30.1	-1.64	25.9	-3.64	33.54	37.0	1.65	41.2	3.65	34.3	0.36	37	1.65	34.0	0.22
54 Nasal breadth	30	1.8	403	22.7	-1.48	19.1	-3.48	25.36	29.5	2.30	33.1	4.30	26.3	0.52	23	-1.31	29.0	2.02
55 Nasal height	30	2.9	388	43.4	-2.89	37.6	-4.89	51.78	58.5	2.32	64.3	4.32	52.5	0.25	57	1.80	56.0	1.46

[1)]The sample means used here are those published by previous authors. The details of the samples are shown in Appendix 1.

[2)]Variable number according to Martin and Saller (1957). The variables examined are those of the third variable set of the skull (Table 1).

[3)]Modern Japanese from the Kinai district (Miyamoto, 1924). The means and standard deviations were recalculated by the present author on the basis of the raw data published by Miyamoto. When measurements were available for both sides, only those from the right side were used.

[4)]Minimum value in the among-group variation standardized by the standard deviation (SD) for the within-group variation of the Kinai Japanese sample.

[5)]Maximum value in the among-group variation standardized by the standard deviation (SD) for the within-group variation of the Kinai Japanese sample.

[6)]Iyeyoshi Tokugawa [1793-1853], the 12th Shogun of the Edo period in Japan (Suzuki, 1967).

[7)]Herto (*Homo sapiens idaltu*), Ethiopia, dated to 160,000-154,000 years old (White et al., 2003).

associations behind the measurements. The statistical significance of factor loadings on both PCs and rotated factors (Facs) was again tested by the bootstrap method. The presence of common factors, such as PCs or Facs, was furthermore tested by evaluating the similarity between the factors obtained for two different data sets of the same kind, that is, by estimating Spearman's rank correlation coefficient, rho (Siegel, 1956), between the patterns of variation of factor loadings.

Finally, path analysis (Wright, 1934; Li, 1956, 1975; Kempthorne, 1969; Yasuda, 1969; Mizoguchi, 1978, 1986, 2010) was carried out to get a piece of information on some unknown factors which can influence the among-group variations of craniofacial measurements. The model used here is a very simple one, the same as that described in Mizoguchi (1978). Craniofacial measurements were regarded as endogenous variables, and environmental variables, as exogenous variables.

Methods of calculation

Statistical calculations were executed using programs written by the present author in FORTRAN: BSFMD for calculating basic statistics, BTPCA and PCAFPP for principal component analysis and Kaiser's normal varimax rotation, RKCNCT for rank correlation coefficients, and PATHAN for path analysis. The FORTRAN 77 compiler used was FTN77 for personal computers, provided by Salford Software Ltd. To increase efficiency during programming and calculation, a GUI for programming, CPad, provided by “kito,” was used.

Results

Limits of among-group variation in each measurement

The minimum and maximum values in the among-group variation of each measurement are shown in Table 2. It was found here that the among-group distributions of craniofacial variables are unimodal when the number of samples was 350 or more (in the case of “Samples with the size of 20 or more” in Table 2), even if the skewness and kurtosis of sample means across various *Homo sapiens sapiens* populations were significantly different from those of normal distributions (Table 2; Figs. 1 to 5).

The ultramodern skull of Iyeyoshi Tokugawa (Suzuki, 1967, 1981), one of so-called aristocrats, is placed almost within the range between the minimum and maximum values of *Homo s. s.* sample means, and definitely within the range between the minimum minus 2SD and the maximum plus 2SD in main craniofacial measurements (Table 3 and Fig. 6). But the skull of Herto [*Homo s. idaltu*] (White et al., 2003) has a very large maximum cranial length (larger than the maximum of *Homo s. s.* plus 4SD), though the other main craniofacial measurements are almost the same as or smaller than the maximum of *Homo s. s.* (Table 3 and Fig. 6).

Positions of sample means in within-group multivariate distributions

Two PCAs based on within-group correlations were first carried out as a base for confirming the positions of the vectors of sample means in the within-group multivariate distributions. The correlation matrices used are of a Japanese and an Australian Aboriginal male sample. The results of the PCAs are shown in Tables 4 and 5, respectively. In these analyses, the fourth variable set of the skull was used so that the results from *Homo sapiens sapiens* samples can be compared with the reported data of one of the two special male specimens, Herto [*Homo s. idaltu*] (White et al., 2003). The PCs obtained from the Japanese sample (Table 4) may be interpreted as follows: PC 1 is a so-called general size factor; PC 2, a factor associated with cranial length and height and, simultaneously, inversely associated with upper facial and nasal heights; PC 3, associated with nasal breadth and inversely with cranial height; PC 4, associated with cranial breadth and inversely with nasal breadth; and PC 5, associated with cranial length and inversely with orbital height. On the other hand, the PCs obtained from the Australian Aboriginal sample (Table 5) may be interpreted as follows: PC 1 is a general

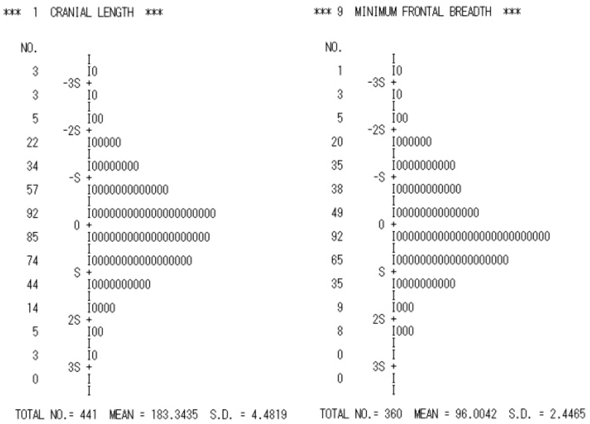

Fig. 1. Among-group distributions of cranial length based on 441 male sample means and of minimum frontal breadth based on 360 male sample means. "S" designates the standard deviation of the among-group distribution.

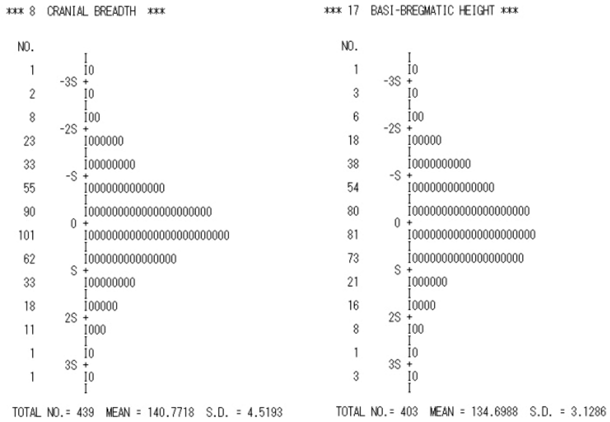

Fig. 2. Among-group distributions of cranial breadth based on 439 male sample means and of basi-bregmatic height based on 403 male sample means. "S" designates the standard deviation of the among-group distribution.

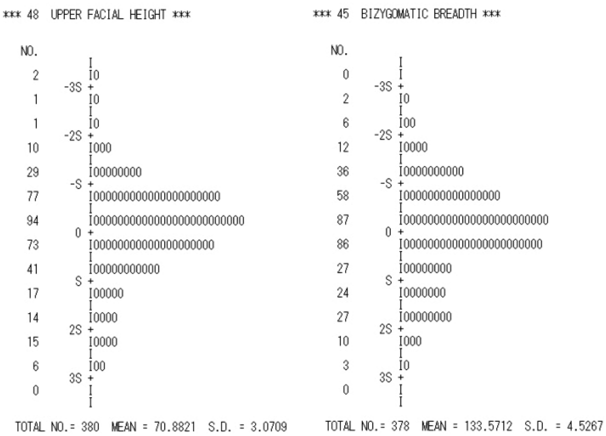

Fig. 3. Among-group distributions of upper facial height based on 380 male sample means and of bizygomatic breadth based on 378 male sample means. "S" designates the standard deviation of the among-group distribution.

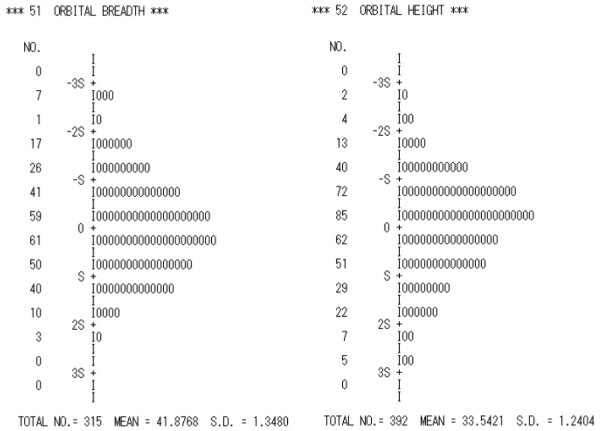

Fig. 4. Among-group distributions of orbital breadth based on 315 male sample means and of orbital height based on 392 male sample means. "S" designates the standard deviation of the among-group distribution.

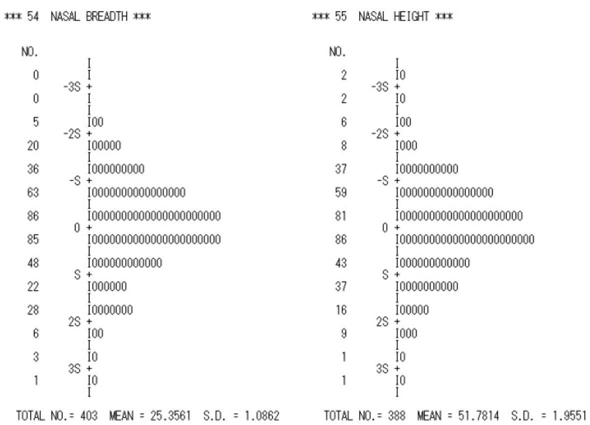

Fig. 5. Among-group distributions of nasal breadth based on 403 male sample means and of nasal height based on 388 male sample means. "S" designates the standard deviation of the among-group distribution.

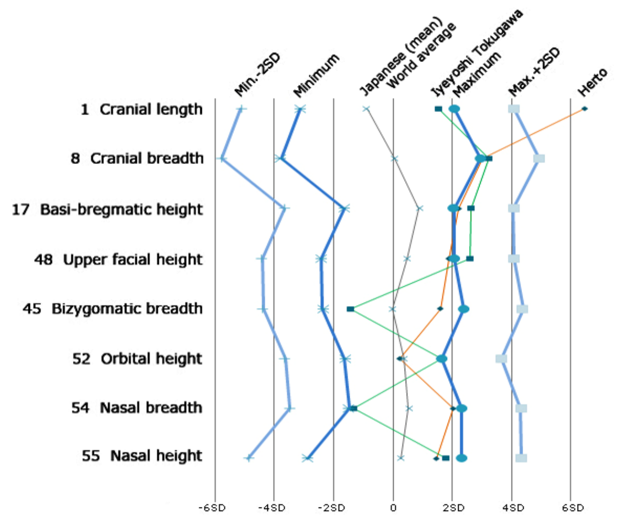

Fig. 6. Mollison's deviation curves for the minimum and maximum values in the among-group variations of eight craniofacial measurements. The vertical base line represents the world average of each measurement, and "SD" designates the within-group standard deviation of the Kinai Japanese male sample (Miyamoto, 1924). For details, see Table 3.

Table 4. Principal component analysis of the correlations between eight main craniofacial measurements in a Japanese male sample from the Kinai district.[1)]

Variable[2)]	Factor loadings PC 1	2	3	4	5	Total variance (%)
1 Cranial length	0.48	0.60***	0.19**	0.23***	0.52***	95.57
8 Cranial breadth	0.54	0.32***	0.25***	-0.59***	-0.29***	88.99
17 Basi-bregmatic height	0.44	0.54***	-0.56***	0.30***	-0.14**	91.11
48 Upper facial height	0.71*	-0.51***	-0.19*	0.01	0.28***	88.17
45 Bizygomatic breadth	0.78*	0.34***	0.04	-0.23***	-0.08	78.16
52 Orbital height	0.70*	-0.28**	-0.15	0.39***	-0.41***	91.33
54 Nasal breadth	0.44	-0.15	0.74***	0.41***	-0.10***	94.64
55 Nasal height	0.72*	-0.48***	-0.14	-0.29***	0.23***	89.65
Total contribution (%)	37.92	18.41	13.07	11.78	8.52	89.70
Cumulative proportion (%)	37.92	56.33	69.40	81.18	89.70	89.70

[1)]Data source: Miyamoto (1924). The sample size is 28. The number of principal components was so determined that the cumulative proportion of the variances of the principal components exceeded 85%.

[2)]Variable number according to Martin and Saller (1957). The variables examined are those of the fourth variable set of the skull (Table 1).

$^{*}P<0.05$; $^{**}P<0.01$; $^{***}P<0.001$, according to a two-tailed bootstrap test.

Table 5. Principal component analysis of the correlations between eight main craniofacial measurements in an Australian Aboriginal male sample of 4000-100 B.P. from Murray River Valley.[1)]

Variable[2)]	Factor loadings PC 1	2	3	4	5	Total variance (%)
1 Cranial length	0.65***	-0.12***	0.43***	0.31***	-0.23***	76.73
(8) Bi-parietal breadth	0.44*	0.05	-0.51***	0.58***	0.36***	92.33
17 Basi-bregmatic height	0.47*	-0.13***	0.68***	-0.05	0.10**	71.29
48 Upper facial height	0.76***	-0.47***	-0.15**	-0.17***	-0.17***	87.27
45 Bizygomatic breadth	0.61***	0.59***	0.09**	0.33***	-0.09***	83.74
52 Orbital height	0.53*	0.28**	0.10	-0.48***	0.58***	93.49
54 Nasal breadth	0.18	0.81***	-0.15	-0.26***	-0.33***	89.83
55 Nasal height	0.67***	-0.27***	-0.50***	-0.30***	-0.19***	89.74
Total contribution (%)	31.77	17.69	15.30	11.95	8.84	85.55
Cumulative proportion (%)	31.77	49.46	64.76	76.71	85.55	85.55

[1)]Data source: Brown (2001). The sample size is 40. The number of principal components was so determined that the cumulative proportion of the variances of the principal components exceeded 85%.

[2)]Variable number according to Martin and Saller (1957). The variables examined are those of the fourth variable set of the skull (Table 1). It should be noted, however, that the cranial breadth used here is Brown's (2001) "bi-parietal breadth," which is substantially equivalent to Martin's "maximum cranial breadth" (Brown, 2000/2011).

$^{*}P<0.05$; $^{**}P<0.01$; $^{***}P<0.001$, according to a two-tailed bootstrap test.

Table 6. Spearman's rank correlation coefficients between Japanese and Australian Aboriginals in the patterns of variation of the factor loadings on principal components shown in Tables 4 and 5.[1)]

Japanese	PC 1	2	3	4	5
Aust. Ab. PC 1	$0.62^{\dagger}$	-	-	-	0.71*
2	-	-	$0.64^{\ddagger}$	-	-
3	-	$0.62^{\dagger}$	-	$0.64^{\ddagger}$	-
4	-	$0.62^{\dagger}$	-	$0.52^{\dagger}$	-
5	-	-	-	-	0.74*

[1)]Only rank correlation coefficients significant at the 20% level are listed here. The signs of rank correlation coefficients are removed because the signs of factor loadings are reversible.

$^{\dagger}P<0.20$; $^{\ddagger}P<0.10$; $^{*}P<0.05$, according to a two-tailed test.

size factor; PC 2, a factor associated with nasal breadth and bizygomatic breadth and inversely with upper facial height; PC 3, associated with cranial height and length and inversely with cranial breadth and nasal height; PC 4, associated with cranial breadth and inversely with orbital height; and PC 5 is associated with orbital height. The repeatability of these PCs was examined by comparing the variation patterns of factor loadings on the PCs from the two samples (Table 6). By this comparison, it is found that PC 2 from the Japanese sample seems to correspond to PC 3 from the Australian Aboriginal sample, and vice versa, though the significance of the Spearman's rank correlation coefficients obtained is not so high.

Using the coefficients of the simultaneous linear equations for prediction of PC scores obtained from the above two PCAs, PC score vectors for 283 sample mean vectors from various *Homo s. s.* male populations were estimated on the basis of the most reliable data (Class A in Table 1). The PC scores are plotted in Figs. 7 and 8 in the form of radar chart. It must be noted here that the axes of PC 2 and PC 3 are reversed in Fig. 8 so that the results on Japanese (Fig. 7) and Australian Aboriginals (Fig. 8) can easily be compared. Both Figs. 7 and 8 show that all the samples are located between the maximum and minimum pseudo-individuals in the case of PC 1 (general size factor), but, in the other PCs, scattered not only within but also outside of the range. It is also found that the PC scores for almost all of the 283 sample mean vectors are located within the ±2SD range of within-group PC scores (Figs. 7 and 8).

Similarly, two special specimens, i.e., the 160,000-154,000 year-old skull from Herto (White et al., 2003) and the ultramodern skull of Iyeyoshi Tokugawa [1793-1853] (Suzuki, 1967, 1981) were compared with the minimum and maximum pseudo-individuals (Tables 7 and 8, and Figs. 9 and 10). Comparing Fig. 9 with Fig. 7 (both are based on the Japanese variances/covariances), it is found that Herto is located clearly outside of the *Homo s. s.* range in PC 2 and PC 5. In the comparison with the Australian Aboriginal variances/covariances (Figs. 8 and 10), however, Herto is located far outside of the *Homo s. s.* range only in PC 4. On the other hand, Iyeyoshi Tokugawa is found to be very close to the lower limit of the *Homo s. s.* range in the PC 3 scores based on the Japanese variances/covariances (Figs. 7 and 9), while, in the PC scores based on Australian Aboriginal variances/covariances (Figs. 8 and 10), he is close to the lower limit of the *Homo s. s.* range in PC 2, which corresponds to Japanese PC 3, and, in PC 5, exceeds the upper limit of the *Homo s. s.* range.

Selection of samples for among-group multivariate analyses

First of all, it was checked whether or not samples were practically usable in multivariate analyses on the basis of the quality of samples, i.e., Classes A, B, and C in Table 1. As a result, in the combined set of the first variable sets for the skull and limb bones, the number of male samples available was only 5, 8, and 10 for Class A, B, and C, respectively. In the case of female samples, this check was not made because the number of the female samples collected was too small, as shown in Table 2.

In the combined set of the second variable sets for the skull and limb bones, the number of male samples available was zero, two, and three for Class A, B, and C, respectively (the check on female samples was not made for the same reason as the above). In the combined set of the third variable sets for the skull and limb bones, the number of male samples available was 14, 22, and 27 for Class A, B, and C, respectively. The number of female samples available was 11 and 20 for Class B and C, respectively (the check on Class A was not made for the same reason as the above).

As mentioned above (also as shown in Table 2), the samples of limb bones collected was too small to carry out multivariate analyses compared with the number of the variables to be analyzed here. Therefore, several sets of only craniofacial measurements were also

Table 7. Principal component scores based on the world average (Table 3) and the variance/covariance matrix of a Japanese male sample (Table 4).[1)]

Specimen	Principal component scores PC 1	2	3	4	5
Maximum[2)] + 2SD[3)]	6.61	1.31	1.22	0.02	-0.14
Maximum[2)]	3.48	0.78	0.83	-0.38	-0.13
Herto[4)]	3.39	3.06	1.68	0.41	3.67
Iyeyoshi Tokugawa[5)]	2.06	0.35	-2.18	-1.00	0.23
Japanese (mean)[1)]	0.31	-0.40	-0.41	0.34	-0.86
Australian Aboriginals (mean)[6)]	-0.17	0.02	1.06	2.30	1.43
Minimum[7)]	-3.83	-1.04	-0.73	1.32	-0.82
Minimum[7)] - 2SD[3)]	-6.96	-1.57	-1.12	0.92	-0.81

[1)]The modern Japanese male sample was derived from the Kinai district (Miyamoto, 1924). The statistics such as means, standard deviations, etc. were recalculated by the present author on the basis of the raw data published by Miyamoto.

[2)]Maximum value across *Homo sapiens sapiens* samples of the Neolihic to modern times (sample size is 20 or more for each variable mean in each sample).

[3)]SD designates the within-group standard deviation of the Kinai Japanese male sample. See the above footnote 1.

[4)]Herto (*Homo sapiens idaltu*), Ethiopia, dated to 160,000-154,000 years old (White et al., 2003).

[5)]Iyeyoshi Tokugawa [1793-1853], the 12th Shogun of the Edo period in Japan (Suzuki, 1967).

[6)]Australian Aboriginal males of 4000-100 B.P. from Murray River Valley (Brown, 2001). The means were recalculated by the present author on the basis of the raw data published by Brown.

[7)]Minimum value across *Homo sapiens sapiens* samples of the Neolihic to modern times (sample size is 20 or more for each variable in each sample).

Table 8. Principal component scores based on the world average (Table 3) and the variance/covariance matrix of an Australian Aboriginal male sample (Table 5).[1)]

Specimen	Principal component scores PC 1	3	2	4	5
Maximum[2)] + 2SD[3)]	7.52	0.18	1.56	0.92	-0.01
Maximum[2)]	3.95	-0.17	0.87	0.81	-0.03
Herto[4)]	4.31	1.70	0.00	2.92	-1.79
Iyeyoshi Tokugawa[5)]	2.84	0.22	-2.68	0.27	2.36
Japanese (mean)[6)]	0.33	0.16	0.04	-0.77	0.32
Australian Aboriginals (mean)[1)]	-0.23	1.24	0.94	-0.91	-2.23
Minimum[7)]	-4.48	0.68	-0.22	-1.63	-0.07
Minimum[7)] - 2SD[3)]	-8.06	0.34	-0.90	-1.74	-0.08

[1)]The Australian Aboriginal male sample of 4000-100 B.P. was derived from Murray River Valley (Brown, 2001). The statistics such as means and variances/covariances were recalculated by the present author on the basis of the raw data published by Brown. It should be noted here that the columns for PC 2 and PC 3 are reversed. For the reason, see text.

[2)]Maximum value across *Homo sapiens sapiens* samples of the Neolihic to modern times (sample size is 20 or more for each variable mean in each sample).

[3)]SD designates the within-group standard deviation of the Kinai Japanese male sample. See the footnote 6.

[4)]Herto (*Homo sapiens idaltu*), Ethiopia, dated to 160,000-154,000 years old (White et al., 2003).

[5)]Iyeyoshi Tokugawa [1793-1853], the 12th Shogun of the Edo period in Japan (Suzuki, 1967).

[6)]Modern Japanese males from the Kinai district (Miyamoto, 1924). The means and standard deviations were recalculated by the present author on the basis of the raw data published by Miyamoto.

[7)]Minimum value across *Homo sapiens sapiens* samples of the Neolihic to modern times (sample size is 20 or more for each variable in each sample).

prepared for multivariate analyses to achieve the aim of the present study.

In the first variable set of the skull, the number of samples available was 117, 140, and 159 in males, and 38, 49, and 69 in females for Class A, B, and C, respectively. In the second variable set of the skull, the number of male samples available was only 5, 7, and 10 for Class A, B, and C, respectively (the check on female samples was not made for the same reason as the above). In the third variable set of the skull, the number of samples available was 237, 291, and 325 in males, and 42, 53, and 73 in females for Class A, B, and C, respectively.

Among-group covariations of craniofacial, limb bone, and environmental variables

The among-group covariations between craniofacial, limb bone, and environmental variables were also examined using PCA. In either case of the first and second variable sets, however, the number of samples collected was not enough for any multivariate analysis of the three kinds of data under the statistical restriction on sample size given the number of variables. Only in the third variable sets of craniofacial and limb bone measurements, 27 male samples were available (in this case, the total number of variables is 23, i.e., 9 craniofacial, 8 postcranial, and 6 environmental variables), though the quality of the samples is not so high (Class C in Table 1). The results of PCA and the rotated solution based on these samples are shown in Tables 9 and 10, respectively.

It was found that PC I was significantly associated with bizygomatic breadth and, at the same time, with humeral and femoral midshaft thickness measurements (Table 9), and that Fac IV which was significantly associated with average temperature was inversely associated with absolute value of latitude (Table 10). No association was suggested between craniofacial or limb bone measurements and environmental variables. Incidentally, 22 of the 27 samples are those from the Japanese archipelago of the Jomon period to modern times. This means that the above results do not necessarily reflect a global tendency.

Among-group covariations of craniofacial and environmental variables

Since the number of the limb bone samples collected was too small, the among-group covariations of craniofacial measurements and environmental variables were intensively examined. The PCA based on the data set with the highest quality for the first variable set (Class A in Table 1) showed a very interesting result (PC I in Table 11 or Fac I in Table 12), suggesting that cranial breadth, upper facial height, bizygomatic breadth, orbital height, and nasal height have a negative correlation with average temperature and a positive correlation with absolute value of latitude. Strangely, however, any of the factor loadings on PC I or Fac I was not significant at the 5% level. The significance tests were performed by Efron’s bootstrap method. Usually, the bootstrap method gives convincing results, even if the form of distribution of the statistic to be tested is deviated from that of a normal distribution, except for an extreme value in an observed sample, as already stated in “Methods.” In the present study, therefore, PCA was, then, separately applied to the correlation matrices for craniofacial measurements and environmental variables to explore the reason why the bootstrap method did not give an appropriate probability to a high factor loading. The results from the craniofacial data are shown in Tables 13 and 14, and those from the environmental data, in Tables 15 and 16. PC I and Fac I from the craniofacial data show that they are highly significantly associated with cranial breadth, upper facial height, bizygomatic breadth, orbital height, and nasal height at the 0.1% level (Tables 13 and 14). The state of high factor loadings for these original variables is almost perfectly compatible with the

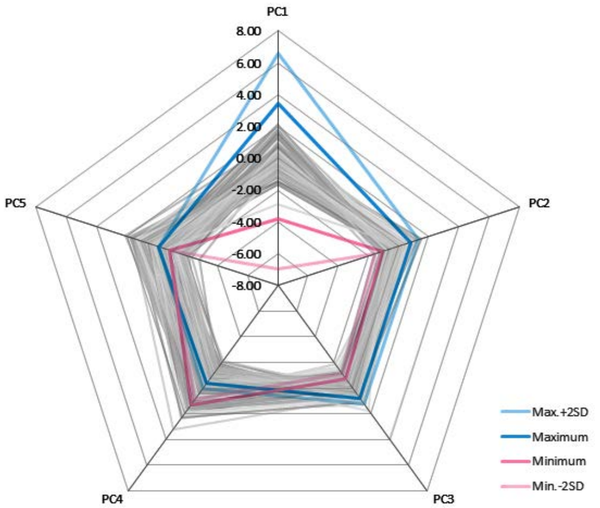

Fig. 7. Radar chart on the first five PCs (Table 4) for 283 male samples (Class A in Table 1, designated by gray pentagons of different brightness) and the pseudo-individuals with the minimum-2SD, minimum, maximum, or maximum+2SD across male sample means in each of eight craniofacial measurements (Tables 3 and 7). PC scores were calculated on the basis of the world averages (Table 3) and the within-group variance/ covariance matrix of a modern Japanese male sample (Table 4). “0.00” represents the world averages.

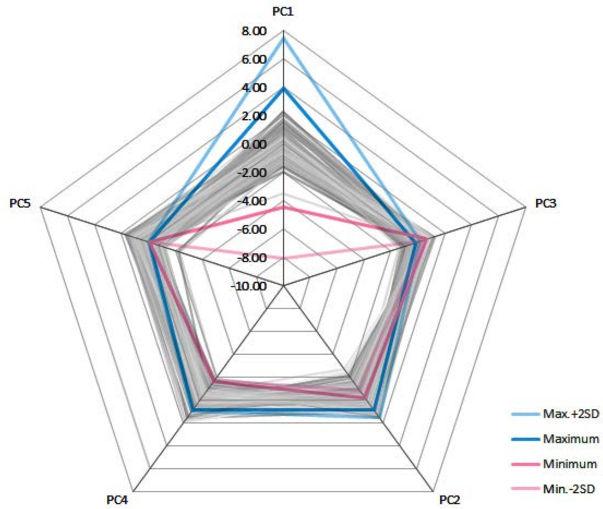

Fig. 8. Radar chart on the first five PCs (Table 5) for 283 male samples (Class A in Table 1, designated by gray pentagons of different brightness) and the pseudo-individuals with the minimum-2SD, minimum, maximum, or maximum+2SD across male sample means in each of eight craniofacial measurements (Tables 3 and 8). PC scores were calculated on the basis of the world averages (Table 3) and the within-group variance/ covariance matrix of an Australian Aboriginal male sample (Table 5). “0.00” represents the world averages. It should be noted that the axes of PC 2 and PC 3 are reversed. For details, see text.

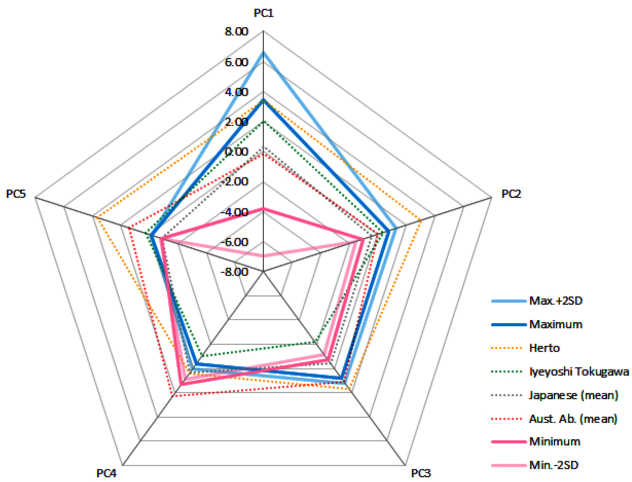

Fig. 9. Radar chart on the first five PCs (Table 4) for the pseudo-individuals with the minimum-2SD, minimum, maximum, or maximum+2SD across male sample means in each of eight craniofacial measurements (Tables 3 and 7) and for two special individual specimens (Tables 3 and 7). PC scores were calculated on the basis of the world averages (Table 3) and the within-group variance/ covariance matrix of a modern Japanese male sample (Table 4). “0.00” represents the world averages.

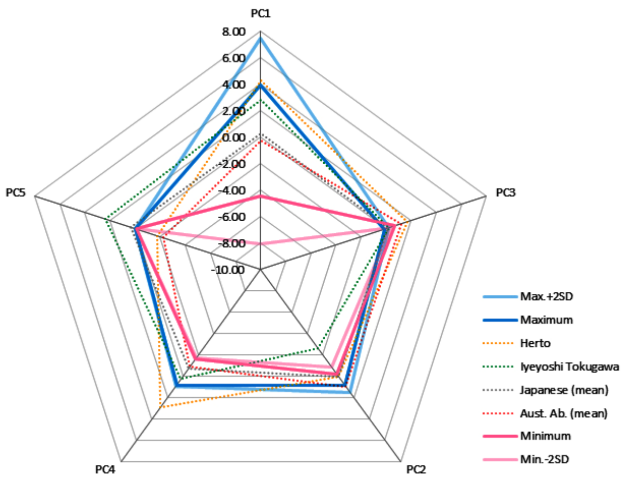

Fig. 10. Radar chart on the first five PCs (Table 5) for the pseudo-individuals with the minimum-2SD, minimum, maximum, or maximum+2SD across male sample means in each of eight craniofacial measurements (Tables 3 and 8) and for two special individual specimens (Tables 3 and 8). PC scores were calculated on the basis of the world averages (Tables 3) and the within-group variance/covariance matrix of an Australian Aboriginal male sample (Table 5). “0.00” represents the world averages. It should be noted that the axes of PC 2 and PC 3 are reversed. For details, see text.

results shown in Tables 11 and 12. On the other hand, the results obtained from the environmental data show that, although some of the factor loadings on PC I and II or Fac I and II have very high values (Tables 15 and 16), the probabilities estimated for them by the bootstrap method are greater than 0.05.

The same tendency as the above was confirmed also in the analyses based on the third variable set of the skull (Tables 17 to 22). These findings point to a possible cause hidden in the environmental data.

In Figs. 11 to 16, the distributions of the six environmental variables are drawn. Their skewness and

Table 9. Principal component analysis of the among-group correlations between craniofacial and postcranial measurements and environmental variables (males).[1)]

Variable[2)]	Factor loadings						Total
	PC I	II	III	IV	V	VI	variance (%)
1 Cranial length	0.24	-0.22	0.09	0.74	0.26	0.39	88.20
9 Minimum frontal breadth	0.54	-0.58	0.10	0.01	0.17	0.03	66.00
8 Cranial breadth	0.51	-0.02	-0.47	-0.43	0.25	-0.35	85.74
17 Basi-bregmatic height	0.44	0.42	-0.12	-0.19	0.61	-0.17	81.26
48 Upper facial height	0.17	0.74	-0.23	0.35	-0.18	-0.35	89.71
45 Bizygomatic breadth	0.80**	-0.24	-0.34	0.10	-0.04	-0.17	84.70
52 Orbital height	0.06	0.85	-0.00	0.30	0.20	0.06	84.79
54 Nasal breadth	0.37	-0.40	0.26	0.11	-0.51	-0.06	63.98
55 Nasal height	0.11	0.88	0.13	-0.03	-0.02	-0.31	90.01
1 Maximum length (humerus)	0.21	0.21	0.83	0.23	0.12	-0.05	85.92
7 Min. circum. of the shaft (humerus)	0.74	0.36	0.18	-0.29	-0.25	0.16	88.08
5 Max. diameter of the midshaft (humerus)	0.90***	0.06	-0.10	-0.11	-0.10	0.27	90.70
6 Min. diameter of the midshaft (humerus)	0.77**	0.35	0.01	-0.03	-0.17	0.42*	92.46
1 Maximum length (femur)	0.38	-0.10	0.82	0.03	-0.01	-0.27	89.47
6 Sagittal diameter at midshaft (femur)	0.85**	-0.37	0.13	-0.00	0.03	-0.15	90.16
7 Transverse diameter at midshaft (femur)	0.57	0.32	-0.18	0.45	-0.35	0.06	78.78
8 Circumference at midshaft (femur)	0.94***	-0.12	0.04	0.17	-0.07	-0.06	93.60
Average temperature (degree Celsius)	-0.02	0.08	0.67	-0.67	-0.03	0.05	90.81
Average precipitation (mm)	-0.00	0.10	-0.39	-0.64	0.06	0.49	82.14
Average relative humidity (%)	0.47	0.30	-0.51	-0.43	0.10	0.00	76.48
Chronological age (yrs before 2000)	0.31	-0.76	-0.29	-0.16	0.12	-0.27	87.73
Absolute value of latitude (degree)	-0.09	-0.13	-0.67	0.70	0.03	-0.02	95.33
Great circle distance (km)[3)]	0.32	-0.02	0.34	0.27	0.76	0.19	90.30
Total contribution (%)	26.50	17.71	15.01	13.21	7.44	5.62	85.49
Cumulative proportion (%)	26.50	44.21	59.22	72.43	79.87	85.49	85.49

[1)]Based on the third variable sets of the skull and limb bones (Table 1) as well as six environmental variables. The number of samples (Class C in Table 1) is 27. Of the 27 samples, 22 are derived from the Japanese archipelago. The number of principal components was so determined that the cumulative proportion of the variances of the principal components exceeded 80%.

[2)]Variable number according to Martin and Saller (1957).

[3)]Great circle distance from Kamoya's hominid site (Omo-Kibish I), Ethiopia (Shea, 2008).

*P<0.05; **P<0.01; ***P<0.001, according to a two-tailed bootstrap test.

Table 10. Rotated solution of the first six principal components extracted from the among-group correlations between craniofacial and postcranial measurements and environmental variables (Table 9).[1)]

Variable[2)]	Factor loadings					
	Fac I	II	III	IV	V	VI
1 Cranial length	0.25	-0.13	0.17	0.46	0.65	0.37
9 Minimum frontal breadth	0.37	-0.61	0.20	-0.00	0.29	-0.18
8 Cranial breadth	0.24	-0.12	-0.15	0.02	-0.09	-0.87***
17 Basi-bregmatic height	0.15	0.34	-0.10	-0.11	0.43	-0.69*
48 Upper facial height	0.20	0.80	0.20	0.33	-0.19	-0.19
45 Bizygomatic breadth	0.66	-0.27	0.15	0.32	0.00	-0.46
52 Orbital height	0.09	0.87	-0.05	0.10	0.28	-0.02
54 Nasal breadth	0.46	-0.38	0.41	-0.06	-0.25	0.23
55 Nasal height	0.09	0.87	0.14	-0.22	-0.07	-0.24
1 Maximum length (humerus)	0.15	0.26	0.57	-0.45	0.43	0.24
7 Min. circum. of the shaft (humerus)	0.80	0.23	-0.05	-0.40	-0.05	-0.14
5 Max. diameter of the midshaft (humerus)	0.90*	-0.07	-0.13	-0.05	0.13	-0.23
6 Min. diameter of the midshaft (humerus)	0.89	0.23	-0.21	-0.10	0.15	-0.00
1 Maximum length (femur)	0.25	-0.08	0.70	-0.53	0.21	0.05
6 Sagittal diameter at midshaft (femur)	0.66	-0.41	0.36	-0.06	0.18	-0.35
7 Transverse diameter at midshaft (femur)	0.70	0.35	0.15	0.39	-0.06	0.06
8 Circumference at midshaft (femur)	0.84	-0.15	0.32	0.08	0.17	-0.26
Average temperature (degree Celsius)	-0.03	-0.04	-0.00	-0.95*	-0.03	0.04
Average precipitation (mm)	0.09	-0.08	-0.85**	-0.22	-0.09	-0.15
Average relative humidity (%)	0.38	0.16	-0.45	-0.00	-0.10	-0.61
Chronological age (yrs before 2000)	0.08	-0.78	0.12	0.18	-0.06	-0.46
Absolute value of latitude (degree)	-0.07	-0.00	-0.02	0.97*	0.02	0.04
Great circle distance (km)[3)]	0.07	-0.02	0.15	-0.06	0.93*	-0.11

[1)]The number of samples (Class C in Table 1) is 27. The cumulative proportion of the variances of the six principal components is 85.49%.

[2)]Variable number according to Martin and Saller (1957).

[3)]Great circle distance from Kamoya's hominid site (Omo-Kibish I), Ethiopia (Shea, 2008).

*P<0.05; **P<0.01; ***P<0.001, according to a two-tailed bootstrap test.

Table 11. Principal component analysis of the among-group correlations between craniofacial and environmental variables (males).[1)]

Variable[2)]	Factor loadings					Total
	PC I	II	III	IV	V	variance (%)
1 Cranial length	-0.10	-0.10	0.72	0.43	-0.34	84.22
5 Cranial base length	0.27	0.28	0.67	0.55	0.12	91.78
9 Minimum frontal breadth	0.20	-0.36	-0.27	0.70**	0.25	79.20
8 Cranial breadth	0.72	-0.27	-0.33	0.07	0.41	87.63
17 Basi-bregmatic height	-0.09	0.66**	0.27	0.34	0.39	77.64
48 Upper facial height	0.81	-0.15	0.30	-0.32*	0.15	88.86
45 Bizygomatic breadth	0.88	0.19*	0.07	0.02	0.10	81.65
52 Orbital height	0.73	0.34**	0.03	-0.29**	-0.13	74.50
54 Nasal breadth	0.18	0.52*	0.29	-0.32	0.09	49.86
55 Nasal height	0.80	0.14	0.21	-0.24	0.24	81.85
Average temperature (degree Celsius)	-0.81	0.40**	-0.12	-0.03	0.27	90.01
Average precipitation (mm)	-0.02	0.70*	-0.52	0.22	-0.03	81.81
Average relative humidity (%)	0.57	0.16	-0.49	0.48*	-0.17	84.36
Chronological age (yrs before 2000)	-0.47	-0.27	0.56	0.02	0.22	65.81
Absolute value of latitude (degree)	0.68	-0.60***	0.09	0.17	-0.19	90.10
Great circle distance (km)[3)]	0.37	0.73***	0.09	0.11	-0.36	81.65
Total contribution (%)	31.71	17.67	14.39	10.99	5.92	80.68
Cumulative proportion (%)	31.71	49.38	63.76	74.76	80.68	80.68

[1)]Based on the first variable set of the skull (Table 1) excluding orbital breadth (Martin's No. 51) and six environmental variables. The number of samples (Class A in Table 1) is 117. The number of principal components was so determined that the cumulative proportion of the variances of the principal components exceeded 80%.

[2)]Variable number according to Martin and Saller (1957).

[3)]Great circle distance from Kamoya's hominid site (Omo-Kibish I), Ethiopia (Shea, 2008).

*P<0.05; **P<0.01; ***P<0.001, according to a two-tailed bootstrap test.

Table 12. Rotated solution of the first five principal components extracted from the among-group correlations between craniofacial and environmental variables (Table 11).[1)]

Variable[2)]	Factor loadings				
	Fac I	II	III	IV	V
1 Cranial length	-0.11	-0.09	0.18	-0.04	-0.89***
5 Cranial base length	0.30	0.43	-0.01	0.14	-0.79**
9 Minimum frontal breadth	-0.01	-0.01	-0.07	0.88	-0.09
8 Cranial breadth	0.65	-0.08	-0.08	0.58	0.32
17 Basi-bregmatic height	0.01	0.83*	-0.12	-0.02	-0.27
48 Upper facial height	0.92	-0.18	0.11	-0.05	-0.03
45 Bizygomatic breadth	0.82	0.05	-0.34	0.11	-0.09
52 Orbital height	0.70	-0.05	-0.42	-0.28	0.03
54 Nasal breadth	0.35	0.36	-0.09	-0.49	-0.05
55 Nasal height	0.89	0.09	-0.08	-0.06	0.01
Average temperature (degree Celsius)	-0.67	0.57	0.13	-0.22	0.24
Average precipitation (mm)	-0.21	0.43	-0.73	0.00	0.22
Average relative humidity (%)	0.22	-0.08	-0.74	0.48	-0.00
Chronological age (yrs before 2000)	-0.24	0.13	0.70	-0.06	-0.30
Absolute value of latitude (degree)	0.53	-0.61	0.01	0.43	-0.25
Great circle distance (km)[3)]	0.23	0.22	-0.70	-0.34	-0.31

[1)]The number of samples (Class A in Table 1) is 117. The cumulative proportion of the variances of the five principal components is 80.68%.

[2)]Variable number according to Martin and Saller (1957).

[3)]Great circle distance from Kamoya's hominid site (Omo-Kibish I), Ethiopia (Shea, 2008).

*P<0.05; **P<0.01; ***P<0.001, according to a two-tailed bootstrap test.

Table 13. Principal component analysis of the among-group correlations between craniofacial measurements (males).[1)]

Variable[2)]	Factor loadings				Total
	PC I	II	III	IV	variance (%)
1 Cranial length	-0.10	0.69***	0.34	-0.60	96.02
5 Cranial base length	0.34*	0.81***	0.40	0.05	92.83
9 Minimum frontal breadth	0.04	-0.18	0.89***	0.09	84.14
8 Cranial breadth	0.66***	-0.51	0.41**	0.17	88.95
17 Basi-bregmatic height	0.05	0.65***	-0.00	0.71	92.54
48 Upper facial height	0.86***	-0.08	-0.05	-0.23	80.35
45 Bizygomatic breadth	0.88***	0.01	0.10	0.06	78.77
52 Orbital height	0.78***	-0.01	-0.24**	-0.08	68.09
54 Nasal breadth	0.37**	0.40	-0.46**	0.01	51.00
55 Nasal height	0.90***	0.04	-0.09	-0.03	82.16
Total contribution (%)	36.41	20.14	15.29	9.64	81.48
Cumulative proportion (%)	36.41	56.55	71.84	81.48	81.48

[1)]Based on the craniofacial data of the same samples as used in Table 11. The number of samples (Class A in Table 1) is 117. The number of principal components was so determined that the cumulative proportion of the variances of the principal components exceeded 80%.

[2)]Variable number according to Martin and Saller (1957).

*P<0.05; **P<0.01; ***P<0.001, according to a two-tailed bootstrap test.

Table 14. Rotated solution of the first four principal components extracted from the among-group correlations between craniofacial measurements (Table 13).[1)]

Variable[2)]	Factor loadings			
	Fac I	II	III	IV
1 Cranial length	-0.10	0.97*	-0.02	-0.02
5 Cranial base length	0.27***	0.69***	0.11	0.61*
9 Minimum frontal breadth	0.01	0.14	0.91***	0.04
8 Cranial breadth	0.65***	-0.32	0.60***	-0.07
17 Basi-bregmatic height	-0.06	0.02	-0.11	0.95
48 Upper facial height	0.88***	0.07	-0.02	-0.13
45 Bizygomatic breadth	0.86***	0.00	0.13	0.16
52 Orbital height	0.80***	-0.04	-0.21*	-0.00
54 Nasal breadth	0.37**	0.11	-0.55*	0.25
55 Nasal height	0.90***	0.01	-0.07	0.09

[1)]The number of samples (Class A in Table 1) is 117. The cumulative proportion of the variances of the four principal components is 81.48%.

[2)]Variable number according to Martin and Saller (1957).

*P<0.05; **P<0.01; ***P<0.001, according to a two-tailed bootstrap test.

kurtosis are indicated in Table 23. They clearly show their extreme deviation from normal distributions, except for average temperature and absolute value of latitude. This is considered a cause of the failure in the above bootstrap tests. In fact, for example, the bootstrap standard deviations for the z-transformed factor loadings of upper facial height and bizygomatic breadth on PC I in Table 11 are 1.16 and 1.40, respectively, while those in Table 13 are 0.12 and 0.11, respectively (not shown in tables). Namely, the former bootstrap SDs are about ten times as large as the latter. As a result, it turns out that the former factor loadings are not significantly different from zero, while the latter, significantly different from zero.

Table 15. Principal component analysis of the among-group correlations between environmental variables.[1)]

Variable	Factor loadings PC I	II	III	Total variance (%)
Average temperature (degree Celsius)	-0.79	0.55	-0.18**	95.08
Average precipitation (mm)	0.18	0.90	-0.12	85.46
Average relative humidity (%)	0.82	0.32	-0.20	80.75
Chronological age (yrs before 2000)	-0.64	-0.39	0.37	69.08
Absolute value of latitude (degree)	0.70	-0.68	-0.04	94.72
Great circle distance (km)[2)]	0.44	0.54	0.70***	97.59
Total contribution (%)	40.03	35.17	11.91	87.12
Cumulative proportion (%)	40.03	75.20	87.12	87.12

[1)]Based on the environmental data of the same samples as used in Table 11. The number of samples is 117. The number of principal components was so determined that the cumulative proportion of the variances of the principal components exceeded 80%.

[2)]Great circle distance from Kamoya's hominid site (Omo-Kibish I), Ethiopia (Shea, 2008).

$^{*}P$<0.05; $^{**}P$<0.01; $^{***}P$<0.001, according to a two-tailed bootstrap test.

Table 16. Rotated solution of the first three principal components extracted from the among-group correlations between environmental variables (Table 15).[1)]

Variable	Factor loadings Fac I	II	III
Average temperature (degree Celsius)	-0.95	-0.15	-0.15
Average precipitation (mm)	-0.55	0.65	0.36
Average relative humidity (%)	0.29	0.82	0.23
Chronological age (yrs before 2000)	-0.10	-0.82	-0.06
Absolute value of latitude (degree)	0.96	0.14	-0.12
Great circle distance (km)[2)]	0.00	0.21	0.97

[1)]The number of samples is 117. The cumulative proportion of the variances of the three principal components is 87.12%.

[2)]Great circle distance from Kamoya's hominid site (Omo-Kibish I), Ethiopia (Shea, 2008).

$^{*}P$<0.05; $^{**}P$<0.01; $^{***}P$<0.001, according to a two-tailed bootstrap test.

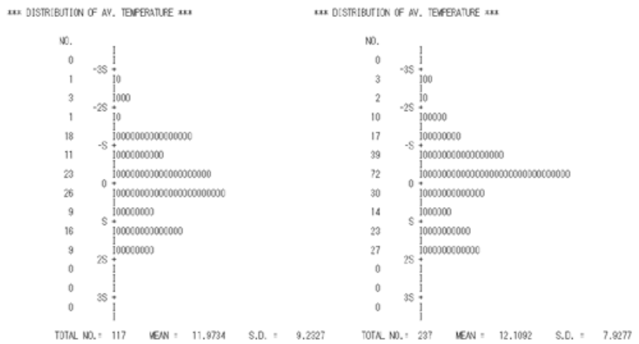

Fig. 11. Among-group distributions of average temperature based on two sets of *Homo sapiens sapiens* samples from all over the world (Appendices 3 and 4). "S" designates the standard deviation of the among-group distribution.

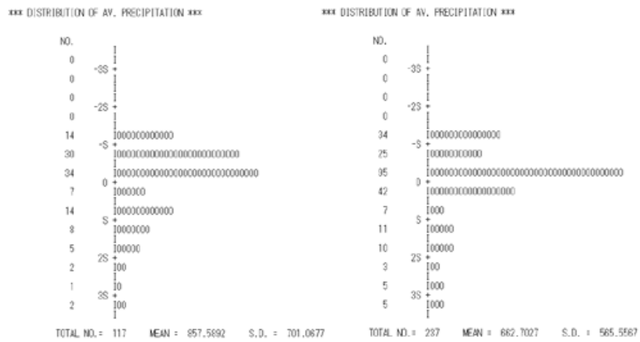

Fig. 12. Among-group distributions of average precipitation based on two sets of *Homo sapiens sapiens* samples from all over the world (Appendices 3 and 4). "S" designates the standard deviation of the among-group distribution.

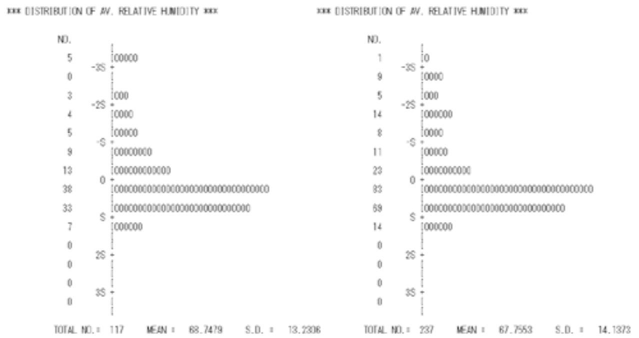

Fig. 13. Among-group distributions of average relative humidity based on two sets of *Homo sapiens sapiens* samples from all over the world (Appendices 3 and 4). "S" designates the standard deviation of the among-group distribution.

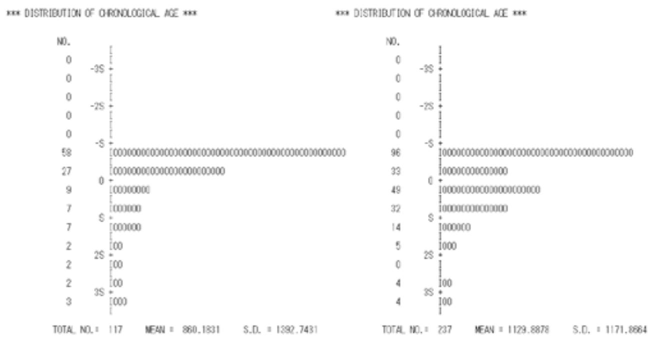

Fig. 14. Among-group distributions of chronological age based on two sets of *Homo sapiens sapiens* samples from all over the world (Appendices 3 and 4). "S" designates the standard deviation of the among-group distribution.

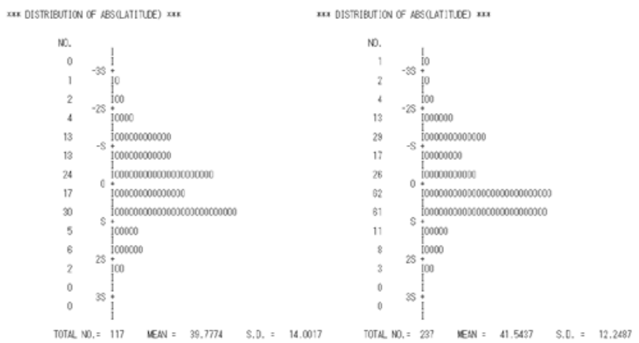

Fig. 15. Among-group distributions of the absolute value of latitude based on two sets of *Homo sapiens sapiens* samples from all over the world (Appendices 3 and 4). "S" designates the standard deviation of the among-group distribution.

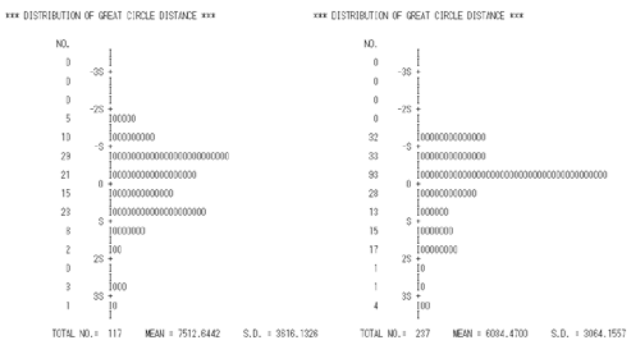

Fig. 16. Among-group distributions of great circle distance (from Kamoya's hominid site [Omo-Kibish I], Ethiopia) based on two sets of *Homo sapiens sapiens* samples from all over the world (Appendices 3 and 4). "S" designates the standard deviation of the among-group distribution.

In the present study, therefore, the existence of a factor such as a PC or rotated factor was confirmed mainly by comparing the variation patterns of factor loadings on two PCs or rotated factors, as stated in "Methods."

In passing, it is a noteworthy finding in the present study that PC I from among-group correlations between craniofacial measurements is not a so-called general size factor because of the fact that all factor loadings on the PC do not have the same sign (Tables 13 and 19). In the case of within-group PCA, PC I is usually a general size factor, as seen in Tables 4 and 5.

The existence of PCs or Facs obtained from the among-group correlations between craniofacial measurements was confirmed using Spearman's rank correlation coefficient (Tables 24 and 25). At least, the significant Spearman's rank correlation coefficients of 0.90 and 0.98 (Table 24) between PC I's (Tables 13 and 11) and between Fac I's (Tables 14 and 12), respectively, suggest that there is a common factor which strongly influence the among-group covariations between cranial breadth, upper facial height, bizygomatic breadth, orbital height, and nasal height. The significant Spearman's rank correlation coefficients of 0.83 and 1.00 (Table 25) between PC I's (Tables 19 and 17) and between Fac I (Table 20) and Fac II (Table 18), respectively, also point to the existence of the same factor. Tables 24 and 25 furthermore suggest the existence of other common factors.

Similarly, the repeatability of PCs or Facs from environmental variables was also examined (Tables 26 and 27). The significant rank correlation coefficients of 0.94 and 0.89 (Table 26) between PC I's (Tables 15 and 11) and between Fac I's (Tables 16 and 12) suggest that there is a common factor which strongly associated with average temperature and absolute value of latitude in the opposite direction. The same tendency is also indicated by the significant rank correlation coefficients of 1.00 and, again, 1.00 (Table 27) between PC I's (Tables 21 and 17) and between Fac I's (Tables 22 and 18), respectively.

Hence, PCA and the rotation of the PCs on both craniofacial (the first variable set) and environmental variables were carried out for female Class A samples as well (Tables 28 and 29).

The PCAs based on Class B samples, both male and female, showed similar results to those based on Class A samples. Therefore, the description is omitted here.

The results of PCAs and the rotations based on male and female Class C samples are shown in Tables 30 to 33.

Table 34 shows Spearman's rank correlation coefficients between the PCs or rotated factors from the Class A male samples and those from the Class C male samples of ten craniofacial and six environmental variables. These rank correlation coefficients indicate very clear correspondence between the results from the Class A and C male samples. It is almost true of females (Table 35). Tables 36 and 37 reveal the degree of correspondence between males and females in Class A and Class C samples, respectively.

Tables 38 to 47 show the results of analyses for the third variable set of the skull, which were performed following the same procedure as used for the first variable set of the skull (Tables 28 to 37).

Here, once again, the existence of PCs or rotated factors from the combination of the nine craniofacial and eight postcranial measurements and six environmental variables (Tables 9 and 10) was examined using Spearman's rank correlation coefficients. The results are shown in Tables 48 and 49, where, however, no clear evidence is found for existence of concrete common factors.

In Figs. 17 to 22, the factor loadings of major common factors, the existence of which was confirmed by Spearman's rank correlation coefficients, are illustrated. To know which people have the highest or lowest scores in each major factor, standardized means of craniofacial and environmental variables were checked in the Class A male samples with the highest or lowest scores (Table 50). As a result, for example, those who have the highest scores of PC I in Table 11 are peoples like Yakuts (Russia; 73 YAKUT in Appendix 3), Buryats (Russia; 71 B-T-B) and Chukchi (Russia; 74 CHUK3), while those who have the lowest scores of PC I in Table 11 are peoples from Lower Nubia (Egypt; 26 L-NB2), Naqada (Egypt; 4 NAQAD) and S. Egyptians (Upper Egypt; 3 S-EGY). The standardized means of original variables make the characteristics of extracted factors clearer, as shown in Figs. 23 to 28.

Path analysis of craniofacial measurements and environmental variables

Finally, path analysis was performed to get a piece of information on some unknown factors which may influence the among-group variations of craniofacial measurements. On a simple model, such as used in Mizoguchi (1978, 1986), craniofacial measurements were treated as endogenous variables, and environmental variables, as exogenous variables. The results based on the Class A male samples of the first and third variable sets are shown in Tables 51 and 52, respectively. In both analyses, it was found that residual variables had relatively high values. This suggests the existence of unknown factors influencing on craniofacial measurements in addition to the factors found in the above PCAs.

Discussion

First of all, it should be noted that the data collected for the present study may contain many kinds of errors, for example, original sampling error, intra- and inter-observer errors, errors in the determination of chronological age, errors in the assignment of

Table 17. Principal component analysis of the among-group correlations between craniofacial and environmental variables (males).[1)]

Variable[2)]	Factor loadings PC I	II	III	IV	V	VI	Total variance (%)
1 Cranial length	0.18	-0.25	-0.26	0.74***	-0.33	0.11	82.94
9 Minimum frontal breadth	-0.29	-0.62***	0.30	0.23*	0.40*	0.14	79.34
8 Cranial breadth	-0.74	-0.28**	0.05	-0.22*	0.41*	0.14	86.56
17 Basi-bregmatic height	0.06	0.37*	0.13	0.63***	0.45	-0.33	86.87
48 Upper facial height	-0.63	0.06	-0.65	0.00	0.09	-0.22	88.48
45 Bizygomatic breadth	-0.88	0.15*	-0.04	0.10	0.10	0.26	88.19
52 Orbital height	-0.65	0.49***	-0.24	-0.14	-0.14	-0.18	78.69
54 Nasal breadth	-0.17	0.63***	-0.26	0.12	0.07	0.63	91.96
55 Nasal height	-0.70	0.25	-0.45	0.06	0.17	-0.19	82.56
Average temperature (degree Celsius)	0.78	0.43**	0.11	-0.07	0.25*	-0.01	87.65
Average precipitation (mm)	-0.27	0.47	0.72	0.10	0.00	-0.00	81.61
Average relative humidity (%)	-0.68	-0.24	0.56	0.20*	-0.10	-0.04	88.18
Chronological age (yrs before 2000)	0.53	-0.18	-0.42	0.40***	0.13	0.09	67.24
Absolute value of latitude (degree)	-0.63	-0.66***	-0.08	0.09	-0.21**	-0.02	90.40
Great circle distance (km)[3)]	-0.52	0.56*	0.28	0.27**	-0.32*	-0.03	84.09
Total contribution (%)	32.44	17.65	13.61	9.25	6.30	5.07	84.32
Cumulative proportion (%)	32.44	50.09	63.70	72.95	79.25	84.32	84.32

[1)]Based on the third variable set of the skull (Table 1) and six environmental variables. The number of samples (Class A in Table 1) is 237. The number of principal components was so determined that the cumulative proportion of the variances of the principal components exceeded 80%.

[2)]Variable number according to Martin and Saller (1957).

[3)]Great circle distance from Kamoya's hominid site (Omo-Kibish I), Ethiopia (Shea, 2008).

$^{*}P$<0.05; $^{**}P$<0.01; $^{***}P$<0.001, according to a two-tailed bootstrap test.

Table 18. Rotated solution of the first six principal components extracted from the among-group correlations between craniofacial and environmental variables (Table 17).[1)]

Variable[2)]	Factor loadings Fac I	II	III	IV	V	VI
1 Cranial length	0.06	-0.05	-0.10	0.90***	0.04	0.01
9 Minimum frontal breadth	0.14	-0.17	-0.08	0.02	0.85	-0.10
8 Cranial breadth	-0.10	0.37	0.02	-0.40***	0.74*	0.11
17 Basi-bregmatic height	0.90***	0.08	0.16	0.15	-0.04	0.00
48 Upper facial height	-0.03	0.92*	-0.13	0.03	0.13*	0.04
45 Bizygomatic breadth	-0.06	0.56	0.38	-0.07	0.49*	0.41
52 Orbital height	-0.08	0.75	0.39	-0.18*	-0.13	0.14
54 Nasal breadth	0.04	0.21	0.12	0.03	-0.18	0.91
55 Nasal height	0.12	0.87	0.08	-0.07	0.13	0.13
Average temperature (degree Celsius)	0.41	-0.49	-0.21	-0.20	-0.61*	0.14
Average precipitation (mm)	0.27	-0.17	0.8	-0.25**	0.05	0.12
Average relative humidity (%)	-0.05	0.06	0.63	0.01	0.67*	-0.18
Chronological age (yrs before 2000)	0.23	-0.15	-0.58	0.48**	-0.14	0.08
Absolute value of latitude (degree)	-0.41	0.33	0.05	0.25*	0.69*	-0.28
Great circle distance (km)[3)]	0.09	0.30	0.83	0.10	-0.07	0.19

[1)]The number of samples (Class A in Table 1) is 237. The cumulative proportion of the variances of the six principal components is 84.32%.

[2)]Variable number according to Martin and Saller (1957).

[3)]Great circle distance from Kamoya's hominid site (Omo-Kibish I), Ethiopia (Shea, 2008).

$^{*}P$<0.05; $^{**}P$<0.01; $^{***}P$<0.001, according to a two-tailed bootstrap test.

Table 19. Principal component analysis of the among-group correlations between craniofacial measurements (males).[1)]

Variable[2)]	Factor loadings PC I	II	III	IV	V	Total variance (%)
1 Cranial length	-0.21**	-0.10	0.78***	-0.49	0.22	96.21
9 Minimum frontal breadth	0.07	0.81***	0.43**	0.10	0.13	87.71
8 Cranial breadth	0.66***	0.64***	-0.12	0.15*	0.06	89.63
17 Basi-bregmatic height	0.00	-0.30	0.58***	0.65**	-0.39	99.28
48 Upper facial height	0.81***	-0.08	0.12	-0.31*	-0.25	83.20
45 Bizygomatic breadth	0.84***	0.15*	0.07	0.20	0.25	84.20
52 Orbital height	0.78***	-0.27***	-0.13	-0.15	-0.11	73.51
54 Nasal breadth	0.41***	-0.58***	0.05	0.28	0.61	94.90
55 Nasal height	0.87***	-0.13*	0.15*	-0.14	-0.20	85.47
Total contribution (%)	37.56	18.15	13.41	10.62	8.49	88.23
Cumulative proportion (%)	37.56	55.71	69.12	79.74	88.23	88.23

[1)]Based on the craniofacial data of the same samples as used in Table 17. The number of samples (Class A in Table 1) is 237. The number of principal components was so determined that the cumulative proportion of the variances of the principal components exceeded 80%.

[2)]Variable number according to Martin and Saller (1957).

$^{*}P$<0.05; $^{**}P$<0.01; $^{***}P$<0.001, according to a two-tailed bootstrap test.

Table 20. Rotated solution of the first five principal components extracted from the among-group correlations between craniofacial measurements (Table 19).[1)]

Variable[2)]	Factor loadings Fac I	II	III	IV	V
1 Cranial length	-0.02	0.00	0.98***	0.04	0.00
9 Minimum frontal breadth	-0.13**	0.88***	0.21**	0.05	-0.19
8 Cranial breadth	0.39***	0.77***	-0.35***	-0.15	0.02
17 Basi-bregmatic height	0.01	-0.03	0.04	0.99*	0.07
48 Upper facial height	0.91***	0.09*	0.06	-0.02	0.00
45 Bizygomatic breadth	0.57***	0.52***	-0.17*	0.01	0.46
52 Orbital height	0.80***	-0.07	-0.16**	-0.07	0.23
54 Nasal breadth	0.18***	-0.13**	0.02	0.08	0.94*
55 Nasal height	0.90***	0.12**	0.00	0.10*	0.13*

[1)]The number of samples (Class A in Table 1) is 237. The cumulative proportion of the variances of the five principal components is 88.23%.

[2)]Variable number according to Martin and Saller (1957).

$^{*}P$<0.05; $^{**}P$<0.01; $^{***}P$<0.001, according to a two-tailed bootstrap test.

Table 21. Principal component analysis of the among-group correlations between environmental variables.[1)]

Variable	Factor loadings PC I	II	III	Total variance (%)
Average temperature (degree Celsius)	0.78	0.55***	-0.10	92.53
Average precipitation (mm)	-0.45	0.79***	0.10	84.13
Average relative humidity (%)	-0.88	0.06	0.08	79.11
Chronological age (yrs before 2000)	0.62	-0.32***	0.69**	95.82
Absolute value of latitude (degree)	-0.69	-0.70***	0.02	95.81
Great circle distance (km)[2)]	-0.58	0.52***	0.39	76.35
Total contribution (%)	46.48	29.98	10.83	87.29
Cumulative proportion (%)	46.48	76.46	87.29	87.29

[1)]Based on the environmental data of the same samples as used in Table 17. The number of samples is 237. The number of principal components was so determined that the cumulative proportion of the variances of the principal components exceeded 80%.

[2)]Great circle distance from Kamoya's hominid site (Omo-Kibish I), Ethiopia (Shea, 2008).

$^{*}P$<0.05; $^{**}P$<0.01; $^{***}P$<0.001, according to a two-tailed bootstrap test.

Table 22. Rotated solution of the first three principal components extracted from the among-group correlations between environmental variables (Table 21).[1)]

Variable	Factor loadings Fac I	II	III
Average temperature (degree Celsius)	0.96	-0.08	0.08
Average precipitation (mm)	0.18	0.84***	-0.32
Average relative humidity (%)	-0.63	0.55***	-0.31
Chronological age (yrs before 2000)	0.15	-0.22	0.94
Absolute value of latitude (degree)	-0.97	-0.11	-0.07
Great circle distance (km)[2)]	-0.14	0.86*	-0.05

[1)]The number of samples is 237. The cumulative proportion of the variances of the three principal components is 87.29%.

[2)]Great circle distance from Kamoya's hominid site (Omo-Kibish I), Ethiopia (Shea, 2008).

$^{*}P$<0.05; $^{**}P$<0.01; $^{***}P$<0.001, according to a two-tailed bootstrap test.

Table 23. Skewness and kurtosis of the distributions of environmental variables across the sites of *Homo sapiens sapiens* of the Neolithic to modern times in the world.

Environmental variable	Analysis on the first variable set of the skull[1)] Skewness	*P*(skew.)	Kurtosis	*P*(kurt.)	Analysis on the third variable set of the skull[2)] Skewness	*P*(skew.)	Kurtosis	*P*(kurt.)
Average temperature	-0.29	0.1999	-0.53	0.2366	-0.01	0.9659	-0.12	0.7073
Average precipitation	1.15	0.0000	1.02	0.0212	1.72	0.0000	3.86	0.0000
Average relative humidity	-1.65	0.0000	2.44	0.0000	-1.50	0.0000	1.50	0.0000
Chronological age	2.30	0.0000	5.50	0.0000	1.79	0.0000	5.07	0.0000
Absolute value of latitude	-0.28	0.2116	-0.22	0.6233	-0.51	0.0012	0.11	0.7304
Great circle distance	1.09	0.0000	2.60	0.0000	1.69	0.0000	5.08	0.0000

[1)]The environmental data for 117 sites of *Homo s. s.*, i.e., those of the same samples as used in Table 11, were used.

[2)]The environmental data for 237 sites of *Homo s. s.*, i.e., those of the same samples as used in Table 17, were used.

Table 24. Spearman's rank correlation coefficients between the PCs or rotated factors from ten craniofacial measurements (Tables 13 and 14) and those from the combination of the ten craniofacial and six environmental variables (Tables 11 and 12).[1)]

From Tables 13 and 14:	PC I	II	III	IV	Fac I	II	III	IV
From Table 11: PC I	.90***	-	-	-	.92***	-	-	-
II	-	-	.63*	-	-	-	.77**	.73*
III	-	.79**	-	-	-	.73*	-	-
IV	.70*	-	.83**	-	.71*	-	.64*	-
V	-	-	-	.75*	-	-	-	-
From Table 12: Fac I	.96***	-	-	-	.98***	-	-	-
II	-	-	-	-	-	-	-	.98***
III	-	-	-	-	-	.72*	-	-
IV	-	-	.96***	-	-	-	.92***	-
V	-	.76*	-	-	.67*	.77**	-	-

[1)]Based on the variation patterns of the factor loadings of the craniofacial variables common to both PCAs or rotated solutions. Only rank correlation coefficients significant at the 5% level are listed here. The signs of rank correlation coefficients are removed because the signs of factor loadings are reversible.

$^{*}P$<0.05; $^{**}P$<0.01; $^{***}P$<0.001, according to a two-tailed test.

Table 25. Spearman's rank correlation coefficients between the PCs or rotated factors from nine craniofacial measurements (Tables 19 and 20) and those from the combination of the nine craniofacial and six environmental variables (Tables 17 and 18).[1)]

From Tables 19 and 20:	PC I	II	III	IV	V	Fac I	II	III	IV	V
From Table 17: PC I	.83**	-	-	-	-	-	-	.83**	-	-
II	-	.92***	-	-	-	-	.85**	-	-	.83**
III	-	-	-	-	-	.68*	-	-	-	-
IV	.68*	-	.83**	-	-	.73*	-	.73*	.70*	-
V	-	-	-	-	-	-	-	-	-	-
VI	-	-	-	-	.93***	-	-	-	-	-
From Table 18: Fac I	-	-	.83**	-	-	-	-	.68*	.90***	-
II	.87**	-	-	-	-	1.00***	-	-	-	-
III	-	-	-	-	-	-	-	-	-	.78*
IV	-	-	.77*	-	-	-	-	.83**	-	-
V	-	.93***	-	-	-	-	1.00***	-	-	-
VI	-	-	.72*	-	-	-	-	-	-	.90***

[1)]Based on the variation patterns of the factor loadings of the craniofacial variables common to both PCAs or rotated solutions. Only rank correlation coefficients significant at the 5% level are listed here. The signs of rank correlation coefficients are removed because the signs of factor loadings are reversible.

$^{*}P$<0.05; $^{**}P$<0.01; $^{***}P$<0.001, according to a two-tailed test.

Table 26. Spearman's rank correlation coefficients between the PCs or rotated factors from six environmental variables (Tables 15 and 16) and those from the combination of ten craniofacial and the six environmental variables (Tables 11 and 12).[1)]

From Tables 15 and 16:	PC I	II	III	Fac I	II	III
From Table 11: PC I	.94**	-	-	.94**	-	-
II	-	.83*	-	-	-	-
III	-	-	-	-	-	-
IV	.83*	-	-	-	.89*	-
V	-	-	-	-	-	-
From Table 12: Fac I	.83*	-	-	.89*	-	-
II	-	.89*	-	.94**	-	-
III	-	-	-	-	1.00***	-
IV	-	-	-	-	-	-
V	-	-	.83*	-	-	-

[1)]Based on the variation patterns of the factor loadings of the environmental variables common to both PCAs or rotated solutions. Only rank correlation coefficients significant at the 5% level are listed here. The signs of rank correlation coefficients are removed because the signs of factor loadings are reversible.

*P <0.05; **P <0.01; ***P <0.001, according to a two-tailed test.

Table 27. Spearman's rank correlation coefficients between the PCs or rotated factors from six environmental variables (Tables 21 and 22) and those from the combination of nine craniofacial and the six environmental variables (Tables 17 and 18).[1)]

From Tables 21 and 22:	PC I	II	III	Fac I	II	III
From Table 17: PC I	1.00***	-	-	.89*	-	-
II	-	-	-	-	-	-
III	-	-	-	-	.83*	.83*
IV	-	-	.94**	-	-	-
V	-	-	-	-	-	-
VI	-	-	-	-	-	-
From Table 18: Fac I	.89*	-	-	1.00***	-	-
II	-	-	-	.94**	-	-
III	-	-	-	-	.94**	-
IV	-	.89*	-	-	-	-
V	.89*	-	-	.83*	-	-
VI	-	-	-	-	-	-

[1)]Based on the variation patterns of the factor loadings of the environmental variables common to both PCAs or rotated solutions. Only rank correlation coefficients significant at the 5% level are listed here. The signs of rank correlation coefficients are removed because the signs of factor loadings are reversible.

*P <0.05; **P <0.01; ***P <0.001, according to a two-tailed test.

Table 28. Principal component analysis of the among-group correlations between craniofacial and environmental variables (females).[1)]

	Factor loadings					Total
Variable[2)]	PC I	II	III	IV	V	variance (%)
1 Cranial length	-0.19	0.76	0.00	0.09	0.50	87.89
5 Cranial base length	0.07	0.71	0.48	0.32	0.24	89.68
9 Minimum frontal breadth	0.43	0.58	0.57	-0.12	-0.09	87.21
8 Cranial breadth	0.88***	-0.05	0.19	-0.07	-0.23	86.42
17 Basi-bregmatic height	-0.40	0.13	0.47	0.51	-0.29	74.40
48 Upper facial height	0.76***	0.04	-0.29	0.43	-0.16	87.69
45 Bizygomatic breadth	0.78***	-0.07	0.13	0.34	0.38	88.50
52 Orbital height	0.50	-0.53	0.01	0.26	-0.04	60.28
54 Nasal breadth	0.17	-0.32	-0.08	0.58	0.29	55.26
55 Nasal height	0.81***	0.08	-0.12	0.36	-0.29	89.61
Average temperature (degree Celsius)	-0.78**	-0.01	0.23	0.26	-0.32	82.90
Average precipitation (mm)	-0.27	-0.43	0.73	0.14	0.06	81.18
Average relative humidity (%)	0.41	-0.31	0.63	-0.34	0.19	80.60
Chronological age (yrs before 2000)	-0.22	0.64	-0.38	0.22	0.07	65.50
Absolute value of latitude (degree)	0.80***	0.26	-0.02	-0.42	0.16	90.08
Great circle distance (km)[3)]	-0.30	-0.55	-0.07	0.13	0.62	80.14
Total contribution (%)	30.64	18.18	12.84	10.33	8.47	80.46
Cumulative proportion (%)	30.64	48.82	61.66	71.99	80.46	80.46

[1)]Based on the first variable set of the skull (Table 1) excluding orbital breadth (Martin's No. 51) and six environmental variables. The number of samples (Class A in Table 1) is 38. The number of principal components was so determined that the cumulative proportion of the variances of the principal components exceeded 80%.

[2)]Variable number according to Martin and Saller (1957).

[3)]Great circle distance from Kamoya's hominid site (Omo-Kibish I), Ethiopia (Shea, 2008).

*P <0.05; **P <0.01; ***P <0.001, according to a two-tailed bootstrap test.

Table 29. Rotated solution of the first five principal components extracted from the among-group correlations between craniofacial and environmental variables (Table 28).[1)]

	Factor loadings				
Variable[2)]	Fac I	II	III	IV	V
1 Cranial length	-0.25	0.81	-0.37	-0.11	0.08
5 Cranial base length	0.10	0.91*	0.01	0.18	-0.16
9 Minimum frontal breadth	0.16	0.61	0.30	-0.09	-0.61
8 Cranial breadth	0.66*	-0.04	0.37	-0.35	-0.41
17 Basi-bregmatic height	0.00	0.24	0.05	0.82*	-0.09
48 Upper facial height	0.89*	-0.02	-0.20	-0.20	-0.09
45 Bizygomatic breadth	0.74	0.31	0.28	-0.33	0.23
52 Orbital height	0.60	-0.31	0.31	-0.06	0.21
54 Nasal breadth	0.48	0.01	0.01	0.12	0.56
55 Nasal height	0.89	-0.01	-0.07	-0.15	-0.29
Average temperature (degree Celsius)	-0.40	-0.06	-0.11	0.81*	0.00
Average precipitation (mm)	-0.14	0.03	0.69	0.51	0.22
Average relative humidity (%)	0.07	0.08	0.86	-0.24	-0.07
Chronological age (yrs before 2000)	-0.08	0.38	-0.71	0.03	-0.05
Absolute value of latitude (degree)	0.30	0.21	0.18	-0.78*	-0.35
Great circle distance (km)[3)]	-0.19	-0.11	0.17	-0.02	0.85

[1)]The number of samples (Class A in Table 1) is 38. The cumulative proportion of the variances of the five principal components is 80.46%.

[2)]Variable number according to Martin and Saller (1957).

[3)]Great circle distance from Kamoya's hominid site (Omo-Kibish I), Ethiopia (Shea, 2008).

*P <0.05; **P <0.01; ***P <0.001, according to a two-tailed bootstrap test.

Table 30. Principal component analysis of the among-group correlations between craniofacial and environmental variables (males).[1)]

	Factor loadings						Total
Variable[2)]	PC I	II	III	IV	V	VI	variance (%)
1 Cranial length	-0.03	-0.10	0.71	0.27	0.55	-0.06	88.48
5 Cranial base length	0.33	0.30	0.72	0.41	0.02	0.10	90.62
9 Minimum frontal breadth	0.16	-0.42**	-0.07	0.71*	-0.10	0.13	74.25
8 Cranial breadth	0.68	-0.29**	-0.28	0.23	-0.46	-0.07	88.87
17 Basi-bregmatic height	-0.03	0.61**	0.39	0.25	-0.39	0.39	89.77
48 Upper facial height	0.81	-0.13	0.17	-0.39*	-0.08	0.18	89.56
45 Bizygomatic breadth	0.81	0.27*	0.03	0.15	-0.19	-0.34	90.71
52 Orbital height	0.69	0.35**	-0.12	-0.35*	0.20	0.21	82.36
54 Nasal breadth	0.16	0.60***	0.18	-0.28	-0.16	-0.50	77.96
55 Nasal height	0.77	0.15	0.14	-0.34*	-0.11	0.28	84.86
Average temperature (degree Celsius)	-0.82	0.37**	-0.07	-0.00	-0.17	0.16	85.74
Average precipitation (mm)	-0.12	0.72***	-0.41	0.37	0.05	-0.01	83.64
Average relative humidity (%)	0.48	0.18	-0.42	0.62	0.11	-0.01	84.16
Chronological age (yrs before 2000)	-0.34	-0.24	0.59	0.08	-0.44	-0.21	75.25
Absolute value of latitude (degree)	0.68	-0.61***	0.09	0.13	0.15	-0.08	89.14
Great circle distance (km)[3)]	0.31	0.77***	0.02	0.12	0.25	-0.11	78.75
Total contribution (%)	28.78	19.12	12.83	11.98	6.97	4.96	84.63
Cumulative proportion (%)	28.78	47.89	60.73	72.70	79.67	84.63	84.63

[1)]Based on the first variable set of the skull (Table 1) excluding orbital breadth (Martin's No. 51) and six environmental variables. The number of samples (Class C in Table 1) is 159. The number of principal components was so determined that the cumulative proportion of the variances of the principal components exceeded 80%.

[2)]Variable number according to Martin and Saller (1957).

[3)]Great circle distance from Kamoya's hominid site (Omo-Kibish I), Ethiopia (Shea, 2008).

*P <0.05; **P <0.01; ***P <0.001, according to a two-tailed bootstrap test.

Table 31. Rotated solution of the first six principal components extracted from the among-group correlations between craniofacial and environmental variables (Table 30).[1)]

	Factor loadings					
Variable[2)]	Fac I	II	III	IV	V	VI
1 Cranial length	-0.06	-0.02	0.10	-0.07	0.93	0.06
5 Cranial base length	0.20	0.56	0.02	0.22	0.68	-0.19
9 Minimum frontal breadth	-0.18	0.06	0.01	0.72	0.15	0.41*
8 Cranial breadth	0.35	-0.04	0.06	0.81	-0.32	-0.04
17 Basi-bregmatic height	0.02	0.93*	-0.06	-0.06	0.08	-0.12
48 Upper facial height	0.92	-0.05	0.12	0.17	0.01	-0.07
45 Bizygomatic breadth	0.45	0.07	-0.20	0.56	0.05	-0.59
52 Orbital height	0.77	0.00	-0.44	-0.07	-0.04	-0.18
54 Nasal breadth	0.10	0.13	-0.04	-0.18	-0.02	-0.85
55 Nasal height	0.89	0.16	-0.06	0.08	-0.03	-0.13
Average temperature (degree Celsius)	-0.61	0.39	-0.01	-0.51*	-0.25	0.07
Average precipitation (mm)	-0.35	0.33	-0.72	0.00	-0.17	-0.23
Average relative humidity (%)	0.01	0.04	-0.65	0.65	0.02	-0.00
Chronological age (yrs before 2000)	-0.29	0.24	0.75	0.04	0.17	-0.12
Absolute value of latitude (degree)	0.47	-0.42*	0.16	0.60*	0.28	0.17
Great circle distance (km)[3)]	0.15	0.26	-0.63	-0.06	0.22	-0.50

[1)]The number of samples (Class C in Table 1) is 159. The cumulative proportion of the variances of the six principal components is 84.63%.

[2)]Variable number according to Martin and Saller (1957).

[3)]Great circle distance from Kamoya's hominid site (Omo-Kibish I), Ethiopia (Shea, 2008).

*P <0.05; **P <0.01; ***P <0.001, according to a two-tailed bootstrap test.

Table 32. Principal component analysis of the among-group correlations between craniofacial and environmental variables (females).[1)]

	Factor loadings						Total
Variable[2)]	PC I	II	III	IV	V	VI	variance (%)
1 Cranial length	0.28	0.73	0.08	-0.20	-0.30	0.15	77.08
5 Cranial base length	0.09	0.55	0.62	-0.26	-0.12	0.39	92.99
9 Minimum frontal breadth	-0.05	0.76	0.35	0.24	0.29	-0.13	85.60
8 Cranial breadth	-0.69	0.11	0.35	0.10	0.35	-0.34	85.73
17 Basi-bregmatic height	0.45	-0.04	0.52*	-0.23	0.34	0.43	83.14
48 Upper facial height	-0.78	-0.15	-0.07	-0.44	0.15	0.18	87.59
45 Bizygomatic breadth	-0.51	-0.01	0.71*	-0.16	-0.26	-0.24	90.73
52 Orbital height	-0.46	-0.63	0.18	-0.13	-0.04	0.24	71.54
54 Nasal breadth	-0.10	-0.38	0.43	-0.34	-0.08	-0.49	69.70
55 Nasal height	-0.75	-0.09	-0.03	-0.39	0.35	0.19	88.45
Average temperature (degree Celsius)	0.82	-0.20	0.05	-0.09	0.42	-0.13	91.20
Average precipitation (mm)	0.44	-0.41	0.56	0.37	0.19	0.03	85.42
Average relative humidity (%)	-0.30	0.01	0.40	0.77	-0.05	0.09	84.55
Chronological age (yrs before 2000)	0.37	0.48	0.10	-0.48	-0.16	-0.33	73.97
Absolute value of latitude (degree)	-0.75	0.47	-0.12	0.29	-0.21	0.08	93.45
Great circle distance (km)[3)]	0.19	-0.60	0.28	-0.01	-0.62	0.11	87.61
Total contribution (%)	25.66	18.87	13.74	11.09	8.26	6.67	84.30
Cumulative proportion (%)	25.66	44.53	58.27	69.36	77.62	84.30	84.30

[1)]Based on the first variable set of the skull (Table 1) excluding orbital breadth (Martin's No. 51) and six environmental variables. The number of samples (Class C in Table 1) is 69. The number of principal components was so determined that the cumulative proportion of the variances of the principal components exceeded 80%.

[2)]Variable number according to Martin and Saller (1957).

[3)]Great circle distance from Kamoya's hominid site (Omo-Kibish I), Ethiopia (Shea, 2008).

*P <0.05; **P <0.01; ***P <0.001, according to a two-tailed bootstrap test.

Table 33. Rotated solution of the first six principal components extracted from the among-group correlations between craniofacial and environmental variables (Table 32).[1)]

	Factor loadings					
Variable[2)]	Fac I	II	III	IV	V	VI
1 Cranial length	-0.19	0.33	-0.15	-0.30	0.13	0.70**
5 Cranial base length	0.09	-0.03	0.11	0.03	0.09	0.95***
9 Minimum frontal breadth	-0.08	0.21	0.08	0.19	0.76	0.44
8 Cranial breadth	-0.20	-0.38	0.52	0.31	0.54	-0.10
17 Basi-bregmatic height	0.75	-0.12	-0.05	0.07	-0.03	0.50
48 Upper facial height	-0.28	-0.87***	0.14	-0.10	0.00	-0.04
45 Bizygomatic breadth	-0.22	-0.22	0.82	0.21	-0.04	0.30
52 Orbital height	0.03	-0.61	0.23	0.26	-0.44	-0.17
54 Nasal breadth	0.18	-0.08	0.77	-0.14	-0.16	-0.13
55 Nasal height	-0.17	-0.90***	0.10	-0.05	0.18	-0.04
Average temperature (degree Celsius)	0.84	0.35*	-0.11	-0.24	0.07	-0.13
Average precipitation (mm)	0.68	0.27	0.18	0.52	-0.15	-0.02
Average relative humidity (%)	-0.19	0.12	0.11	0.88	0.10	0.04
Chronological age (yrs before 2000)	0.04	0.35	0.23	-0.62	0.17	0.38
Absolute value of latitude (degree)	-0.84	-0.21	-0.05	0.30	0.28	0.14
Great circle distance (km)[3)]	0.10	0.16	0.27	0.16	-0.86	0.02

[1)]The number of samples (Class C in Table 1) is 69. The cumulative proportion of the variances of the six principal components is 84.30%.

[2)]Variable number according to Martin and Saller (1957).

[3)]Great circle distance from Kamoya's hominid site (Omo-Kibish I), Ethiopia (Shea, 2008).

*P <0.05; **P <0.01; ***P <0.001, according to a two-tailed bootstrap test.

Table 34. Spearman's rank correlation coefficients between the PCs or rotated factors from the Class A male samples (Tables 11 and 12) and those from the Class C male samples (Tables 30 and 31) of ten craniofacial and six environmental variables.[1)]

From Tables 11 and 12:	PC I	II	III	IV	V	Fac I	II	III	IV	V
From Table 30: PC I	.98***	-	-	-	-	.96***	.55*	-	-	-
II	-	1.00***	-	-	-	-	.74**	.56*	.56*	-
III	-	-	.97***	-	-	-	-	.61*	-	.76***
IV	-	-	-	.95***	-	-	-	-	.76***	-
V	-	-	-	-	.86***	-	-	-	-	-
VI	-	-	-	-	-	-	-	-	-	-
From Table 31: Fac I	.88***	-	-	-	-	.97***	-	-	-	-
II	.52*	.70**	-	-	-	-	.96***	-	-	-
III	-	.71**	.59*	-	-	-	-	.90***	-	-
IV	-	.66**	-	-	-	-	-	-	.87***	-
V	-	-	.61*	.54*	-	-	-	-	-	.96***
VI	-	.65**	-	-	-	-	-	-	-	-

1)Based on the variation patterns of the factor loadings on PCs or rotated factors. Only rank correlation coefficients significant at the 5% level are listed here. The signs of rank correlation coefficients are removed because the signs of factor loadings are reversible.

*P<0.05; **P<0.01; ***P<0.001, according to a two-tailed test.

Table 35. Spearman's rank correlation coefficients between the PCs or rotated factors from the Class A female samples (Tables 28 and 29) and those from the Class C female samples (Tables 32 and 33) of ten craniofacial and six environmental variables.[1)]

From Tables 28 and 29:	PC I	II	III	IV	V	Fac I	II	III	IV	V
From Table 32: PC I	.93***	-	-	-	-	.88***	-	-	.84***	-
II	-	.85***	-	-	-	-	.82***	-	-	.62*
III	-	-	.59*	-	-	-	-	-	-	-
IV	-	-	.69**	.76***	-	-	-	.81***	-	-
V	-	-	-	-	.93***	-	-	-	-	-
VI	-	-	-	-	-	-	-	-	-	-
From Table 33: Fac I	.82***	-	-	-	-	.60*	-	-	.95***	-
II	.75***	-	-	-	-	.89***	-	-	-	-
III	-	.61*	-	-	-	-	-	-	-	-
IV	-	-	.59*	-	-	-	-	.96***	-	-
V	-	.69**	-	.51*	-	-	-	-	-	.86***
VI	-	.71**	-	-	-	-	.89***	-	-	-

1)Based on the variation patterns of the factor loadings on PCs or rotated factors. Only rank correlation coefficients significant at the 5% level are listed here. The signs of rank correlation coefficients are removed because the signs of factor loadings are reversible.

*P<0.05; **P<0.01; ***P<0.001, according to a two-tailed test.

Table 36. Spearman's rank correlation coefficients between the PCs or rotated factors from the Class A male samples (Tables 11 and 12) and those from the Class A female samples (Tables 28 and 29) of ten craniofacial and six environmental variables.[1)]

From Tables 11 and 12:	PC I	II	III	IV	V	Fac I	II	III	IV	V
From Table 28: PC I	.82***	.65**	-	-	-	.80***	.69**	-	-	-
II	-	.59*	.60*	-	-	-	-	.79***	-	.52*
III	-	-	.61*	.68**	-	-	-	-	.59*	-
IV	-	-	-	.58*	-	-	-	-	.57*	-
V	-	-	-	-	.79***	-	-	-	-	.64**
From Table 29: Fac I	.86***	-	-	-	-	.91***	-	-	-	-
II	-	-	-	.66**	-	-	-	-	.52*	.65**
III	-	-	.84***	-	-	-	-	.81***	-	-
IV	.71**	.70**	-	-	-	.60*	.88***	-	-	-
V	-	.74**	-	-	.53*	-	-	-	.66**	-

1)Based on the variation patterns of the factor loadings on PCs or rotated factors. Only rank correlation coefficients significant at the 5% level are listed here. The signs of rank correlation coefficients are removed because the signs of factor loadings are reversible.

*P<0.05; **P<0.01; ***P<0.001, according to a two-tailed test.

Table 37. Spearman's rank correlation coefficients between the PCs or rotated factors from the Class C male samples (Tables 30 and 31) and those from the Class C female samples (Tables 32 and 33) of ten craniofacial and six environmental variables.[1)]

From Tables 30 and 31:	PC I	II	III	IV	V	VI	Fac I	II	III	IV	V	VI
From Table 32: PC I	.91***	.54*	-	-	-	-	.86***	.75***	-	.53*	-	-
II	-	.72**	-	.59*	-	-	-	-	.62*	.59*	.58*	.55*
III	-	-	-	.54*	-	-	-	-	-	-	-	.55*
IV	-	-	.78***	.56*	-	-	-	-	-	-	-	-
V	-	-	-	-	.51*	.65**	-	-	-	-	.75***	-
VI	-	-	-	-	-	.72**	-	-	-	-	-	-
From Table 33: Fac I	.71**	.76***	-	-	-	-	.61*	.86***	-	.64**	-	-
II	.89***	-	-	-	-	-	.93***	-	-	-	-	-
III	-	-	-	-	-	.54*	-	-	-	-	-	.74**
IV	-	-	.75***	-	-	-	-	-	.52*	.54*	-	-
V	-	.86***	-	-	-	-	-	-	.59*	.65**	-	.74**
VI	-	-	-	.67**	-	-	-	-	-	-	.82***	-

1)Based on the variation patterns of the factor loadings on PCs or rotated factors. Only rank correlation coefficients significant at the 5% level are listed here. The signs of rank correlation coefficients are removed because the signs of factor loadings are reversible.

*P<0.05; **P<0.01; ***P<0.001, according to a two-tailed test.

Table 38. Principal component analysis of the among-group correlations between craniofacial and environmental variables (females).[1)]

	Factor loadings						Total
Variable[2)]	PC I	II	III	IV	V	VI	variance (%)
1 Cranial length	-0.24	-0.63	0.14	0.01	0.59	-0.20	86.77
9 Minimum frontal breadth	0.37	-0.57	-0.48	0.39	0.19	-0.06	88.44
8 Cranial breadth	0.88	-0.02	-0.19	0.17	-0.11	0.09	86.46
17 Basi-bregmatic height	-0.41	-0.04	-0.10	0.70	-0.03	-0.38	81.40
48 Upper facial height	0.66	-0.04	0.48	0.29	-0.14	-0.18	81.08
45 Bizygomatic breadth	0.72	0.24	0.18	0.11	0.50	-0.05	87.38
52 Orbital height	0.49	0.58	0.18	0.10	-0.19	-0.28	74.35
54 Nasal breadth	0.14	0.48	0.43	0.17	0.46	0.48	91.57
55 Nasal height	0.76	0.00	0.38	0.36	-0.12	0.04	87.86
Average temperature (degree Celsius)	-0.78	0.11	-0.02	0.47	-0.05	0.28	92.51
Average precipitation (mm)	-0.26	0.60	-0.46	0.37	0.23	-0.10	82.88
Average relative humidity (%)	0.45	0.25	-0.70	-0.03	0.24	0.07	82.17
Chronological age (yrs before 2000)	-0.26	-0.58	0.49	0.05	0.18	-0.06	67.94
Absolute value of latitude (degree)	0.76	-0.38	-0.26	-0.33	0.06	-0.03	91.13
Great circle distance (km)[3)]	-0.27	0.66	0.15	-0.40	0.28	-0.41	93.37
Total contribution (%)	30.33	18.04	13.07	10.47	7.74	5.38	85.02
Cumulative proportion (%)	30.33	48.37	61.44	71.91	79.65	85.02	85.02

1)Based on the third variable set of the skull (Table 1) and six environmental variables. The number of samples (Class A in Table 1) is 42. The number of principal components was so determined that the cumulative proportion of the variances of the principal components exceeded 80%.

2)Variable number according to Martin and Saller (1957).

3)Great circle distance from Kamoya's hominid site (Omo-Kibish I), Ethiopia (Shea, 2008).

*P<0.05; **P<0.01; ***P<0.001, according to a two-tailed bootstrap test.

Table 39. Rotated solution of the first six principal components extracted from the among-group correlations between craniofacial and environmental variables (Table 38).[1)]

	Factor loadings					
Variable[2)]	Fac I	II	III	IV	V	VI
1 Cranial length	-0.15	-0.91*	0.09	0.00	-0.03	0.05
9 Minimum frontal breadth	0.17	-0.40	-0.47	0.01	-0.26	0.64**
8 Cranial breadth	0.61	0.21	-0.42	-0.33	-0.01	0.41
17 Basi-bregmatic height	0.06	-0.18	-0.02	0.84	-0.24	0.06
48 Upper facial height	0.87	0.01	0.17	-0.09	0.03	0.12
45 Bizygomatic breadth	0.66	-0.18	-0.40	-0.25	0.42	-0.13
52 Orbital height	0.65	0.43	-0.14	0.01	0.03	-0.34
54 Nasal breadth	0.20	0.04	-0.02	0.05	0.92*	-0.14
55 Nasal height	0.86	0.10	0.05	-0.12	0.19	0.29
Average temperature (degree Celsius)	-0.49	0.07	0.23	0.75	0.23	0.12
Average precipitation (mm)	-0.16	0.19	-0.58	0.59	0.14	-0.26
Average relative humidity (%)	0.01	0.18	-0.86*	-0.19	0.02	0.09
Chronological age (yrs before 2000)	-0.01	-0.61	0.54	0.03	0.02	0.11
Absolute value of latitude (degree)	0.30	-0.13	-0.35	-0.74	-0.23	0.29
Great circle distance (km)[3)]	-0.10	0.05	-0.08	0.04	0.09	-0.95***

1)The number of samples (Class A in Table 1) is 42. The cumulative proportion of the variances of the six principal components is 85.02%.

2)Variable number according to Martin and Saller (1957).

3)Great circle distance from Kamoya's hominid site (Omo-Kibish I), Ethiopia (Shea, 2008).

*P<0.05; **P<0.01; ***P<0.001, according to a two-tailed bootstrap test.

Table 40. Principal component analysis of the among-group correlations between craniofacial and environmental variables (males).[1)]

	Factor loadings						Total
Variable[2)]	PC I	II	III	IV	V	VI	variance (%)
1 Cranial length	-0.08	0.29	-0.10	0.61***	0.60	-0.09	84.02
9 Minimum frontal breadth	0.28	0.61	0.34	0.26*	-0.22	-0.37	82.02
8 Cranial breadth	0.70	0.28	0.08	-0.06	-0.54	0.02	87.57
17 Basi-bregmatic height	0.02	-0.31	0.07	0.73***	-0.17	-0.31	76.30
48 Upper facial height	0.66	-0.00	-0.63	0.03	0.05	-0.16	85.07
45 Bizygomatic breadth	0.81	-0.20	0.04	0.26***	-0.22	0.24	86.53
52 Orbital height	0.60	-0.50	-0.29	-0.27**	0.16	-0.18	81.72
54 Nasal breadth	0.18	-0.62	-0.22	0.31**	-0.17	0.30	68.01
55 Nasal height	0.70	-0.22	-0.48	0.09	0.03	-0.29	85.53
Average temperature (degree Celsius)	-0.78	-0.42	0.01	0.03	-0.20	-0.26	89.79
Average precipitation (mm)	0.14	-0.58	0.69	0.04	0.03	-0.09	84.39
Average relative humidity (%)	0.62	0.16	0.67	0.06	0.14	-0.03	87.35
Chronological age (yrs before 2000)	-0.38	0.25	-0.25	0.61***	-0.17	0.32	77.05
Absolute value of latitude (degree)	0.63	0.68	0.02	-0.02	0.18	0.18	91.57
Great circle distance (km)[3)]	0.45	-0.64	0.34	0.11	0.28	0.19	85.15
Total contribution (%)	28.64	18.76	13.29	10.69	6.93	5.16	83.47
Cumulative proportion (%)	28.64	47.40	60.69	71.38	78.31	83.47	83.47

1)Based on the third variable set of the skull (Table 1) and six environmental variables. The number of samples (Class C in Table 1) is 325. The number of principal components was so determined that the cumulative proportion of the variances of the principal components exceeded 80%.

2)Variable number according to Martin and Saller (1957).

3)Great circle distance from Kamoya's hominid site (Omo-Kibish I), Ethiopia (Shea, 2008).

*P<0.05; **P<0.01; ***P<0.001, according to a two-tailed bootstrap test.

Table 41. Rotated solution of the first six principal components extracted from the among-group correlations between craniofacial and environmental variables (Table 40).[1)]

	Factor loadings					
Variable[2)]	Fac I	II	III	IV	V	VI
1 Cranial length	0.11	0.02	-0.11	0.19	0.88	-0.07
9 Minimum frontal breadth	0.56	0.12	-0.05	0.48**	-0.02	-0.51
8 Cranial breadth	0.71	-0.22	-0.05	0.21	-0.53	-0.01
17 Basi-bregmatic height	-0.15	-0.07	0.14	0.80*	0.18	0.20
48 Upper facial height	0.28	-0.84	-0.22	0.01	0.04	0.11
45 Bizygomatic breadth	0.58	-0.36	0.25	0.24	-0.19	0.49
52 Orbital height	-0.02	-0.80	0.33	-0.17	-0.13	0.15
54 Nasal breadth	-0.15	-0.23	0.12	0.19	-0.08	0.74
55 Nasal height	0.20	-0.88	0.01	0.17	-0.01	0.13
Average temperature (degree Celsius)	-0.86	0.29	-0.04	0.22	-0.12	-0.03
Average precipitation (mm)	-0.10	0.13	0.86	0.21	-0.14	0.11
Average relative humidity (%)	0.68	0.05	0.61	0.11	0.02	-0.17
Chronological age (yrs before 2000)	-0.01	0.37	-0.57	0.31	0.30	0.35
Absolute value of latitude (degree)	0.89	-0.13	-0.13	-0.20	0.16	-0.18
Great circle distance (km)[3)]	0.09	-0.19	0.77	-0.01	0.09	0.46

1)The number of samples (Class C in Table 1) is 325. The cumulative proportion of the variances of the six principal components is 83.47%.

2)Variable number according to Martin and Saller (1957).

3)Great circle distance from Kamoya's hominid site (Omo-Kibish I), Ethiopia (Shea, 2008).

*P<0.05; **P<0.01; ***P<0.001, according to a two-tailed bootstrap test.

Table 42. Principal component analysis of the among-group correlations between craniofacial and environmental variables (females).[1)]

Variable[2)]	PC I	II	III	IV	V	VI	Total variance (%)
	Factor loadings						
1 Cranial length	-0.27	0.63	-0.04	0.26	-0.29	0.35	74.38
9 Minimum frontal breadth	0.08	0.69	0.48	0.33	0.21	0.04	86.56
8 Cranial breadth	0.70	0.05	0.36	0.34	0.22	-0.28	85.03
17 Basi-bregmatic height	-0.44	-0.14	0.13	0.43	0.41	0.51	84.00
48 Upper facial height	0.72	-0.16	-0.42	0.21	0.21	0.21	84.25
45 Bizygomatic breadth	0.48	-0.28	0.35	0.57	-0.39	0.05	90.25
52 Orbital height	0.44	-0.69	-0.10	-0.03	0.07	0.20	72.40
54 Nasal breadth	0.07	-0.54	0.03	0.51	-0.24	-0.36	73.76
55 Nasal height	0.72	-0.15	-0.35	0.25	0.34	0.09	85.92
Average temperature (degree Celsius)	-0.83	-0.17	-0.02	0.17	0.37	-0.21	91.99
Average precipitation (mm)	-0.44	-0.52	0.60	0.04	0.20	0.05	85.76
Average relative humidity (%)	0.33	-0.03	0.79	-0.29	0.02	0.10	83.65
Chronological age (yrs before 2000)	-0.37	0.38	-0.19	0.56	-0.34	-0.04	74.61
Absolute value of latitude (degree)	0.76	0.48	0.16	-0.23	-0.19	0.08	93.28
Great circle distance (km)[3)]	-0.20	-0.69	0.09	-0.11	-0.53	0.27	89.36
Total contribution (%)	26.46	19.49	12.40	10.98	8.89	5.46	83.68
Cumulative proportion (%)	26.46	45.95	58.35	69.33	78.22	83.68	83.68

[1)]Based on the third variable set of the skull (Table 1) and six environmental variables. The number of samples (Class C in Table 1) is 73. The number of principal components was so determined that the cumulative proportion of the variances of the principal components exceeded 80%.

[2)]Variable number according to Martin and Saller (1957).

[3)]Great circle distance from Kamoya's hominid site (Omo-Kibish I), Ethiopia (Shea, 2008).

$^{*}P<0.05$; $^{**}P<0.01$; $^{***}P<0.001$, according to a two-tailed bootstrap test.

Table 43. Rotated solution of the first six principal components extracted from the among-group correlations between craniofacial and environmental variables (Table 42).[1)]

Variable[2)]	Fac I	II	III	IV	V	VI
	Factor loadings					
1 Cranial length	-0.01	0.13	0.02	-0.17	0.09	0.83
9 Minimum frontal breadth	-0.12	0.10	0.39	0.00	0.72**	0.41
8 Cranial breadth	0.14	-0.35	0.37	0.48	0.54	-0.21
17 Basi-bregmatic height	-0.88*	-0.09	-0.03	-0.06	0.00	0.23
48 Upper facial height	0.14	-0.90***	-0.02	0.08	0.02	-0.09
45 Bizygomatic breadth	0.02	-0.27	0.38	0.80*	-0.11	0.17
52 Orbital height	-0.08	-0.54	0.13	0.21	-0.42	-0.44
54 Nasal breadth	-0.07	-0.03	-0.23	0.80*	-0.15	-0.15
55 Nasal height	0.10	-0.88***	-0.03	0.13	0.18	-0.18
Average temperature (degree Celsius)	-0.63	0.46*	-0.53	-0.05	0.10	-0.12
Average precipitation (mm)	-0.69	0.40	0.22	0.20	-0.16	-0.33
Average relative humidity (%)	0.00	0.16	0.85	0.06	0.08	-0.27
Chronological age (yrs before 2000)	-0.03	0.19	-0.38	0.24	0.11	0.70***
Absolute value of latitude (degree)	0.64	-0.29	0.59	-0.10	0.25	0.13
Great circle distance (km)[3)]	-0.14	0.15	0.10	0.27	-0.88***	-0.07

[1)]The number of samples (Class C in Table 1) is 73. The cumulative proportion of the variances of the six principal components is 83.68%.

[2)]Variable number according to Martin and Saller (1957).

[3)]Great circle distance from Kamoya's hominid site (Omo-Kibish I), Ethiopia (Shea, 2008).

$^{*}P<0.05$; $^{**}P<0.01$; $^{***}P<0.001$, according to a two-tailed bootstrap test.

Table 44. Spearman's rank correlation coefficients between the PCs or rotated factors from the Class A male samples (Tables 17 and 18) and those from the Class C male samples (Tables 40 and 41) of nine craniofacial and six environmental variables.[1)]

From Tables 17 and 18:	PC I	II	III	IV	V	VI	Fac I	II	III	IV	V	VI
From Table 40: PC I	.96***	-	-	.53*	-	-	.73**	.81***	-	-	.67**	-
II	-	.99***	-	-	-	-	-	-	.56*	-	.66**	.75**
III	-	-	.95***	-	-	-	-	.52*	-	-	-	-
IV	-	-	-	.88***	-	-	.57*	-	-	.62*	-	-
V	-	-	-	-	.90***	-	-	-	-	-	-	-
VI	-	-	-	-	-	-	-	-	-	-	-	-
From Table 41: Fac I	.72**	.76***	-	-	-	-	0.72**	-	-	-	.87***	-
II	.67**	-	.53*	-	-	-	.54*	.95***	-	-	-	-
III	-	.63*	.61*	-	-	-	-	-	.92***	-	-	-
IV	-	-	-	-	.74**	-	.61*	.52*	-	-	-	-
V	-	-	-	.70**	-	-	-	-	-	.93***	-	.51*
VI	-	.71**	-	-	-	-	-	-	-	-	.56*	.74**

[1)]Based on the variation patterns of the factor loadings on PCs or rotated factors. Only rank correlation coefficients significant at the 5% level are listed here. The signs of rank correlation coefficients are removed because the signs of factor loadings are reversible.

$^{*}P<0.05$; $^{**}P<0.01$; $^{***}P<0.001$, according to a two-tailed test.

Table 45. Spearman's rank correlation coefficients between the PCs or rotated factors from the Class A female samples (Tables 38 and 39) and those from the Class C female samples (Tables 42 and 43) of nine craniofacial and six environmental variables.[1)]

From Tables 38 and 39:	PC I	II	III	IV	V	VI	Fac I	II	III	IV	V	VI
From Table 42: PC I	.95***	-	-	-	-	-	.85***	-	-	.87***	-	-
II	-	.89***	-	-	-	-	-	.54*	-	-	.76***	.75**
III	-	-	.84***	-	-	-	-	-	.88***	-	-	-
IV	-	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	.79***	.70**	-	-	-	-	-	-	-
VI	-	-	-	-	-	.78***	-	-	-	-	-	-
From Table 43: Fac I	.86***	-	-	-	-	-	.66**	-	-	.91***	-	-
II	.77***	-	-	-	.52*	-	.94***	-	-	.55*	-	-
III	-	-	.68**	-	-	-	-	-	.87***	.61*	-	-
IV	-	.54*	-	-	-	-	-	-	-	-	.59*	-
V	-	.74**	-	-	-	-	-	-	-	-	-	.96***
VI	-	.73**	-	-	-	-	-	.97***	-	-	-	-

[1)]Based on the variation patterns of the factor loadings on PCs or rotated factors. Only rank correlation coefficients significant at the 5% level are listed here. The signs of rank correlation coefficients are removed because the signs of factor loadings are reversible.

$^{*}P<0.05$; $^{**}P<0.01$; $^{***}P<0.001$, according to a two-tailed test.

Table 46. Spearman's rank correlation coefficients between the PCs or rotated factors from the Class A male samples (Tables 17 and 18) and those from the Class A female samples (Tables 38 and 39) of nine craniofacial and six environmental variables.[1)]

From Tables 17 and 18:	PC I	II	III	IV	V	VI	Fac I	II	III	IV	V	VI
From Table 38: PC I	.84***	-	-	.55*	-	-	.79***	.73**	-	-	.68**	-
II	-	.77***	-	-	-	-	-	-	.81***	.54*	-	.63*
III	-	-	.84***	-	-	-	-	-	-	-	.54*	.54*
IV	-	-	-	-	.76***	-	.62*	-	-	-	-	-
V	-	-	-	.67**	-	.59*	-	-	-	-	-	-
VI	-	-	-	-	-	-	-	-	-	-	-	-
From Table 39: Fac I	.73**	-	.55*	-	-	-	.59*	.90***	-	-	-	-
II	-	-	-	.71**	-	-	-	-	-	.79***	-	-
III	.56*	-	.70**	-	-	-	-	-	.64**	-	.65**	-
IV	.78***	.65**	-	-	-	-	.84***	.58*	-	-	.72**	-
V	-	.69**	-	-	-	-	-	-	-	-	-	.85***
VI	-	.76**	-	-	.56*	-	-	-	.65**	-	.56*	.53*

[1)]Based on the variation patterns of the factor loadings on PCs or rotated factors. Only rank correlation coefficients significant at the 5% level are listed here. The signs of rank correlation coefficients are removed because the signs of factor loadings are reversible.

$^{*}P<0.05$; $^{**}P<0.01$; $^{***}P<0.001$, according to a two-tailed test.

Table 47. Spearman's rank correlation coefficients between the PCs or rotated factors from the Class C male samples (Tables 40 and 41) and those from the Class C female samples (Tables 42 and 43) of nine craniofacial and six environmental variables.[1)]

From Tables 40 and 41:	PC I	II	III	IV	V	VI	Fac I	II	III	IV	V	VI
From Table 42: PC I	.89***	-	-	.51*	-	-	.79***	.72**	-	.55*	-	-
II	-	.93***	-	-	-	-	-	-	.69**	-	-	.68**
III	-	-	.94***	-	-	-	-	-	-	-	-	-
IV	-	-	-	.60*	.65**	-	-	-	-	.74**	-	-
V	-	-	-	-	-	.78***	-	-	-	-	-	-
VI	-	-	-	-	.64*	-	-	-	-	-	.56*	-
From Table 43: Fac I	.71**	.58*	-	-	-	-	.80***	-	-	-	-	-
II	.74**	-	.52*	-	-	-	-	.89***	-	-	-	-
III	.54*	-	.60*	-	-	-	.75**	-	-	-	-	-
IV	-	-	-	-	-	.60*	-	-	-	-	.57*	.72**
V	-	.82***	-	-	-	-	-	-	.70**	-	-	.64*
VI	-	-	-	.70**	-	-	-	-	.57*	-	.65**	-

[1)]Based on the variation patterns of the factor loadings on PCs or rotated factors. Only rank correlation coefficients significant at the 5% level are listed here. The signs of rank correlation coefficients are removed because the signs of factor loadings are reversible.

$^{*}P<0.05$; $^{**}P<0.01$; $^{***}P<0.001$, according to a two-tailed test.

Table 48. Spearman's rank correlation coefficients between the PCs or rotated factors from the combination of nine craniofacial and six environmental variables (Tables 17 and 18, i.e., based on Class A male samples) and those from the combination of the nine craniofacial and eight postcranial measurements and six environmental variables (Tables 9 and 10, i.e., based on Class C male samples).1)

From Tables 17 and 18:	PC I	II	III	IV	V	VI	Fac I	II	III	IV	V	VI
From Table 9: PC I	-	-	-	-	-	-	-	-	-	-	-	-
II	-	-	-	-	-	.81***	-	-	-	-	-	-
III	-	.56*	-	-	-	-	-	-	-	-	.58*	.54*
IV	-	-	.51*	-	.63*	-	-	-	-	.59*	-	-
V	-	-	-	-	-	-	-	-	-	-	-	-
VI	-	-	.52*	-	.61*	-	-	.54*	-	-	-	-
From Table 10: Fac I	-	-	-	-	-	-	-	-	-	-	-	-
II	-	-	-	-	-	.88***	-	.55*	-	-	-	-
III	-	-	.54*	-	-	-	-	-	-	-	-	-
IV	-	.59*	-	-	-	-	.68**	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-	-	-	-
VI	-	-	-	-	.59*	-	-	-	-	-	-	-

1)Based on the variation patterns of the factor loadings of the craniofacial and environmental variables common to both PCAs or rotated solutions. Only rank correlation coefficients significant at the 5% level are listed here. The signs of rank correlation coefficients are removed because the signs of factor loadings are reversible.

*$P<0.05$; **$P<0.01$; ***$P<0.001$, according to a two-tailed test.

Table 49. Spearman's rank correlation coefficients between the PCs or rotated factors from the combination of nine craniofacial and six environmental variables (Tables 40 and 41, i.e., based on Class C male samples) and those from the combination of the nine craniofacial and eight postcranial measurements and six environmental variables (Tables 9 and 10, i.e., based on Class C male samples).1)

From Tables 40 and 41:	PC I	II	III	IV	V	VI	Fac I	II	III	IV	V	VI
From Table 9: PC I	-	-	-	-	.51*	-	-	-	-	-	-	-
II	-	-	-	-	-	.54*	-	-	-	-	-	-
III	-	-	-	-	-	-	.62*	-	-	-	-	-
IV	-	-	-	-	.61*	-	-	-	-	.55*	-	-
V	-	-	-	-	-	-	-	-	-	-	-	-
VI	-	-	-	-	-	-	-	-	-	-	-	-
From Table 10: Fac I	-	-	-	-	-	-	-	-	-	-	-	-
II	-	-	-	-	-	-	-	.52*	-	.56*	-	-
III	-	-	-	-	-	-	-	-	-	-	-	-
IV	-	.64*	-	-	-	-	.63*	-	.53*	-	-	-
V	-	-	-	-	-	-	-	-	-	-	-	-
VI	-	-	-	-	-	-	-	-	-	-	-	-

1)Based on the variation patterns of the factor loadings of the craniofacial and environmental variables common to both PCAs or rotated solutions. Only rank correlation coefficients significant at the 5% level are listed here. The signs of rank correlation coefficients are removed because the signs of factor loadings are reversible.

*$P<0.05$; **$P<0.01$; ***$P<0.001$, according to a two-tailed test.

environmental data to the samples collected, duplication of data, etc. Notwithstanding, the present study was carried out in expectation of being able to get some information which are not concealed by such errors.

Unimodal distribution of sample means and the limits of among-group variation

It is well known that the within-group distribution of a linear measurement of the animal body is generally a normal distribution. And the among-group distribution may not necessarily be normal depending on conditions. In the present study, it was found that the distributions of sample means for craniofacial measurements across world human populations of the Neolithic to modern times were unimodal at least in the cases of as large number of samples as 300 or more (each sample has the size of 20 or more), as shown in Table 2 and Figs. 1 to 5. This means that the geographical/chronological distribution of *Homo sapiens sapiens* populations is not a uniform nor uneven distribution, and, in turn, may indicate that an appropriate morphology of our head or face has been formed through the human evolutionary process respondent to some selective pressure, and/or that all recent human populations derived from a single ancestral human population. If the latter is the case, this finding may support the Out-of-Africa hypothesis on the origins of modern humans (e.g., Stringer and Andrews, 2005). The validity of these hypotheses will be discussed later on the basis of the analyses of craniofacial measurements and environmental variables.

The limits of among-group variation of *Homo s. s.* in each variable are shown in Tables 2 and 3. For major craniofacial measurements (Table 3 and Fig. 6), at least, it was confirmed that the ranges between the minimum and maximum values of *Homo s. s.* sample means corresponded to those between the world average minus 3SD or 4SD and the world average plus 2SD or 3SD of the within-group variation in a Japanese sample. It is also interesting that even the ultramodern skull of a Shogun of the Edo period in Japan is positioned within this range (Table 3 and Fig. 6). On the other hand, the deviation curve for the Herto skull (*Homo s. idaltu*) is partially outside of the range of *Homo s. s.* (Fig. 6). This seems not to be inconsistent with Figure 4b or 4c in White et al. (2003).

Comparison to within-group multivariate distributions

How do the vectors of sample means from all over the world distribute in a within-group multivariate space? This question was checked using two within-group variance/covariance matrices. The results demonstrate that most of the PC score vectors for 283 sample mean vectors are placed within the ±2SD range of within-group PC scores (Figs. 7 and 8). This means that there are certain constant limits in the craniofacial among-group covariations of *Homo sapiens sapiens*, as anticipated. It was also clarified that there was no such a *Homo s. s.* population as a pseudo-individual with the minimum or maximum values in all eight craniofacial variables (Figs. 7 and 8). These findings suggest some complicated system or factors controlling the coordination between substructures of the skull (or the body). This supports Weidenreich's (1941) idea: the body should be considered as a totality, i.e., as a unique construction in which all parts harmonize from the beginning of its organization, and every essential alteration must be accounted as a consequence of a change in the entire construction.

In addition, two special individuals, i.e. the 160,000-154,000 year-old skull from Herto [*Homo s.*

idaltu] (White et al., 2003) and the ultramodern skull of Iyeyoshi Tokugawa [1793-1853] (Suzuki, 1967, 1981), were plotted in the radar charts of within-group PC scores (Figs. 9 and 10). These radar charts show that Herto partially exceeds the upper limits of the *Homo s. s.* range. This is again not inconsistent with Figure 4b or 4c in White et al. (2003). Regarding Iyeyoshi Tokugawa, it is found that he is very close to or slightly exceeds the upper or lower limits of the *Homo s. s.* range in a few PCs. This is probably due to his own living environment and genetic changes in his family through aristocratic way of life for several generations, i.e. a kind of artificial selection.

General size factor and regularity in among-group variations

Usually, a so-called general size factor (all factor loadings on this factor have the same sign) is extracted in the form of PC I from the PCA of a within-group correlation or variance/covariance matrix, as seen in Tables 4 and 5 or in many studies (e.g., Kanda and Kurisu, 1967; Mizoguchi, 1992; etc.). In the PCAs of among-group correlations between craniofacial measurements in the present study, however, such a general size factor was not extracted (Tables 13 and 19). This is robust evidence for a qualitative difference between within-group and among-group covariations of craniofacial measurements. Namely, this difference is considered to result from various differences between the ontogenetic and phylogenetic processes.

As shown in Tables 13 and 19, however, some PCs or local common factors were certainly extracted from among-group correlation matrices of craniofacial measurements. This fact is evidence for the existence of some regularity in the among-group variations between craniofacial measurements. From these tables, it is found that, while cranial breadth, upper facial height, bizygomatic breadth, orbital height and nasal height vary in parallel with one another, cranial length and nasal breadth vary relatively independently of each other and of the above five measurements. This supports Mizoguchi's (1998b, c) findings from Asian samples.

Česnys (1991) carried out an inter-group PCA of craniofacial measurements on the basis of 70 male Central and Eastern European samples from the Late Mesolithic, Neolithic and Early Bronze Ages, and showed that the first PC was relatively highly associated with bizygomatic breadth, upper facial height, orbital breadth and nasal height, and that the second PC was relatively highly associated with cranial breadth and, at the same time, inversely associated with cranial length. These findings are partially consistent with those of the present study (Tables 13 and 19).

Deviated distributions of environmental variables

The data of craniofacial and postcranial measurements used here have been collected by the present author from the literature as randomly as possible in the research environment of the present author, namely in Japan. But there are lots of bias factors affecting the amount of data for a particular character or the shape of among-group distribution of a variable. For example, the geographical distribution of anthropologists (some people say that the number of archeological sites excavated is large in the areas where there are many universities or institutions to which archeologists belong), the research environment of a data collector, main interest of many researchers, etc. may influence on the amount of data or the shape of among-group distributions in addition to a simple sampling error due to the smallness of sample size. In the present study, the number of samples collected for limb bone measurements is smaller than that for craniofacial measurements (Table 2). This fact may be explained by the possibility that many anthropologists are interested in the skull more than in limb bones.

Among the environmental variables analyzed here, only average annual temperature has a distribution which is not significantly different from normal distributions at the 5% level (Table 23 and Fig. 11). This may be evidence that many people prefer a moderate climate, especially in temperature.

The distributions of the other environmental variables are highly significantly different from normal distributions (Table 23 and Figs. 12 to 16). In particular, chronological age of sample is extremely deviated. This is, however, convincing because the older the sample is, the worse the preservation of bones is.

Regarding the deviated distributions of precipitation, relative humidity, the absolute value of latitude, and great circle distance, various causes can be considered. But it is not easy to identify them without other information.

Environmental influence on the craniofacial morphology

In his studies on within-group correlations between craniofacial and postcranial measurements, Mizoguchi (e.g., 2007a) showed that, for example, cranial length was associated with many postcranial measurements. In the beginning of this study, therefore, it was planned to carry out analyses based on the data including postcranial measurements to clarify the causes for the among-group correlations between craniofacial measurements. As already stated, however, the number of samples collected for postcranial measurements was too small to examine the global tendency in the among-group associations between craniofacial, postcranial, and environmental variables (Tables 9, 10, 48 and 49). Therefore, the among-group associations between only craniofacial and environmental variables are mainly discussed here.

Major among-group associations between craniofacial measurements and environmental variables are shown in Figs. 17 to 22. In Figs. 17 and 18, it is clear that cranial breadth, upper facial height, bizygomatic breadth, and nasal height tend to be larger in colder regions of higher latitudes, and vice versa. The robustness of this tendency is confirmed by highly

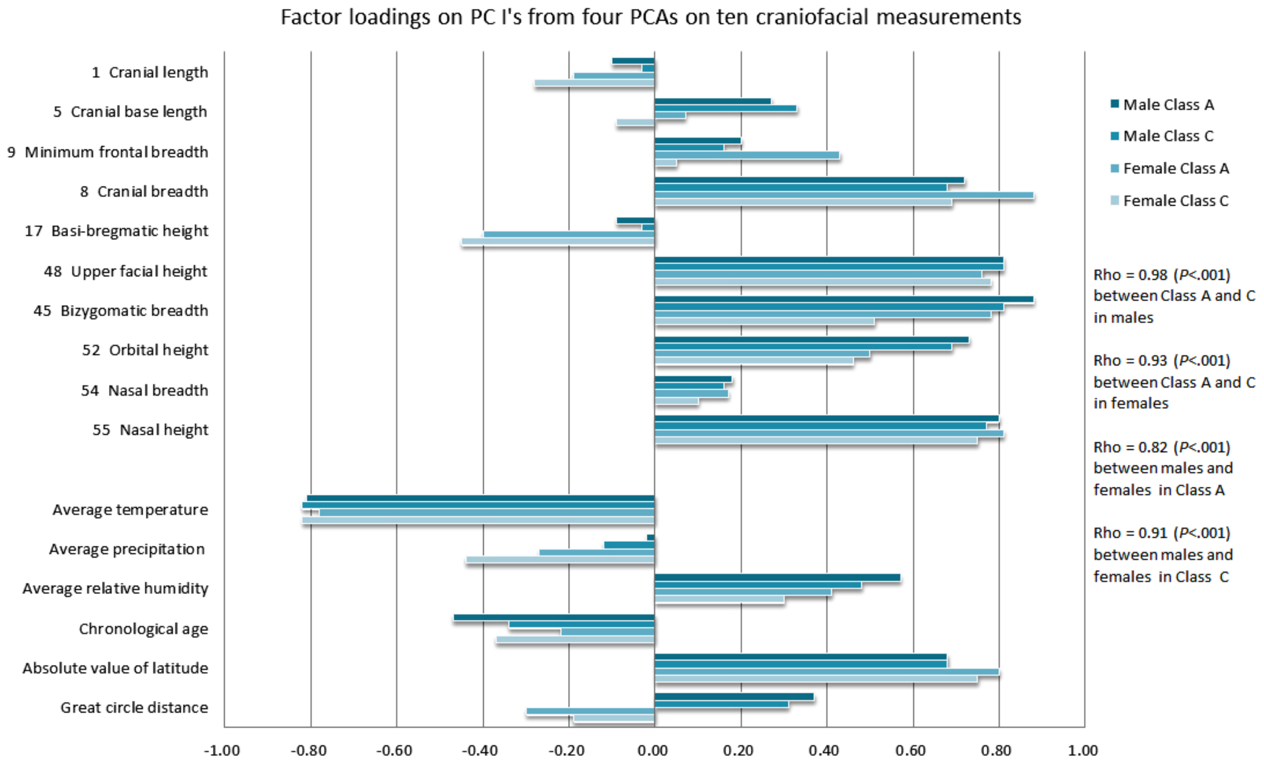

Fig. 17. Factor loadings on PC I's from the four PCAs of among-group correlations between ten craniofacial and six environmental variables based on male Class A samples (Table 11), male Class C samples (Table 30), female Class A samples (Table 28), and female Class C samples (Table 32). 'Rho' is a Spearman's rank correlation coefficient between PCs estimated on the basis of the variation patterns of factor loadings.

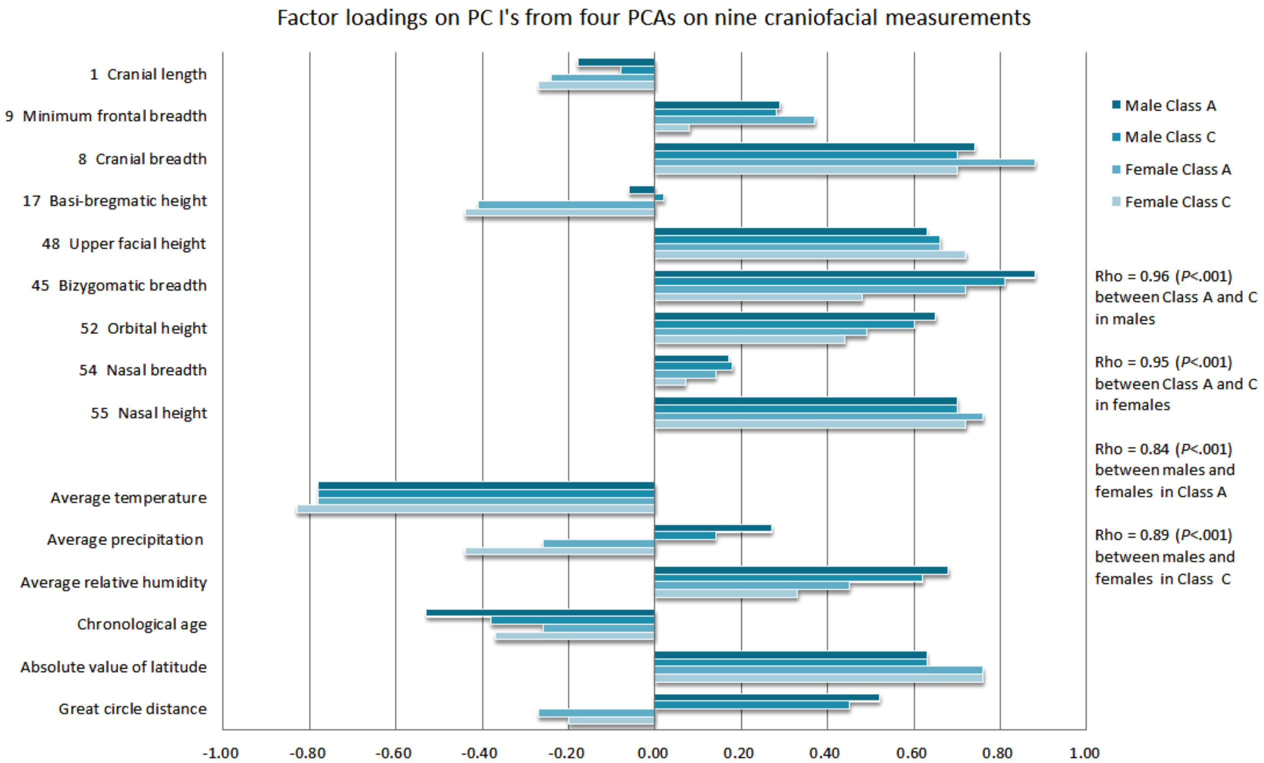

Fig. 18. Factor loadings on PC I's from the four PCAs of among-group correlations between nine craniofacial and six environmental variables based on male Class A samples (Table 17), male Class C samples (Table 40), female Class A samples (Table 38), and female Class C samples (Table 42). 'Rho' is a Spearman's rank correlation coefficient between PCs estimated on the basis of the variation patterns of factor loadings.

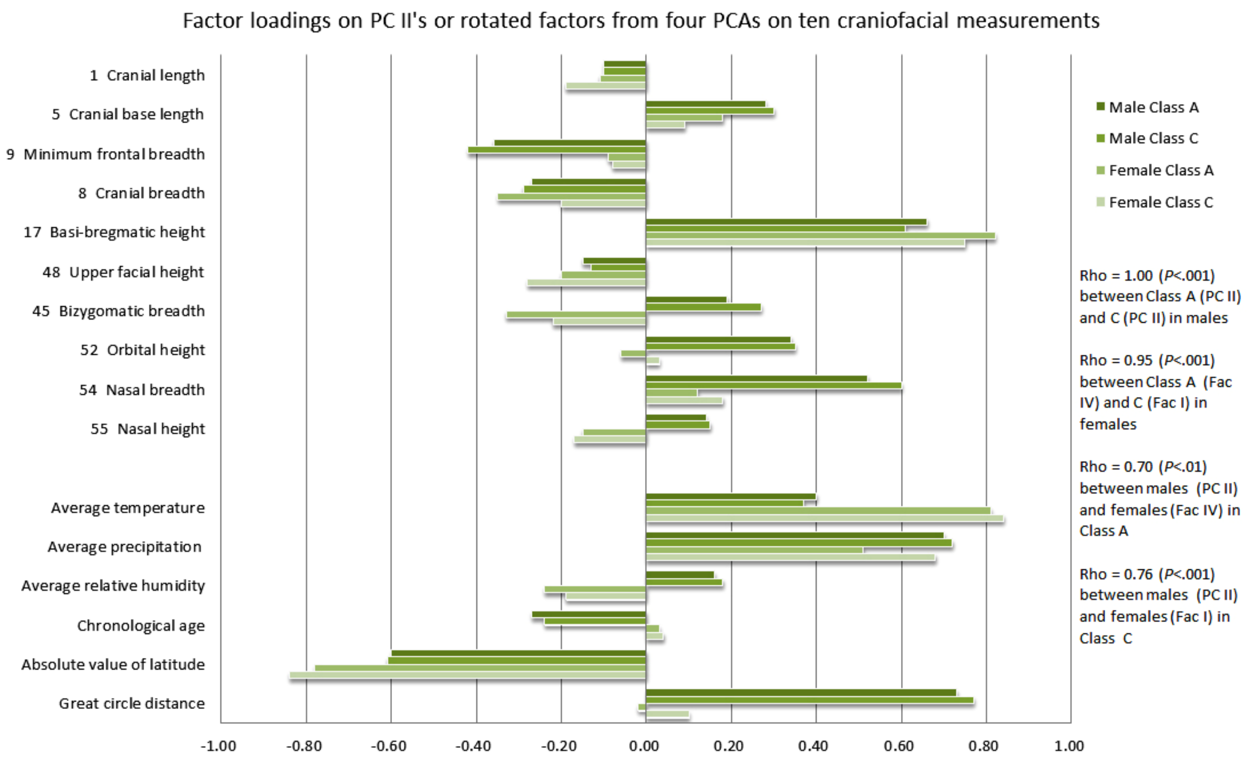

Fig. 19. Factor loadings on PC II's or rotated factors from the four PCAs of among-group correlations between ten craniofacial and six environmental variables based on male Class A samples (Table 11), male Class C samples (Table 30), female Class A samples (Table 29), and female Class C samples (Table 33). 'Rho' is a Spearman's rank correlation coefficient between factors (PC or rotated factor [Fac]) estimated on the basis of the variation patterns of factor loadings.

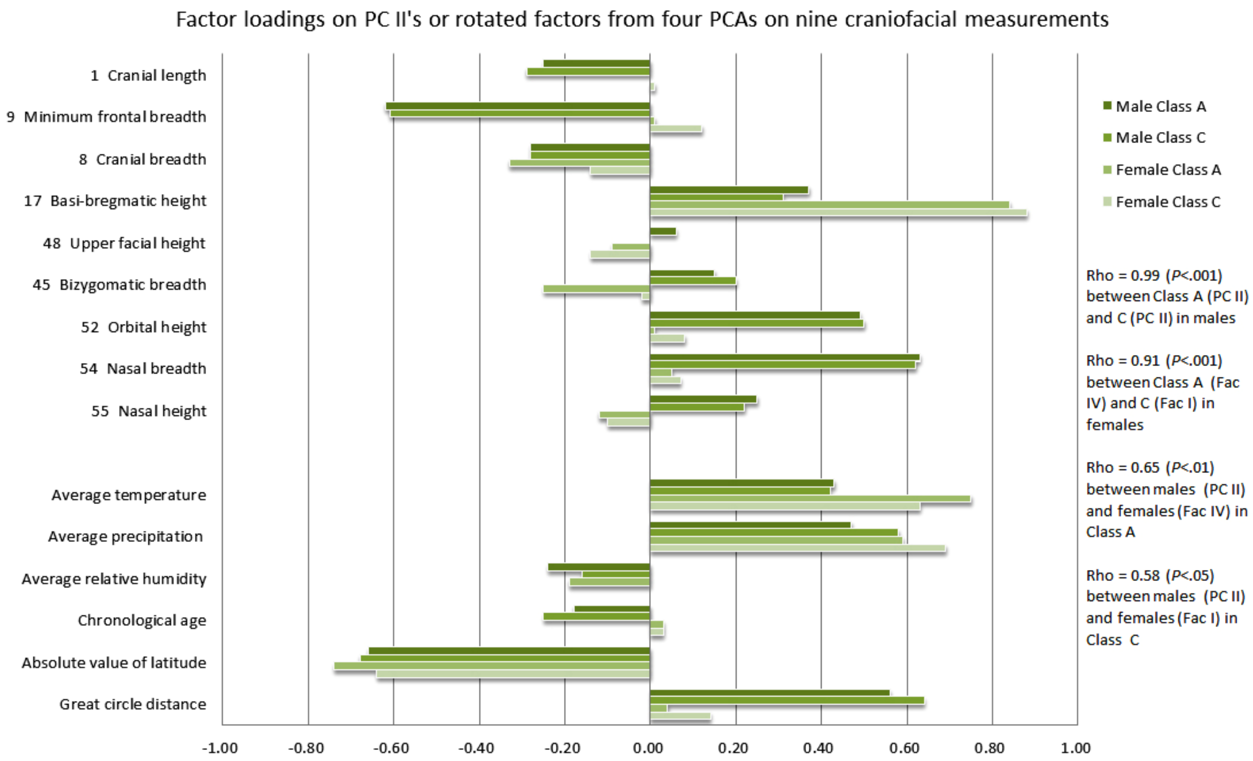

Fig. 20. Factor loadings on PC II's or rotated factors from the four PCAs of among-group correlations between nine craniofacial and six environmental variables based on male Class A samples (Table 17), male Class C samples (Table 40), female Class A samples (Table 39), and female Class C samples (Table 43). 'Rho' is a Spearman's rank correlation coefficient between factors (PC or rotated factor [Fac]) estimated on the basis of the variation patterns of factor loadings.

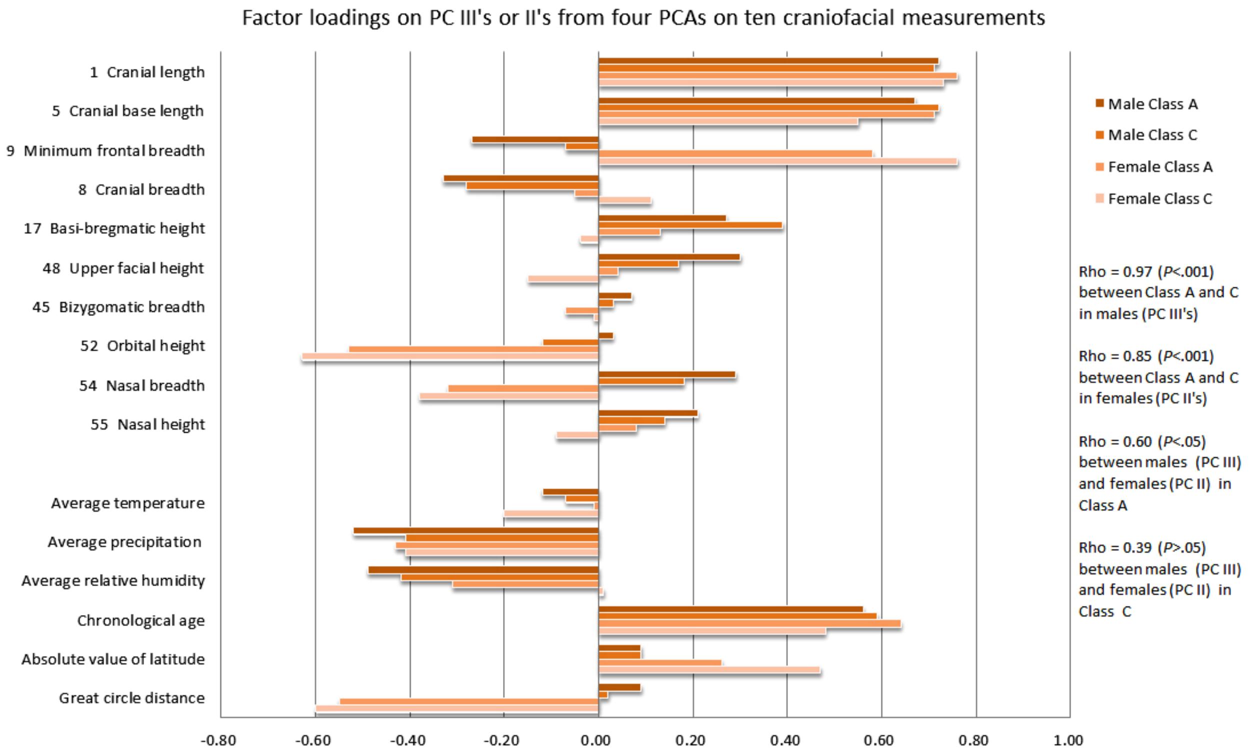

Fig. 21. Factor loadings on PC III's or II's from the four PCAs of among-group correlations between ten craniofacial and six environmental variables based on male Class A samples (Table 11), male Class C samples (Table 30), female Class A samples (Table 28), and female Class C samples (Table 32). 'Rho' is a Spearman's rank correlation coefficient between PCs estimated on the basis of the variation patterns of factor loadings.

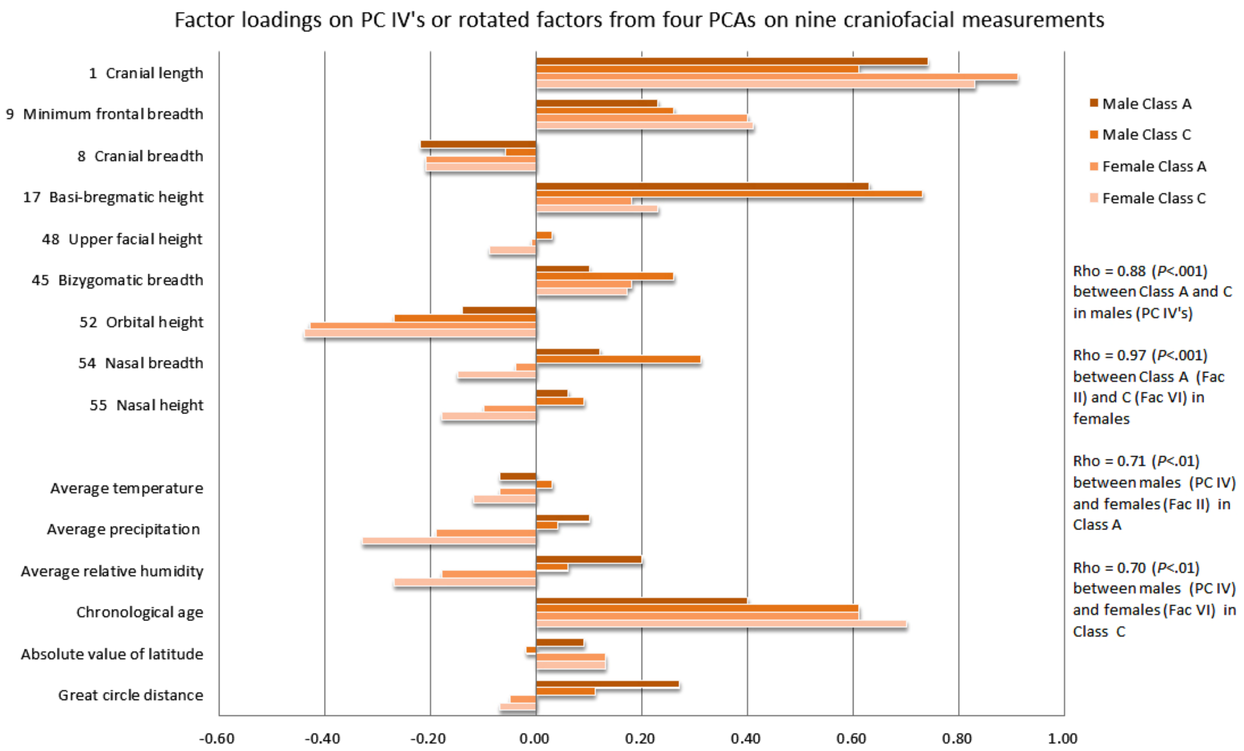

Fig. 22. Factor loadings on PC IV's or rotated factors from the four PCAs of among-group correlations between nine craniofacial and six environmental variables based on male Class A samples (Table 17), male Class C samples (Table 40), female Class A samples (Table 39), and female Class C samples (Table 43). 'Rho' is a Spearman's rank correlation coefficient between factors (PC or rotated factor [Fac]) estimated on the basis of the variation patterns of factor loadings.

significant Spearman's rank correlation coefficients between independent male and female samples (Figs. 17 and 18). Crognier (1979, 1981), using "zero-order correlation coefficients" based on 85 male samples from Europe, North Africa and Near/Middle East, suggested that temperature (all of mean annual temperature, mean temperature of the coldest month, and mean temperature of the hottest month) had high inverse correlations with maximum head breadth, morphological face height, bizygomatic breadth, and nose height. Although it is unknown whether or not Crognier took into account the premise of bi-variate normal distribution for correlation coefficient when estimating a correlation coefficient from the among-group samples, the findings are very suggestive and not inconsistent with the above results of the present study. Guglielmino-Matessi et al. (1979) compared the PCs from 19 climatic variables on temperature and humidity with the discriminant functions based on Howells' (1973) craniofacial data from 17 populations, and found that their PC I mainly associated with temperature had significant inverse correlations with Howells' first discriminant function strongly associated with skull breadth and facial height in both males and females. This is also compatible with the findings in the present study. Gilligan and Bulbeck (2007) showed, using male data from Australian Aboriginal tribes (the number of tribal groups varies from 59 to 102 across the variables cited here), that maximum head breadth was negatively associated with temperature, but bizygomatic diameter and nasal height had no significant association with temperature. Although their findings is not completely consistent with the present study, this does not necessarily mean that either of the two studies is wrong because Gilligan and Bulbeck's data are derived from a local region, not from all over the world. After all, the strong among-group associations of craniofacial measurements with temperature found in the present study are considered a result of the adaptation of local populations to their living environments.

Incidentally, the representative samples which are placed at both extreme positions in the tendencies shown in Figs. 17 and 18 are listed in Table 50. The three male samples with the highest scores of PC I in Fig. 17 are Yakuts [Russia; 73 YAKUT in Appendix 3], Buryats [Russia; 71 B-T-B] and Chukchi [Russia; 74 CHUK3], while the three male samples with the lowest scores are Lower Nubia [Egypt; 26 L-NB2], Naqada [Egypt; 4 NAQAD] and S. Egyptians [Upper Egypt; 3 S-EGY] (Table 50). In Fig. 18, those with the highest scores of PC I are S. Egyptians [Upper Egypt; 4 S-EGY in Appendix 4], Naqada [Egypt; 5 NAQAD] and Lower Nubia [Egypt; 108 L-NB2], while those with the lowest scores are Buryats [176 BURYATM], Buryats [Russia; 175 B-T-B] and Yakuts [Russia; 177 YAKUT] (Table 50). The contrast between these samples is shown in Figs. 23 and 24. Such examples make our imagination real.

In Figs. 19 and 20, the variation patterns of factor loadings are slightly different between males and females, as indicated by Spearman's rank correlation coefficients. But the results based on male samples, the number of which is much larger than that of female samples, show interesting among-group associations between craniofacial and environmental variables. Both figures show a tendency of basi-bregmatic height and nasal breadth to be larger and, at the same time, another tendency of minimum frontal breadth to be smaller in the regions more distant from Ethiopia and of lower latitudes where average precipitation is higher and average temperature is also relatively high.

Wolpoff (1968), using cranial samples from Australian Aboriginals and Alaska Natives, showed that nasal breadth was smaller in colder and drier regions. Noback et al. (2011), using ten modern human population samples from five climatic groups, suggested that nasal aperture tended to be narrower and higher in cold and dry regions, and that the bony nasal cavity appeared mostly associated with temperature, and the nasopharynx with humidity. According to Crognier (1979, 1981), however, nose breadth has a significant negative correlation with the mean precipitation of the rainiest month in males and, in females (Crognier,1979), with the mean precipitation of the driest month. Gilligan and Bulbeck (2007), using 75 male tribal groups of Australian Aboriginals, showed that nasal breadth is positively associated with temperature and negatively with relative humidity. As regards the association between nasal breadth and temperature, the finding in the present study is compatible with those of Wolpoff, Gilligan and Bulbeck, and Noback et al. But Crognier's results on precipitation and Gilligan and Bulbeck's findings on relative humidity are not completely consistent with those of the present study. Maddux et al. (2016) suggest that environments typically characterized as "cold-wet" actually exhibit low absolute humidities, with values virtually identical to cold-dry environments and significantly lower than hot-wet and even hot-dry environments, and that strong associations between the nasal index and absolute humidity are, potentially erroneously, predicated on individuals from hot-dry environments possessing intermediate (mesorrhine) nasal indices. Furthermore, Maddux et al. (2017) state that only the internal nasal fossa, which is one of the four morphofunctional units of the nasorespiratory tract (external pyramid, nasal aperture, internal nasal fossa, and nasopharynx), exhibits an ecogeographic distribution consistent with climatic adaptation, with crania from colder and/or drier environments displaying internal nasal fossae that are longer, taller, and narrower (especially superiorly) compared to those from hotter and more humid environments. Although the problems on precipitation or humidity should be investigated in more depth in the future, it is most likely that nasal breadth has been determined through adaptation to temperature to a considerable extent.

Regarding the within-group genetic variation of nasal breadth, there is an interesting report.

Table 50. Standardized means of craniofacial and environmental variables in Class A male samples with the highest or lowest scores of PC I, II, or III (or IV) extracted from their among-group correlations.[1)]

Sample[2)]	PC score	Martin's No. 1	No. 5	No. 9	No. 8	No. 17	No. 48	No. 45	No. 52	No. 54	No. 55	Av. temp.	Av. precip.	Av. rel. humid.	Chron. age	Abs (latitude)	Gr. cir. distance
Three samples with the highest scores of PC I in Table 11:																	
73 YAKUT	2.31	0.61	1.26	-0.48	1.06	0.35	2.51	1.89	1.09	2.13	2.52	-2.54	-0.77	0.17	-0.58	1.87	0.58
71 B-T-B	2.11	-0.07	0.70	0.12	2.33	-0.82	1.79	1.91	1.95	1.52	1.97	-1.43	-0.69	0.30	-0.58	0.94	0.28
74 CHUK3	2.09	0.18	0.76	0.16	0.10	-0.25	2.03	1.33	2.03	-0.85	1.77	-2.44	-0.86	1.27	-0.58	2.02	1.08
Mean of the three samples	2.17	0.24	0.91	-0.07	1.16	-0.24	2.11	1.71	1.69	0.93	2.09	-2.14	-0.78	0.58	-0.58	1.61	0.64
Three samples with the lowest scores of PC I in Table 11:																	
26 L-NB2	-2.30	0.28	-0.81	-1.52	-1.78	-1.04	-1.14	-2.36	-1.40	-0.06	-1.67	1.53	-1.22	-3.11	0.46	-1.20	-1.53
4 NAQAD	-2.35	0.74	-1.02	-1.68	-1.23	0.17	-1.11	-1.95	-1.75	-0.41	-1.62	1.37	-1.22	-2.09	3.48	-0.98	-1.44
3 S-EGY	-2.46	0.08	-0.51	-1.68	-1.83	-0.16	-0.84	-2.38	-2.09	-0.68	-1.67	1.18	-1.22	-2.02	3.69	-0.91	-1.40
Mean of the three samples	-2.37	0.37	-0.78	-1.63	-1.61	-0.34	-1.03	-2.23	-1.75	-0.38	-1.65	1.36	-1.22	-2.41	2.54	-1.03	-1.46
Three samples with the highest scores of PC II in Table 11:																	
30 MEDCHAMM	2.54	-0.15	1.57	0.51	-0.24	2.24	-0.60	1.31	1.09	0.90	1.08	1.65	1.81	0.92	-0.08	-1.77	1.22
31 HAWAI	2.53	-0.04	2.43	0.24	0.43	2.18	-0.81	0.42	0.92	0.73	1.18	1.13	1.19	0.62	-0.26	-1.41	2.59
91 DAYAK	2.20	-1.40	-0.97	-0.80	-0.64	0.05	-0.47	-0.38	-0.37	1.43	0.38	1.56	3.34	1.19	-0.57	-2.84	0.23
Mean of the three samples	2.43	-0.53	1.01	-0.02	-0.15	1.49	-0.63	0.45	0.55	1.02	0.88	1.45	2.11	0.91	-0.30	-2.01	1.35
Three samples with the lowest scores of PC II in Table 11:																	
61 NENET	-1.28	-0.75	-1.57	-0.44	0.88	-1.70	0.79	0.96	0.40	-0.50	0.43	-1.88	-0.47	0.93	-0.47	2.02	-0.06
102 CARIN	-1.28	-0.98	-1.62	0.91	0.94	-1.79	-0.60	-0.23	-0.37	-0.85	-0.77	-0.58	-0.03	0.47	-0.44	0.59	-0.65
110 CZECH	-1.30	-1.58	-1.32	0.83	0.70	-0.98	-1.20	-0.72	-0.89	-1.47	-1.17	-0.43	-0.55	0.79	-0.55	0.73	-0.59
Mean of the three samples	-1.29	-1.10	-1.51	0.43	0.84	-1.49	-0.33	0.00	-0.28	-0.94	-0.51	-0.96	-0.35	0.73	-0.49	1.11	-0.43
Three samples with the highest scores of PC III in Table 11:																	
7 EKVEN	2.79	2.67	3.54	0.36	-1.34	1.28	1.64	1.26	1.26	-1.03	1.52	-2.06	-0.80	1.23	0.82	1.87	1.17
15 PN-TP	2.48	2.40	1.77	0.75	-1.03	1.16	-0.02	-1.00	-1.49	-0.06	-0.47	0.31	-0.97	-1.59	2.61	-0.27	-1.01
11 MURRY	2.23	1.74	0.60	-3.32	-2.03	-0.34	-0.20	0.21	-0.89	2.48	-1.07	0.54	-0.85	-1.27	0.89	-0.34	1.21
Mean of the three samples	2.50	2.27	1.97	-0.74	-1.47	0.70	0.47	0.16	-0.37	0.46	-0.01	-0.40	-0.87	-0.54	1.44	0.42	0.46
Three samples with the lowest scores of PC III in Table 11:																	
110 CZECH	-1.82	-1.58	-1.32	0.83	0.70	-0.98	-1.20	-0.72	-0.89	-1.47	-1.17	-0.43	-0.55	0.79	-0.55	0.73	-0.59
89 VIETN	-2.06	-1.93	-1.27	-0.40	-0.47	0.65	-1.17	-0.25	-0.28	0.38	-0.32	1.41	3.03	0.77	-0.59	-1.70	0.11
108 VORAR	-2.09	-1.30	-1.17	1.87	1.13	-1.40	0.16	-0.61	-0.46	-1.20	-0.77	-0.69	1.50	0.62	-0.54	0.52	-0.63
Mean of the three samples	-1.99	-1.61	-1.25	0.77	0.45	-0.57	-0.74	-0.53	-0.54	-0.76	-0.76	0.10	1.32	0.73	-0.56	-0.15	-0.37
Three samples with the highest scores of PC I in Table 17:																	
4 S-EGY	2.78	-0.16	-	-2.08	-2.14	-0.14	-0.89	-2.44	-1.82	-0.47	-1.76	1.36	-1.17	-1.82	4.16	-1.19	-1.18
5 NAQAD	2.61	0.47	-	-2.08	-1.42	0.22	-1.22	-1.94	-1.45	-0.17	-1.71	1.58	-1.17	-1.89	3.90	-1.27	-1.23
108 L-NB2	2.52	0.03	-	-1.91	-2.08	-1.10	-1.26	-2.41	-1.08	0.22	-1.76	1.76	-1.17	-2.84	0.32	-1.51	-1.34
Mean of the three samples	2.64	0.11	-	-2.02	-1.88	-0.34	-1.12	-2.27	-1.45	-0.14	-1.75	1.57	-1.17	-2.18	2.79	-1.32	-1.25
Three samples with the lowest scores of PC I in Table 17:																	
176 BURYATM	-2.51	-0.51	-	0.07	2.76	-1.00	2.55	2.21	2.12	2.22	2.54	-1.69	-0.61	0.55	-0.96	0.81	0.73
175 B-T-B	-2.55	-0.31	-	-0.18	2.86	-0.87	2.26	2.48	2.49	2.02	2.48	-1.68	-0.51	0.35	-0.92	0.94	0.80
177 YAKUT	-2.70	0.35	-	-0.81	1.34	0.42	3.13	2.46	1.58	2.71	3.13	-2.98	-0.61	0.23	-0.92	2.00	1.14
Mean of the three samples	-2.59	-0.16	-	-0.31	2.32	-0.48	2.65	2.38	2.06	2.32	2.72	-2.12	-0.58	0.38	-0.94	1.25	0.89
Three samples with the highest scores of PC II in Table 17:																	
195 DAYAK	3.06	-1.62	-	-1.15	-0.71	0.09	-0.46	-0.14	0.02	1.92	0.62	1.80	4.49	1.18	-0.91	-3.39	0.74
115 MEDCHAMM	2.84	-0.39	-	0.24	-0.23	2.51	-0.60	1.79	1.58	1.32	1.44	1.91	2.59	0.93	-0.32	-2.17	1.91
116 HAWAI	2.72	-0.29	-	-0.05	0.58	2.45	-0.86	0.78	1.39	1.12	1.55	1.30	1.82	0.65	-0.54	-1.76	3.53
Mean of the three samples	2.87	-0.76	-	-0.32	-0.12	1.69	-0.64	0.81	0.99	1.45	1.20	1.67	2.97	0.92	-0.59	-2.44	2.06
Three samples with the lowest scores of PC II in Table 17:																	
199 LAPPS	-1.39	-1.20	-	0.49	1.21	-2.13	-1.11	0.26	0.11	-0.47	-0.72	-1.40	-0.34	0.87	-0.91	2.16	0.30
120 CUDEN	-1.40	0.23	-	1.42	0.32	0.72	-0.82	0.63	-2.09	-0.07	-1.18	-1.07	-0.08	0.87	-0.28	1.43	-0.04
96 KAISR	-1.44	1.56	-	0.45	0.03	-1.27	-1.15	-0.19	-1.27	-1.17	-1.53	-0.52	0.07	0.37	0.15	0.61	-0.19
Mean of the three samples	-1.41	0.20	-	0.79	0.52	-0.89	-1.03	0.23	-1.08	-0.57	-1.14	-1.00	-0.12	0.70	-0.35	1.40	0.02
Three samples with the highest scores of PC IV in Table 17:																	
3 CERNC	3.16	1.65	-	1.04	-0.10	1.98	-0.78	-1.08	-0.90	0.42	-0.31	-0.14	-0.15	0.66	4.07	0.20	-0.55
9 EKVEN	3.10	2.37	-	0.07	-1.56	1.45	2.08	1.74	1.76	-0.87	1.96	-2.41	-0.64	1.22	0.74	2.00	1.85
71 KIVUT	2.44	2.17	-	0.16	-0.99	2.15	0.56	-1.03	1.03	-1.47	0.74	-0.77	-0.18	0.89	0.57	1.26	-0.08
Mean of the three samples	2.90	2.06	-	0.42	-0.88	1.86	0.62	-0.12	0.63	-0.64	0.80	-1.11	-0.32	0.93	1.79	1.15	0.41
Three samples with the lowest scores of PC IV in Table 17:																	
144 COPTS	-1.89	-0.46	-	-0.73	-0.10	-1.83	0.12	-1.38	0.48	-0.27	1.15	1.22	-1.16	-1.21	0.06	-1.02	-1.11
231 ARMEN	-1.93	-2.60	-	0.33	0.64	0.06	0.81	0.01	0.75	0.03	1.26	-0.06	-0.68	-0.34	-0.90	-0.13	-0.70
220 HRADK	-2.05	-2.25	-	0.28	0.80	-1.07	-1.65	-0.61	-0.99	-0.47	-2.41	-0.35	-0.34	0.36	-0.75	0.61	-0.30
Mean of the three samples	-1.96	-1.77	-	-0.04	0.45	-0.95	-0.24	-0.66	0.08	-0.24	0.00	0.27	-0.73	-0.40	-0.53	-0.18	-0.70

[1)]The factor loadings on the PCs dealt with here are shown in Tables 11 and 17.

[2)]The details of samples are shown in Appendix 1. The number preceding a sample label is correspondent to that in Appendix 3 (for the samples used in Table 11) or in Appendix 4 (for the samples used in Table 17).

Martínez-Abadías et al. (2009), using 355 pedigree-known adult skulls from Hallstatt, Austria, showed that the estimates of narrow-sense heritability for cranial length, cranial breadth, basi-bregmatic height, bizygomatic breadth, upper facial height, orbital breadth, and nasal height were between 0.24 and 0.43, while the heritability estimate for nasal breadth was 0.00. If this can be applied to most populations, it turns out that nasal breadth is perfectly determined by genes and genetically extremely stable in diverse populations, such as the number of eyes in many animals. If so, the connection of nasal breadth with temperature woud be very strong.

Incidentally, Fabra and Demarchi (2011), using male samples from 17 pre-Hispanic populations in the Southern Cone of South America, suggested that, while nasal height and breadth had no significant among-group

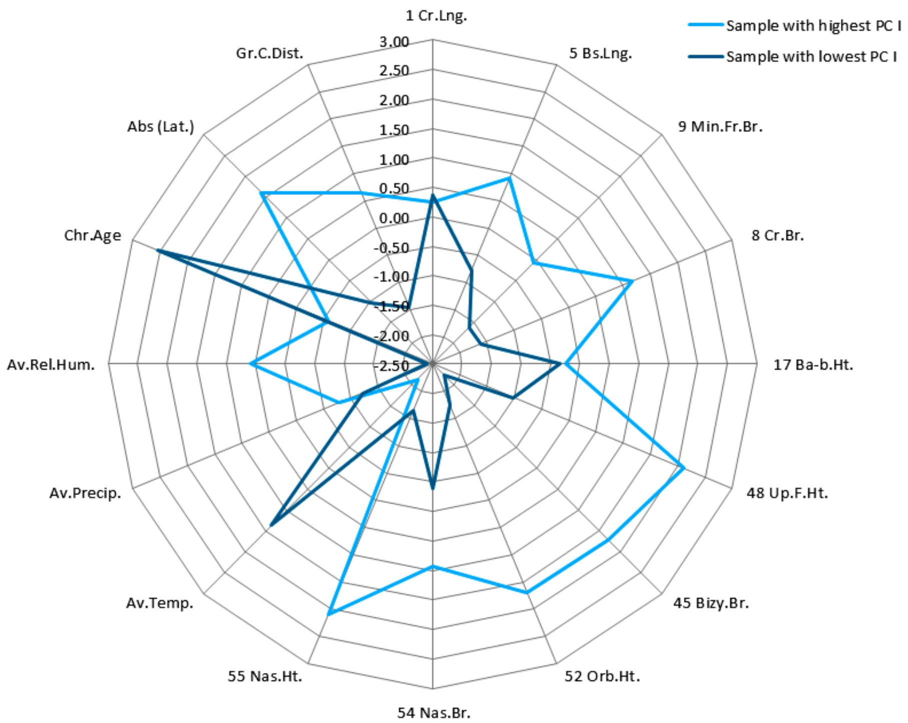

Fig. 23. Arithmetic means in the standardized data of original variables of the three extreme samples which have the highest or lowest principal component scores of PC I (Table 50) from the PCA of among-group correlations between ten craniofacial and six environmental variables based on male Class A samples (Table 11).

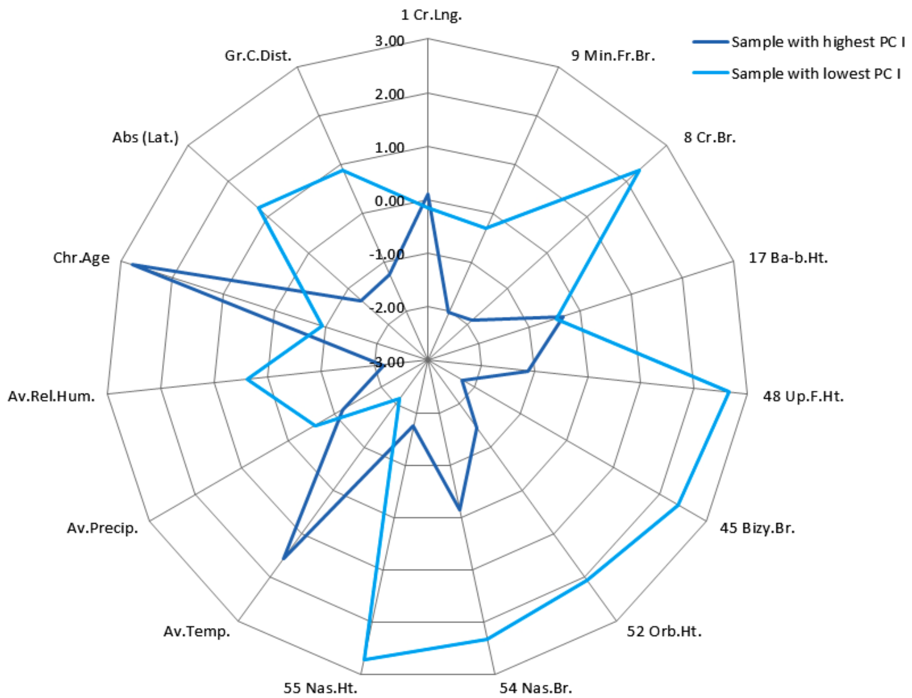

Fig. 24. Arithmetic means in the standardized data of original variables of the three extreme samples which have the highest or lowest principal component scores of PC I (Table 50) from the PCA of among-group correlations between nine craniofacial and six environmental variables based on male Class A samples (Table 17).

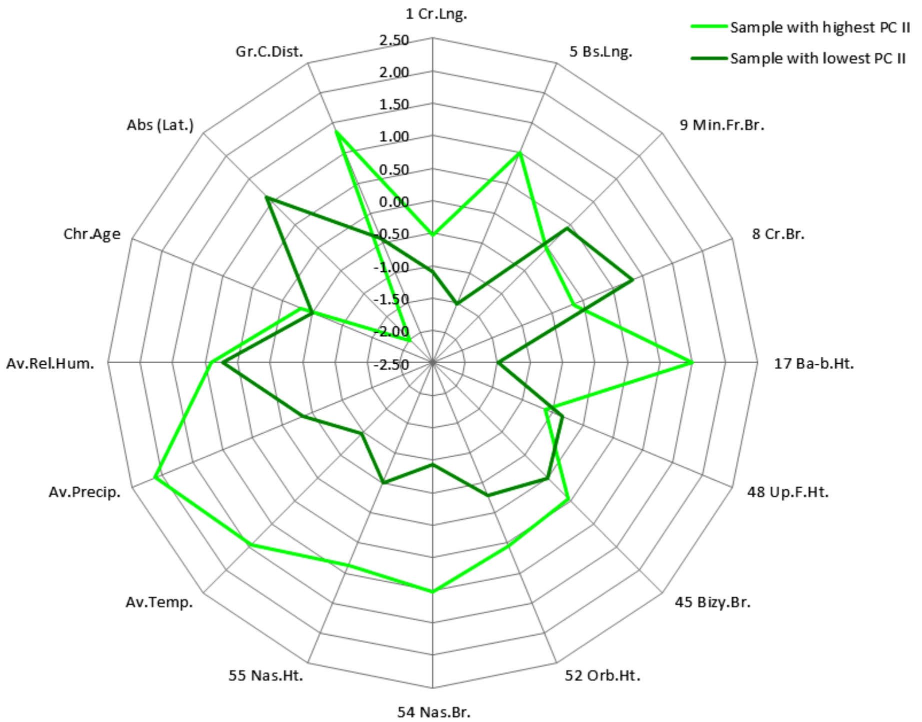

Fig. 25. Arithmetic means in the standardized data of original variables of the three extreme samples which have the highest or lowest principal component scores of PC II (Table 50) from the PCA of among-group correlations between ten craniofacial and six environmental variables based on male Class A samples (Table 11).

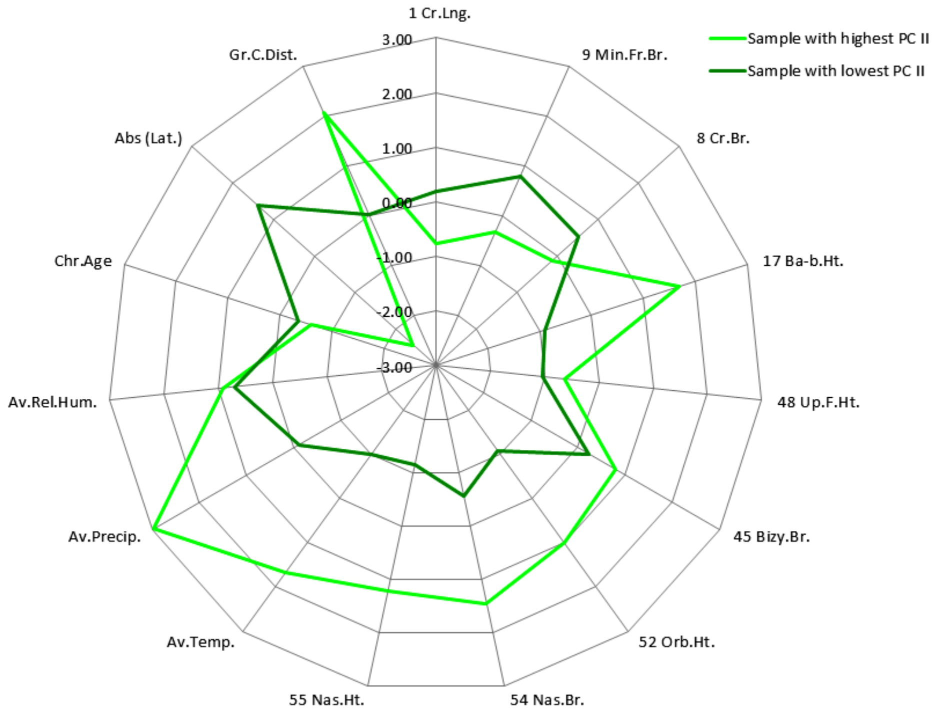

Fig. 26. Arithmetic means in the standardized data of original variables of the three extreme samples which have the highest or lowest principal component scores of PC II (Table 50) from the PCA of among-group correlations between nine craniofacial and six environmental variables based on male Class A samples (Table 17).

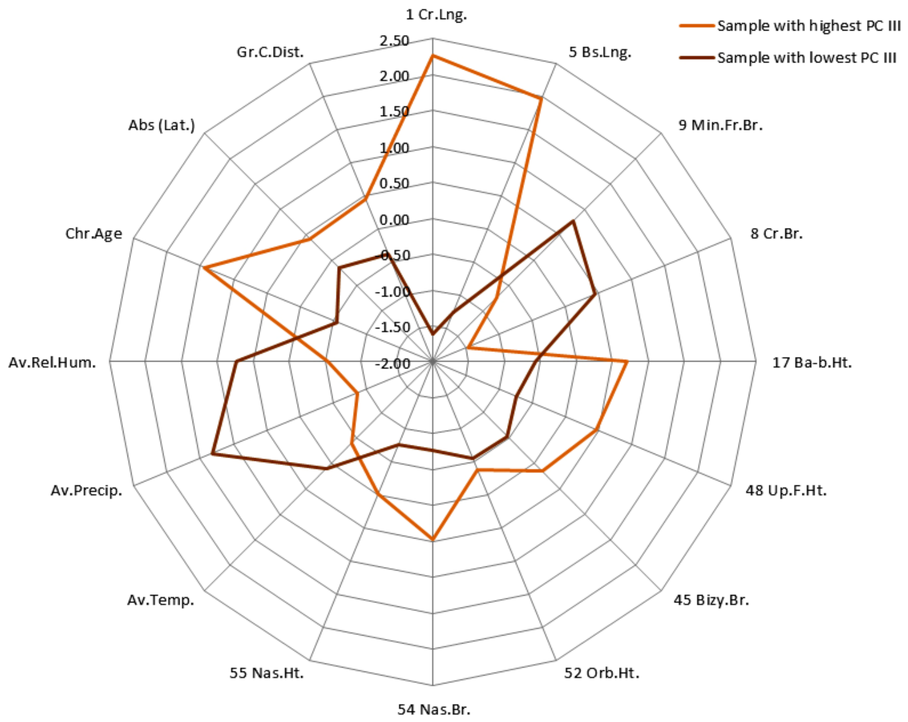

Fig. 27. Arithmetic means in the standardized data of original variables of the three extreme samples which have the highest or lowest principal component scores of PC III (Table 50) from the PCA of among-group correlations between ten craniofacial and six environmental variables based on male Class A samples (Table 11).

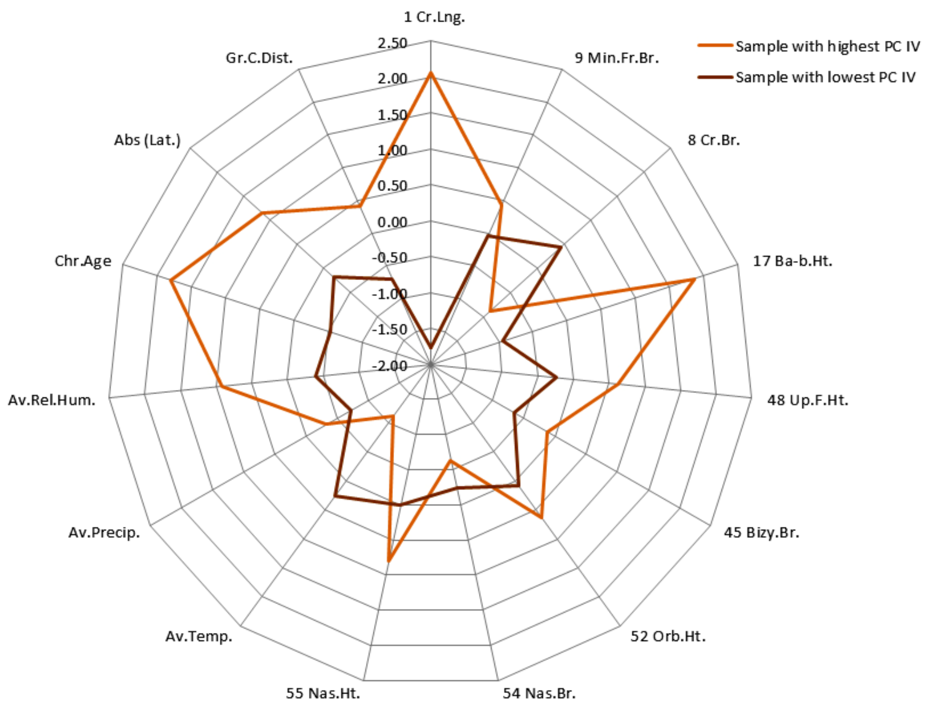

Fig. 28. Arithmetic means in the standardized data of original variables of the three extreme samples which have the highest or lowest principal component scores of PC IV (Table 50) from the PCA of among-group correlations between nine craniofacial and six environmental variables based on male Class A samples (Table 17).

association with temperature nor with rainfall, they had significant negative correlations with altitude. The number of samples used in their analysis is limited. But their findings are very interesting in understanding the adaptation of the nasal structure to some environmental factors other than temperature and humidity, such as oxygen content.

It is also interesting here that the three matric traits, i.e. nasal breadth, basi-bregmatic height and minimum frontal breadth, seem to be highly associated not only with precipitation and latitude but also with the great circle distance from Herto, Ethiopia.

Relethford (2004) comprehensively examined the contribution of isolation by geographic distance to the present global variation patterns in three kinds of characters, i.e., red blood cell polymorphisms, microsatellite DNA markers and craniofacial measurements, and maintains, as an alternative explanation, that, since a common pattern of global gene flow mediated by geographic distance is detectable in diverse genetic and morphological data sets, the correspondence between genetic similarity and geographic distance reflects the history of dispersal of the human species out of Africa. His conclusion seems reasonable if all the geographic distances he computed are those from Africa. In practice, however, the distances he used contain not only distances between local populations within Africa but also those within New World, Australasia, or Eurasia in addition to the distances between the four regions. Namely, it can also be said that his results may reflect the history of dispersal of the human species out of New World, Australasia, or Eurasia. In any case, geographic distance is no doubt an important factor in understanding the background of evolutionary processes.

As shown by Relethford (2004), genetic similarity between populations may decrease with geographic distance between the populations in general, and this can partly be explained by gene flow or migration. Betti et al. (2010) assert that neutral processes (genetic drift) have been much more important than climate in shaping the human cranium, and that a large proportion of the signal for natural selection comes from populations from extremely cold regions. In both of Figs. 19 and 20 of the present study, it is found, though only in males, that the mean values themselves of metric traits, not their differences or similarity between populations, vary in parallel with the geographic distance from Herto, Ethiopia. Can this phenomenon be explained by gene flow (or migration) or genetic drift? The three male samples with the highest scores of PC II in Fig. 19 are Chamorros [Mariana Islands; 30 MEDCHAMM in Appendix 3], Hawaii [Hawaiian Islands; 31 HAWAI] and Dayak [Borneo; 91 DAYAK], while the three male samples with the lowest scores are Nenets [Russia; 61 NENET], Carinthians [S.C. Austria; 102 CARIN] and Czechs [Bohemia; 110 CZECH] (Table 50). In Fig. 20, those with the highest scores of PC II are Dayak [Borneo; 195 DAYAK in Appendix 4], Chamorros [Mariana Islands; 115 MEDCHAMM] and Hawaii [Hawaiian Islands; 116 HAWAI], while those with the lowest scores are Lapps [199 LAPPS], Čuden [Russia; 120 CUDEN] and Kaiserslautern [Germany; 96 KAISR] (Table 50). The contrast between these samples is shown in Figs. 25 and 26. If the Out-of-Africa hypothesis on the origins of modern humans is correct, nasal breadth, for example, must decrease toward the northeast and increase toward the southeast. If two different critical genetic drifts happened in the process of migration and, after that, there have been no great change in the descendant populations, one of which migrated to a more distant region than the other, then such a state as shown here may have appeared. But, if so, not only the above three metric characters but also all the other characters must change in the two directions, namely, all characters must have high correlations with geographic distance, as stated by Fabra and Demarchi (2011). In Figs. 19 and 20, there is no such indication. Therefore, the strong associations of the above three metric characters with geographic distance are also considered evidence of adaptation to environment in each region. But it is not easy to imagine the mechanism of adaptation for minimum frontal breadth and basi-bregmatic height. If the compression by temporal muscles affects the smallness of minimum frontal breadth and the largeness of basi-bregmatic height, their associations with geographic distance may be due to a difference between the ways of subsistence, such as food habits, in the high and low latitudes.

In Figs. 21 and 22, it is found that cranial length and cranial base length are highly associated with chronological age in both males and females. The three male samples with the highest scores of PC III in Fig. 21 are Ekven [Russia; 7 EKVEN in Appendix 3], Proto-Nordics [North Iran; 15 PN-TP] and Murray River Valley [Australia; 11 MURRY], while the three male samples with the lowest scores are Czechs [Bohemia; 110 CZECH], Vietnamese [89 VIETN] and Vorarlberger [Austria; 108 VORAR] (Table 50). In Fig. 22, those with the highest scores of PC IV are Cernica [Romania; 3 CERNC in Appendix 4], Ekven [Russia; 9 EKVEN] and Kivutkalis [Latvia; 71 KIVUT], while those with the lowest scores are Copts [Egypt; 144 COPTS], Armenians [231 ARMEN] and Hradek b. Mikolov [Czech; 220 HRADK] (Table 50). The contrast between these samples is shown in Figs. 27 and 28. The time span in the male Class A samples used here is about 7,000 years, i.e. the period of the Neolithic Age and the succeeding times (Appendices 3 and 4). The association found here between cranial length and chronological age, therefore, does not reflect the whole evolutionary or dispersion process of *Homo sapiens sapiens* after the event of out-of-Africa which conceivably began before 180,000 years ago (Hershkovitz et al., 2018). Even so, however, this is an important finding to understand the background of brachycephalization.

Causes of brachycephalization

As pointed out by Mizoguchi's (1998b, c), cranial length and breadth vary relatively independently of each other in the among-group multivariate space. This is reconfirmed in the present study (Tables 13 and 19). Brachycepahlization or dolichocephalization (Weidenreich, 1945) is a phenomenon associated with time. In Japan, Suzuki (1956) reported the first evidence of brachycephalization. It is well known nowadays that dolichocephalization proceeded from the Kofun period (the 4th to 12th century A.D.) till the Middle Ages (the 12th to 16th c.), and then, reversely, brachycephalization started in the Middle Ages and continued to the present (Suzuki, 1956, 1969; Nakahashi, 1987). According to Mizoguchi (1992), cranial breadth has changed in parallel with cranial index from the Kofun period up to the present, but cranial length has gradually and slightly decreased. (Incidentally, it is said that there is no evidence for a great number of immigrants during the period between the Kofun and modern times.) In a global scale, while cranial breadth does not have any high correlation with chronological age but with temperature (Figs. 17 and 18), cranial length has a considerably high correlation with chronological age (Figs. 21 and 22). From these findings, it is considered that the decrease of cranial length in Japan is also part of such a world tendency. But the reversal from dolichocepahlization to brachycephalization in Japan cannot be explained by the gradual change in cranial length. Even if cranial breadth is strongly correlated with temperature in a global scale, there seems no evidence for a drastic change in temperature during the period between the Kofun and modern times in Japan, as far as the present author knows.

It is well known, on the other hand, that brachycephalization and dolichocephalization have not necessarily proceeded at the same time or at the same pace in various areas of the world (e.g., Ikeda, 1982; Susanne et al., 1988; Kouchi, 1999, 2018). What is the cause for the different patterns of fluctuation in cranial index between geographical regions or between chronological ages?

To elucidate the causes of brachycephalization, Mizoguchi (1992, 1994, 1995b, 1996, 1997, 1998a, d, 1999, 2000a, 2001, 2002, 2003a, b, 2004a, b, 2005, 2007a, b, 2008, 2009, 2013a) carried out a series of PCAs of within-group correlations between cranial and postcranial measurements on the premise that population differences are extensions of individual differences (Howells, 1973), as mentioned above. He found several common factors suggesting that, while cranial breadth has no consistent associations with any postcranial measurements, cranial length is significantly associated with many postcranial measurements, such as vertebral body size, costal chord, pelvic widths, and limb bone lengths and thicknesses; and considered that the variation in cranial length might, in part, be related to the degree of development of skeletal muscles or body size and, besides, that the form of the maternal pelvic inlet might be another important determinant of the neurocranial form. On the way to proceed his study, Mizoguchi (2004b) tentatively hypothesized as follows: There are at least three possible causes for brachycephalization or dolichocephalization, i.e. diachronic changes in the amount of skeletal muscles, body size (substantially the same as the amount of skeletal muscles), and the pelvic form; and, in turn, possible causes for secular changes in body size and/or in the degree of development of skeletal muscles may be diachronic changes in quality and quantity of available nutrition, physical activity, etc. In addition, Mizoguchi (2007b), similarly on the basis of within-group PCAs, stated that neither cranial length nor cranial breadth had any consistent associations with facial measurements across sexes, contrary to our expectations, and that the difference in the way of connecting with other characters between cranial length and breadth might be one of the reasons why brachycephalization and dolichocephalization alternately and irregularly occur in a geographic area.

Later, Mizoguchi (2013a), also performing PCAs of within-group correlations, found positive associations between cranial breadth, the vertical diameter of the femoral head (bearing body weight), nasal height (relating to oxygen intake), and maximum pelvic breadth, and maintained that these findings were compatible with the cold adaptation hypothesis (Coon, 1962) and Ruff's (1991, 1993, 1994, 2002) cylindrical thermoregulatory model, in which the pelvis tended to be wider in colder regions. Miyashita and Takahashi (1971) and Houghton (1996) already pointed out that there were high correlations between body mass and nasal dimensions. In addition, Bastir et al. (2011) showed that males had larger cranial airway passages, both absolutely and relatively, than females and that males tended to have relatively taller piriform apertures, internal nasal cavities and choanae than females, and suggested that the identified sex-specific differences in cranial airways might be linked with sex-specific differences in body size, composition, and energetics. These findings are not inconsistent with those of Mizoguchi (2013a) and of the present study (Figs. 17 and 18).

In summary, it was clarified in the PCAs of among-group correlations between craniofacial measurements and environmental variables that people possessing the broader neurocranium and the higher and wider face tended to live in colder regions of higher latitudes, and, independently of this tendency, that recent people tended to have anteroposteriorly shorter skulls than ancient people during the period of the Neolithic to modern times. Various combinations of these two tendencies seem to have generated the fluctuation of brachycephalization and dolichocephaliztion in each of local regions. If the above Mizoguchi's findings based on within-group analyses can be utilized to explain among-group phenomena, the decrease in cranial length

Table 51. Path coeffcients in a model of causal system of craniofacial measurements (endogenous variables) and environmental variables (exogenous variables).[1)]

Endogenous variables[2)]	Path coefficients from exogenous variables to endogenous variables						Joint effect[9)]	Residual[10)]
	Temp.[3)]	Precip.[4)]	Humid.[5)]	Chr.Age[6)]	Abs(Lat.)[7)]	G.C.Dist.[8)]		
1 Cranial length	0.49	-0.23	-0.03	0.37	0.58	0.39	-0.65	0.74
5 Cranial base length	0.56	-0.19	0.06	0.26	0.66	0.64	-0.98	0.71
9 Minimum frontal breadth	0.22	-0.11	0.55	-0.05	0.22	-0.36	-0.20	0.66
8 Cranial breadth	-0.33	0.05	0.29	-0.13	0.12	-0.25	0.14	0.57
17 Basi-bregmatic height	0.57	0.03	0.06	0.19	0.21	0.54	-0.35	0.65
48 Upper facial height	-0.91	0.02	-0.22	-0.06	-0.15	0.00	-0.38	0.48
45 Bizygomatic breadth	-0.56	0.08	0.09	-0.04	-0.01	0.30	0.13	0.45
52 Orbital height	-0.59	0.11	-0.24	-0.36	-0.19	0.31	-0.20	0.51
54 Nasal breadth	-0.52	0.06	-0.27	-0.16	-0.58	0.17	-0.52	0.79
55 Nasal height	-0.72	-0.04	0.04	-0.11	-0.32	0.08	-0.33	0.69

1)Based on the first variable set of the skull (Table 1) excluding orbital breadth (Martin's No. 51) and six environmental variables. The number of samples (Class A in Table 1) is 117.

2)Variable number according to Martin and Saller (1957).

3)Average temperature (degree Celsius).

4)Average precipitation (mm).

5)Average relative humidity (%).

6)Chronological age (yrs before 2000).

7)Absolute value of latitude (degree).

8)Great circle distance (km) from Kamoya's hominid site (Omo-Kibish I), Ethiopia (Shea, 2008).

9)The change in variance (positive or negative) due to correlated occurrence of the contributions of exogenous variables.

10)Residual variables uncorrelated with each other and with exogenous variables but acting on endogenous variables. The values listed here are coefficients of determination, i.e., squared path coefficients for residual variables.

Table 52. Path coeffcients in a model of causal system of craniofacial measurements (endogenous variables) and environmental variables (exogenous variables).[1)]

Endogenous variables[2)]	Path coefficients from exogenous variables to endogenous variables						Joint effect[9)]	Residual[10)]
	Temp.[3)]	Precip.[4)]	Humid.[5)]	Chr.Age[6)]	Abs(Lat.)[7)]	G.C.Dist.[8)]		
1 Cranial length	0.54	-0.19	0.11	0.43	0.59	0.27	-0.69	0.75
9 Minimum frontal breadth	-0.02	-0.09	0.66	0.00	0.03	-0.42	-0.21	0.59
8 Cranial breadth	-0.45	0.09	0.22	-0.13	0.00	-0.21	0.07	0.62
17 Basi-bregmatic height	0.27	0.03	0.13	0.24	-0.04	0.36	-0.08	0.80
48 Upper facial height	-0.80	-0.07	-0.31	-0.04	-0.18	0.09	-0.45	0.66
45 Bizygomatic breadth	-0.66	0.08	0.03	-0.04	-0.17	0.32	-0.02	0.43
52 Orbital height	-0.49	0.09	-0.33	-0.30	-0.20	0.38	-0.22	0.59
54 Nasal breadth	-0.50	0.13	-0.37	-0.03	-0.48	0.25	-0.45	0.75
55 Nasal height	-0.69	-0.08	-0.01	-0.09	-0.39	0.13	-0.44	0.77

1)Based on the third variable set of the skull (Table 1) and six environmental variables. The number of samples (Class A in Table 1) is 237.

2)Variable number according to Martin and Saller (1957).

3)Average temperature (degree Celsius).

4)Average precipitation (mm).

5)Average relative humidity (%).

6)Chronological age (yrs before 2000).

7)Absolute value of latitude (degree).

8)Great circle distance (km) from Kamoya's hominid site (Omo-Kibish I), Ethiopia (Shea, 2008).

9)The change in variance (positive or negative) due to correlated occurrence of the contributions of exogenous variables.

10)Residual variables uncorrelated with each other and with exogenous variables but acting on endogenous variables. The values listed here are coefficients of determination, i.e., squared path coefficients for residual variables.

may be said to have been caused, in part, by the decrease of the body size or gracilization (Schwidetzky, 1980; Henneberg, 1988) from the Neolithic to the present, which may, in turn, be referred to diachronic changes of sociocultural factors, such as the development of technology, the decrease of physical activity or labor, the improvement of nutrition (Shimada, 1974; Kouchi, 2018), the change of food habits (Mizoguchi, 1993; Noback and Harvati, 2015), the decrease of biomechanical stress on the masticatory apparatus (Ringqvist, 1973; Baab et al., 2010; Mizoguchi, 2012) or the nuchal planum (Mizoguchi, 2008, 2009, 2012; Zafar et al., 2000), etc. It can easily be noticed here that the degree of sociocultural changes varies from region to region and from times to times. Therefore, the change only in cranial length caused by such sociaocultural factors can also explain the fluctuation of brachycephalization and dolichocephalization in some areas. But the same logic cannot be used for the oscillation of cranial index oberved in Japan because the cranial index has changed mainly in parallel with cranial breadth.

For the present, it can be said in general that brachycephalization or dolichocephaliztion is caused by the differential adaptations and/or acclimatizations of cranial length and breadth to our diverse natural and sociocultural environments and by the difference in the way of connecting with other characters between cranial length and breadth.

Unknown factors influencing the craniofacial morphology

Path analysis was performed as a complementary analysis to confirm the existence of unknown factors making a relatively large contribution to each craniofacial measurement. The results are shown in Tables 51 and 52. It was found that cranial length had relatively high positive path coefficients on latitude, temperature, and chronological age; minimum frontal breadth had a relatively high positive coefficient with humidity and a relatively high negative coefficient with great circle distance; cranial breadth had a relatively high negative coefficient with temperature; basi-bregmatic height had relatively high positive coefficients on temperature and great circle distance; upper facial and nasal heights had very high negative coefficients with temperature; bizygomatic breadth and orbital height had relatively high negative coefficients with temperature; and nasal breadth had relatively high negative coefficients with temperature and latitude. Namely, path coefficients from environmental variables to each craniofacial measurement indicate almost the same tendencies as found in the above PCAs. In addition, the path analyses suggest that, for all the craniofacial measurements, there are unknown factors other than the environmental variables dealt with here. For example, the residual variable for nasal breadth has the highest value of 0.79 of those for the craniofacial measurements (Table 51). In the PCA based on the same data set (Tables 11), the total variance of nasal breadth explained by the five PCs or common factors is only 49.86%, the lowest value of those for the variables under consideration. This means that there are some other unknown factors which are not negligible to explain the variation of nasal breadth.

The existence of such unknown factors are suggested also for the other craniofacial measurements. Needless to say, we must collect more data of various environmental factors, natural and artificial (cultural, social, etc.) and ancient and modern, to clarify the causal chain for the formation of our morphology.

Summary and Conclusions

To confirm the limits and regularity of among-group variations in the craniofacial morphology of *Homo sapiens sapiens*, and, if possible, to determine some of the causes for the regularity, data of craniofacial measurements and environmental variables were collected for many *Homo s. s.* populations of the Neolithic to modern times in various regions of the world (687 male and 340 female samples).

The minimum and maximum values in the among-group variation of each craniofacial measurement were simply explored using the data collected. In a within-group multivariate space, it was found that the PC scores for the mean vectors of craniofacial measurements in almost all the samples were located within the ±2 SD ranges of the within-group PC scores based on a single sample. This finding suggests some complicated system or factors controlling the coordination between substructures of the skull (or the body).

The PCAs of among-group correlations between craniofacial measurements clearly indicate the existence of significant common factors, namely, the robust evidence for regularity in the inter-population variations of craniofacial morphology. This means that our craniofacial morphology has not been formed only by chance but, in part, determined by some inevitable controlling factors in the human evolutionary processes.

In the PCAs of among-group correlations between craniofacial measurements and environmental variables, it was found that cranial breadth, upper facial height, bizygomatic breadth, and nasal height tended to be larger in colder regions of higher latitudes; that basi-bregmatic height and nasal breadth tended to be larger and, inversely, minimum frontal breadth tended to be smaller in the regions more distant from Ethiopia and of lower latitudes where average precipitation was higher and average temperature was also relatively high; and that cranial length and cranial base length tended to be larger in ancient times (for the past 7,000 years). In the present study, these findings were interpreted as the results of evolutionary adaptation to our natural and sociocultural environments.

As regards brachycephalization or dolichocephaliztion, it was considered a phenomenon caused by the differential adaptations and/or acclimatizations to our diverse natural and sociocultural environments and by the difference in the way of connecting with other characters between cranial length and breadth.

Path analyses indicated the existence of unknown factors making a relatively large contribution to each craniofacial measurement. This is not inconsistent with the results of among-group PCAs.

In conclusion, the purposes of the present study were partly achieved. The limits and regularity of among-group variations in craniofacial measurements were confirmed; temperature was reconfirmed in a global scale to be a very important cause for our adaptaion to environment; and precipitation and humidity were also suggested to be important causes. But we must still collect more data of various environmental factors, natural and artificial (cultural, social, etc.) and ancient and modern, to clarify the causality for the formation process of our morphology.

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Appendices

Appendix 1. *Homo sapiens sapiens* male samples of the Neolithic to modern times from all over the world.[1)]

	Original sample	Label of the sample	Label of the pooled sample containing the relevant sample	Site (reference)
1	Ohmagari-1	OHMG1	JOM1EJM	Ohmagari-1 cave site, Abashiri, Hokkaido (Ishida et al., 1986)
2	Meotoiwa	MEOTO	JOM1EJM	Meotoiwa Rock Shelter, Saitama (Yamaguchi, 1992)
3	Myoonji Cave 1	MYON1	JOM1EJM	Myoonji Cave 1, Saitama (Baba et al., 1999)
4	Toda (Sakura)	TOD S	JOM1EJM	Toda, Saitama (Sakura, 2008)
5	Tochibara	TOCHB	JOM1EJM	Tochibara rock-shelter, Nagano (Kohara et al., 2011)
6	Odake	ODAKE	JOM1WJM	Odake, Toyama (Sakaue et al., 2014)
7	Mawaki	MAWKI	JOM1WJM	Mawaki, Ishikawa (Yamaguchi, 1986)
8	Mibiki 26	MIB26	JOM1WJM	Mibiki 26, Ishikawa (Yamaguchi, 2004)
9	Isoyamajo	ISYMJ	JOM1WJM	Isoyamajo, Shiga (Ikeda and Kitagawa, 1986)
10	Hashima	HASHM	JOM1WJM	Hashima, Okayama (Hasebe, 1941a)
11	Hikozaki	HIKZK	JOM1WJM	Hikozaki, Okayama (Suzuki, 1981)
12	Kamikuroiwa	KAMKR	JOM1WJM	Kamikuroiwa rock shelter site, Ehime (Nakahashi and Okazaki, 2009)
13	Hegi	HEGI	JOM1WJM	Hegi Cave, Oita (Naito, 1977)
14	Todoroki	TODRK	JOM1WJM	Todoroki, Kumamoto (Kaifu et al., 1998)
15	Iwashita	IWASH	JOM1WJM	Iwashita Cave, Nagasaki (Kaifu et al., 2017a)
16	Shimomotoyama 4	SHMM4	JOM1WJM	Shimomotoyama 4, Nagasaki (Kaifu et al., 2017b)
17	Funadomari	FNDMR	JOM2HKDM	Funadomari, Rebun Island, Hokkaido (Matsumura et al., 2001)
18	Tomoharu	TOMHR	JOM2HKDM	Tomoharu site, eastern Hokkaido (Hiramoto et al., 1982)
19	Takasago (Hanihara)	TKS H	JOM2HKDM	Takasago, Abuta, Hokkaido (Hanihara et al., 1998)
20	Takasago (Ishida)	TKS I	JOM2HKDM	Takasago, Abuta, Hokkaido (Ishida et al., 1987)
21	Kaitori No. 3	KAIT3	JOM2THKM	Kaitori No. 3, Iwate (Ogata and Morisawa, 1971)
22	Ebishima	EBSHM	JOM2THKM	Ebishima, Iwate (Mizoguchi and Dodo, 2001; Yamaguchi, 1983)
23	Miyano	MIYAN	JOM2THKM	Miyano, Iwate (Hayashi et al., 1981)
24	Tagara	TAGAR	JOM2THKM	Tagara, Miyagi (Dodo and Suzuki, 1986)
25	Aoshima	AOSHM	JOM2THKM	Aoshima, Miyagi (Ikeda and Shigehara, 1975)
26	Aoshima No. 1	AOSH1	JOM2THKM	Aoshima No. 1, Miyagi (Dodo, 1981)
27	Kawakudari-Hibiki	KAWKD	JOM2THKM	Kawakudari-Hibiki, Miyagi (Ikeda and Shigehara, 1975)
28	Satohama	SATHM	JOM2THKM	Satohama, Miyagi (Dodo, 1981)
29	Satohama 98-1	ST981	JOM2THKM	Satohama 98-1, Miyagi (Nara et al., 2000)
30	Sanganji	SNGNJ	JOM2THKM	Sanganji, Fukushima (Hanihara and Uchida, 1988; Baba, 1988)
31	Minamitsubo	MINMT	JOM2KNTM	Minamitsubo shell-mound, Ibaraki (Baba et al., 1989)
32	Nakatsuma	NAKTS	JOM2KNTM	Nakatsuma, Ibaraki (Matsumura et al., 1996)
33	Wakaumi 1	WKUM1	JOM2KNTM	Wakaumi 1, Ibaraki (Kajigayama and Baba, 1999)
34	Horinouchi	HRNCH	JOM2KNTM	Horinouchi, Chiba (Suzuki et al., 1957)
35	Honda-Takada	HONDT	JOM2KNTM	Honda-Takada shellmound, Chiba (Ikeda, 1957)
36	Takanekido	TKNKD	JOM2KNTM	Takanekido, Chiba (Ogata et al., 1971)
37	Ubayama	UBAYM	JOM2KNTM	Ubayama, Chiba (Kondo, 1993)
38	Kasori (Suzuki)	KSR S	JOM2KNTM	Kasori, Chiba (Suzuki et al., 1976)
39	Kosaku	KOSAK	JOM2KNTM	Kosaku, Chiba (Koizumi et al., 1985)
40	Kusakari	KSKAR	JOM2KNTM	Kusakari, Chiba (Hiramoto and Mizoguchi, 1986)
41	Kitamura	KITMR	JOM2CHBM	Kitamura (excluding No. 508), Nagano (Shigehara, 1993)
42	Shimekake	SHMKK	JOM2CHBM	Shimekake, Nagano (Tanaka, 2003)
43	Do-no-Kaizuka	DONOK	JOM2CHBM	Do-no-Kaizuka, Sado, Niigata (Ogata and Morisawa, 1977)
44	Shijimizuka	SHJMZ	JOM2TKAM	Shijimizuka, Shizuoka (Hirai, 1928)
45	Yoshiko	YOSHK	JOM2TKAM	Yoshiko, Aichi (Kintaka, 1928; Ohba, 1935; Ishisawa, 1931)
46	Ikawazu	IKAWZ	JOM2TKAM	Ikawazu, Aichi (Suzuki et al., 1972; Ehara et al., 1988)
47	Hazawa	HAZAW	JOM2TKAM	Hazawa, Gifu (Ikeda and Tagaya, 2000)
48	Tsukumo	TSUKM	JOM2SNYM	Tsukumo, Okayama (Kiyono and Miyamoto, 1926; Kiyono and Hirai, 1928a, b)
49	Tsubue No. 3	TSUB3	JOM2SNYM	Tsubue No. 3, Okayama (Hasebe, 1941b)
50	Taishaku-Yosekura	TAISH	JOM2SNYM	Taishaku-Yosekura, Hiroshima (Suzuki and Fukushima, 1976)
51	Toyomatsu-Domen	TOYMT	JOM2SNYM	Toyomatsu-Domen Cave, Hiroshima (Kyushu D.I.K.2K., 1988)
52	Yamaga	YAMAG	JOM2KYSM	Yamaga shell-mound, Fukuoka (Kyushu D.I.K.2K., 1988)
53	Fukuoka	FUKOK	JOM2KYSM	Einomaru, Kojo, and Kitsuki shell-mounds, Fukuoka (Kyushu D.I.K.2K., 1988)
54	Hegi (Late Jomon)	HEGIL	JOM2KYSM	Hegi Cave, Oita (Naito, 1977)
55	Kakiwara	KAKWR	JOM2KYSM	Kakiwara, Kumamoto (Matsuo et al., 1967)
56	Ataka	ATAKA	JOM2KYSM	Ataka, Kumamoto (Omori, 1960)
57	Goryo	GORYO	JOM2KYSM	Goryo shell-mound, Kumamoto (Kyushu D.I.K.2K., 1988)
58	Shiitachi	GSHKW	JOM2OKIM	Shiitachi-Nishiku, Gushikawajima, Okinawa (Matsushita et al., 1992)
59	Shiitachi 106	GS106	JOM2OKIM	Shiitachi-Nishiku 106, Gushikawajima, Okinawa (Doi, 2012)
60	Upper Lena River	ULENA		Upper Lena River, Siberia (Hrdlička, 1942)
61	Angara River	ANGRA		Angara River, Siberia (Hrdlička, 1944)
62	Baikal (Ishida)	BAI I		Baikal, Russia (Ishida, 1997; Kudaka et al., 2013)
63	Yongdengxian	YONGD		Yongdengxian, Gansu, China (Black [1928] cited in Wu and Zhang, 1985)
64	Yangshan	YANGS		Yangshan, Qinghai, China (Han, 1990)
65	Baoji	BAOJI	NEOSHNXM	Baoji, Shaanxi, China (Yen et al., 1960)
66	Banpo	BANPO	NEOSHNXM	Banpo, Shaanxi, China (Yen et al., 1960)
67	Huaxian	HUAXI	NEOSHNXM	Huaxian, Shaanxi, China (Yen [1962] in Han and Pan, 1979)
68	Hengzhen	HENGZ	NEOSHNXM	Hengzhen, Shaanxi, China (Institute of Archaeology [1977] in Wu and Zhang, 1985)
69	Shigu	SHIGU	NEOHENNM	Shigu, Henan, China (Chen and Wu, 1985)
70	Miaodigou	MIAOD	NEOHENNM	Miaodigou, Henan, China (Han and Pan, 1979)
71	Xiawanggang	XIAWN	NEOHENNM	Xiawanggang, Henan, China (Zhang and Chen [n.d.] in Wu and Zhang, 1985)
72	Dawenkou	DAWNK	NEOSHNDM	Dawenkou, Shandong, China (Yen [1972] in Han and Pan, 1979)
73	Hsi-hsia-hou	HSI-H	NEOSHNDM	Hsi-hsia-hou, Shandong, China (Yen, 1973)
74	Fangxian	FANGX		Fangxian, Hubei, China (Zhang et al. [1982] in Wu and Zhang, 1985)
75	Longqiuzhuang	LONGQ		Longqiuzhuang, Jiangsu, China (Han, 1999)
76	Gaomiao M-02	GAOM2		Gaomiao M-02, Hunan, China (Matsumura et al., 2017)
77	Tanshishan	TANSH		Tanshishan, Fujian, China (Han et al., 1976)
78	Zhenpiyan	ZHENP		Zhenpiyan, Guangxi, China (Zhang et al., 1977)
79	Hedang	HEDNG		Hedang, Guangdong, China (Han and Pan, 1982)
80	Unggi III	UNG-3	NEONKREM	Unggi III, North Korea (Imamura, 1932)
81	Unggi E	UNG-E	NEONKREM	Unggi E, North Korea (Imamura, 1932)
82	Bongeui 3A	BON3A	NEONKREM	Bongeui 3A, North Korea (Suzuki, 1944)
83	Ban Kao	BANKA		Ban Kao, Thailand (Sangvichien et al., 1969)
84	Wadjak 1 (Jacob)	WJ1 J		Wadjak 1, Java, Indonesia (Jacob [1967] in Van Heekeren, 1972, and in Storm, 1995)
85	Lake Nitchie	L NTC		Lake Nitchie, New South Wales, Australia (Brown, 1989)
86	Oleniy Island	OLENI		Oleniy Island, Russia (Denisova [1975] in Česnys, 1991)
87	Zvejnieki	ZVEJN		Zvejnieki, Latvia (Denisova [1975] in Česnys, 1991, and in Schwidetzky und Rösing, 1989)
88	British	BRITS		British, England (Morant [1926] in Morant, 1928)
89	Tyrolean Ice Man	ICEMN		Tyrolean Ice Man, Oetztal (Seidler et al., 1992; Szilvássy and Stellwag-Carion, 1994)
90	Lepenski Vir	LEPNS	NEOSRBM	Lepenski Vir (Group I), Serbia (Zoffmann, 1983)
91	Vlasac	VLASC	NEOSRBM	Vlasac, Serbia (Zoffmann, 1983)
92	Cernica	CERNC		Cernica, Romania (Necrasov [1986] in Schwidetzky und Rösing, 1989)
93	El Collado No. 12	ELC12		El Collado No. 12, Valencia, Spain (Pérez-Pérez et al., 1995)
94	Valencia	VALEN		Valencia, Spain (Fusté [1957] in Chamla, 1976)
95	Anatolia	ANATL		Anatolia, Turkey (Fusté [1957] in Chamla, 1976)
96	Kish	KISH		Kish, Iran (Fusté [1957] in Chamla, 1976)
97	Afalou-bou-Rhummel	AFALO		Afalou-bou-Rhummel, Algeria (Vallois [1952] in Schwidetzky und Rösing, 1989)
98	S. Egyptians	S-EGY		S. Egyptians, Badari, Upper Egypt (Stoessiger, Derry, Morant [1925-35] in Angel, 1944)
99	Naqada	NAQAD		Naqada, Egypt (Fawcett in Pearson and Davin, 1924)
100	Browns Valley Man	BROWN		Browns Valley Man, Minnesota, U.S.A. (Jenks [1937] in Bass, 1976)
101	Medicine Crow	MEDCR		Medicine Crow, South Dakota, U.S.A. (Bass, 1976)
102	Onkoromanai	ONKRM	EPJHKKDM	Onkoromanai, Wakkanai, Hokkaido (Yamaguchi, 1963b)
103	Bozuyama VI-2	BOZYM	EPJHKKDM	Bozuyama VI-2, Ebetsu, Hokkaido (Yamaguchi, 1963a)
104	Kobore Cave	KOBOR	EPJHKKDM	Kobore Cave, southwestern Hokkaido (Takigawa et al., 2011)
105	Usu (Zoku-Jomon)	USU-Z	EPJHKKDM	Usu (Zoku-Jomon), southwestern Hokkaido (Kanda, 1978)
106	Etomo	ETOMO	EPJHKKDM	Etomo, Muroran, Hokkaido (Oba et al., 1978)
107	Minami-Usu 7	M-US7	EPJHKKDM	Minami-Usu 7, Date, Hokkaido (Mitsuhashi et al., 1984)
108	Ourayama	OURAY		Ourayama 4, Kanagawa (Suzuki, 1997)
109	Nagasawa	NAGSW	YAYOITKM	Nagasawa, Shizuoka (Sakura and Yamaguchi, 1981)
110	Hokaiji	HOKAI	YAYOITKM	Hokaiji, Aichi (Ikeda, 1993a)
111	Aoyakamijichi	AOYKM	YAYOSNNM	Aoyakamijichi, Tottori (Inoue and Matsumoto, 2002)
112	Koura	KOURA	YAYOSNNM	Koura, Shimane (Kyushu D.I.K.2K., 1988)
113	Doigahama	DOIGH	YAYOYMGM	Doigahama, Yamaguchi (Kyushu D.I.K.2K., 1988)
114	Nakanohama	NAKNH	YAYOYMGM	Nakanohama, Yamaguchi (Kyushu D.I.K.2K., 1988)
115	Yoshimohama	YOSHM	YAYOYMGM	Yoshimohama, Yamaguchi (Nakahashi and Nagai, 1985)
116	Kanenokuma	KNNKM	YAYOFUKM	Kanenokuma, Fukuoka (Nakahashi et al., 1985)
117	Maedayama	MAEDA	YAYOFUKM	Maedayama 1, Fukuoka (Doi et al., 1987)
118	Shinmachi	SHNMC	YAYOFUKM	Shinmachi, Fukuoka (Kyushu D.I.K.2K., 1988; Nakahashi and Nagai, 1987a)
119	Arita	ARITA	YAYOFUKM	Arita, Fukuoka (Nakahashi, 1991a)
120	Hara	HARA	YAYOFUKM	Hara, Fukuoka (Kyushu D.I.K.2K., 1988)
121	Kamitsukiguma	KMTSK	YAYOFUKM	Kamitsukiguma, Fukuoka (Nakahashi, 1991b)
122	Ichinotani	ICHNT	YAYOFUKM	Ichinotani, Fukuoka (Kyushu D.I.K.2K., 1988)
123	Yoshigaura	YSHGA	YAYOFUKM	Yoshigaura, Fukuoka (Kyushu D.I.K.2K., 1988)
124	Nagaoka	NAGAO	YAYOFUKM	Nagaoka, Fukuoka (Nakahashi, 1990)
125	Hasakonomiya	HASKN	YAYOFUKM	Hasakonomiya, Fukuoka (Kyushu D.I.K.2K., 1988)
126	Kuriyama K-8	KRYM8	YAYOFUKM	Kuriyama K-8, Fukuoka (Nakahashi, 1994a)
127	Oba-Kubo No. 1	OBA-1	YAYOFUKM	Oba-Kubo No. 1, Fukuoka (Nakahashi, 1995b)
128	Kocho Jinja	KOCHO	YAYOFUKM	Kocho-Jinja, Fukuoka (Nakahashi, 1995a)
129	Tsukasakihigashihata	TSKSK	YAYOFUKM	Tsukasakihigashihata, Fukuoka (Nakahashi, 1997)
130	Fukuoka	FKOKA	YAYOFUKM	Aoki, Akinari, Dojoyama, Dogasaka, and Hakugensha sites, Fukuoka (Kyushu D.I.K.2K., 1988)
131	Fukuoka, Part 2	FKOK2	YAYOFUKM	Harada, Hayamadai, Hikata, and Fujisaki sites, Fukuoka (Kyushu D.I.K.2K., 1988)
132	Fukuoka, Part 3	FKOK3	YAYOFUKM	Kamenoko, Kasuga, and Kasuga-Noborimachi sites, Fukuoka (Kyushu D.I.K.2K., 1988)
133	Fukuoka, Part 4	FKOK4	YAYOFUKM	Kuma No. 5, Kuriyama, Matsuyama, Misawa, Miyanoshiro, Monden, Morooka, Mukaidani-Minami, Kitauchihara, and Kubodori sites, Fukuoka (Kyushu D.I.K.2K., 1988)
134	Fukuoka, Part 5	FKOK5	YAYOFUKM	Nishihiratsuka, Nishijin-cho, Noboritate, Okuma, Onobaru, Shimomio, Shobaru, and Sudare sites, Fukuoka (Kyushu D.I.K.2K., 1988)
135	Fukuoka, Part 6	FKOK6	YAYOFUKM	Taromaru, Tateiwa, Tsuko, Wakabadai, Yamamura, and Yokogumayama sites, Fukuoka (Kyushu D.I.K.2K., 1988)
136	Mitsu	MITSU	YAYOSAGM	Mitsu, Saga (Ushijima, 1954; Kyushu D.I.K.2K., 1988)
137	Otomo (1st-to-4th exc.)	OTM14	YAYOSAGM	Otomo (the 1st-to-4th excavations), Saga (Matsushita in Nakahashi, 2003; Matsushita [1981] in Nakahashi, 1990)
138	Otomo (5th & 6th exc.)	OTM56	YAYOSAGM	Otomo (the 5th and 6th excavations), Saga (Nakahashi, 2003)
139	Saga, Part 1	SAGA1	YAYOSAGM	Agechi, Asahi, Kamimine, Kiridoshi, Kiyama, and Matsuba sites, Saga (Kyushu D.I.K.2K., 1988)
140	Saga, Part 2	SAGA2	YAYOSAGM	Nakatsukuma and Obuchi sites, Saga (Kyushu D.I.K.2K., 1988)
141	Nejiko-men	NEJKM	YAYONAGM	Nejiko-men, Hirado Island, Nagasaki (Kanaseki et al., 1954)
142	Nagasaki	NAGSK	YAYONAGM	Fukabori, Hamago, and Matsubara sites, Nagasaki (Naito, 1971)
143	Tanowaki	TANWK	YAYOTANM	Tanowaki, Tanegashima, Kagoshima (Takenaka, 2009)
144	Torinomine	TORNM	YAYOTANM	Torinomine, Tanegashima, Kagoshima (Kyushu D.I.K.2K., 1988)
145	Hirota 1	HIRT1	YAYOTANM	Hirota, Tanegashima, Kagoshima (Kyushu D.I.K.2K., 1988)
146	Hirota 2	HIRT2	YAYOTANM	Kita-ku No.1 and Minami-ku No. 2, Hirota, Tanegashima, Kagoshima (Takenaka, 2007)
147	Ekven	EKVEN		Ekven, Russia (Ishida, 1997; Kudaka et al., 2013)
148	Pianobor	PIANO		Pianobor-Kultur, Russia (Akimova [1968] in Schwidetzky und Rösing, 1975)
149	Tastyk	TASTY		Tastyk-Kultur, Russia (Alekseev [1961] and Zalkind [1959] in Schwidetzky und Rösing, 1975)
150	Tagar	TAGAR		Tagar, southern Siberia (Ishida, 1997)
151	Zolotaja Balka	ZOLTJ		Zolotaja Balka, Ukraine (Konduktorova [1968] in Schwidetzky, 1972)
152	Sarmatians	SARMT		Sarmatians, Ukraine (Firstejn [1966], Ginzburg [1959] and Kondukterova [1968] in Schwidetzky und Rösing, 1975)
153	Phanogoria	PHANG		Phanogoria, Russia (Gerasimova [1971] in Schwidetzky und Rösing, 1975)
154	Neopol Skifskij	NPLSK		Neopol Skifskij, Crimea (Konduktorova [1964] in Schwidetzky, 1972)
155	Tianshan Alagou	TIANS		Tianshan Alagou, Xinjiang, China (Han, 1991)
156	Wusun	WUSUN		Wusun, Xinjiang, China (Han and Pan, 1987)
157	Wubao	WUBAO		Wubao (Caucasoid group), Xinjiang, China (He and Xu, 2002)
158	Hunnen	HUNNN		Hunnen, Kyrgyzstan (Ginzburg [1954] in Schwidetzky und Rösing, 1975)
159	Usunen	USUNN		Usunen, Kyrgyzstan (Ginzburg [1950] and Miklasevskaja [1964] in Schwidetzky und Rösing, 1975)
160	Chawuhu	CHAWH		Chawuhu No. 4 cemetery, Xinjiang Uygur, China (Han et al., 1999)
161	Gumu Gou	GUMUG		Gumu Gou, Xinjiang, China (Han, 1986)
162	South Tajikistan	S-TAJ		South Tajikistan (Kijatkina [1961] in Schwidetzky und Rösing, 1975)
163	Wayaogou	WAYAO		Wayaogou, Shaanxi, China (Chen, 2000)
164	Shanpula	SHANP		Shanpula, Xinjiang, China (Shao et al., 1988)
165	An-yang	ANYNG		Da-si-kong, An-yang, Honan, China (Han and Pan, 1985)
166	Man Bac	MANBC		Man Bac, northern Vietnam (Matsumura, 2011; Matsumura et al., 2011)
167	Ban Chiang (P. & D.)	BNC P		Ban Chiang, Northeast Thailand (Pietrusewsky and Douglas, 2002)
168	Murray River Valley	MURRY		Murray River Valley, Australia (Brown, 2001)
169	Swedish	SWEDS		Swedish (Retzius [1900] and Fürst [1912] in Morant, 1928)
170	Kivutkalns	KIVUT		Kivutkalns cemetery, Latvia (Denisova [1975] in Česnys, 1991)
171	English	ENGLS		English, Midlands and north of England (Morant [1926] in Morant, 1928)
172	British	BRITS		British, south of England (Morant [1926] in Morant, 1928)
173	Altendorf	ALTEN		Altendorf, Steinkiste, Germany (Perret [1938] in Schwidetzky und Rösing, 1989)
174	West Germany	W-GER		West Germany (Ehrhardt in Riquet et Brenot, 1976)
175	La Baye	LABAY		La Baye, Grottes Marne, France (Riquet [1973] in Schwidetzky und Rösing, 1989)
176	Gauls	GAULS		Gauls, Marne-Region, France (Coon [1948] in Schwidetzky, 1972)
177	Gauls 2	GAUL2		Gauls, Paris Basin, France (Riquet et al. in Riquet et Brenot, 1976)
178	Paris	PARIS		Paris, France (Auboire, 1982)
179	Dereivka	DEREI		Dereivka, Ukraine (Zinevič [1967] in Schwidetzky und Rösing, 1989)
180	Vovnigi	VOVNG		Vovnigi I, II, Ukraine (Konduktorova [1960] and Gochman [1966] in Schwidetzky und Rösing, 1989)
181	Gauls 3	GAUL3		Gauls, Romandy, Switzerland (Voss in Riquet et Brenot, 1976)
182	Gauls 4	GAUL4		Gauls, South-west German-speaking parts, northern Switzerland (Huez in Riquet et Brenot, 1976)
183	Dolmens de la Lozère	DOLMN		Dolmens de la Lozère, France (Pée-Laborde [1962] in Chamla, 1976)
184	Russe	RUSSE		Russe, Bulgaria (Boev [1973] in Schwidetzky und Rösing, 1989)
185	Kalaly-Gyr	KALAL		Kalaly-Gyr, Uzbekistan (Trofimova [1959] in Schwidetzky und Rösing, 1975)
186	Poladiens (Nice)	POL-N		Poladiens, Nice, France (Riquet [1970] in Chamla, 1976)
187	Poladiens (Catalonia)	POL-C		Poladiens, Catalonia (Riquet [1970] in Chamla, 1976)
188	Bas-Languedoc	BAS-L		Bas-Languedoc, France (Riquet [1970] in Chamla, 1976)
189	Narbonnais-Roussillon	NARBO		Narbonnais-Roussillon, France (Riquet [1970] in Chamla, 1976)
190	Etruscans	ETRUS		Etruscans (Angelotti [1909], Cantuzène [1909], Cipriani [1927], Davide [1959], Frassetto [1906], Giovannozzi [1903], Messeri [1953, 1954, 1963], Morant [1928], Pfannenstiel [1955], Schlaginhaufen [1953] and Sergi [1933/1934] in Schwidetzky, 1972)
191	Etruscans 2	ETRU2		Etruscans, Orvieto, Italy (Sergi [1933] and Cantacuzène [1909] in Chamla, 1976)
192	Etr-Romans	ETR-R		Etr-Romans, Tarquinia, Italy (Schmidt, Morant [1925-1935] in Angel, 1944)
193	Pompeians	POMPE		Pompeians, Italy (Nicolucci [1882] in Morant, 1928; Niccolucci [1882] and Schmidt [1884] in Schwidetzky und Rösing, 1975)
194	Tarragona	TARRG		Tarragona, Spain (Pons [1949] in Chamla, 1976)
195	Spanish	SPANI		Spanish from Argar, Gerundia and Puerto-Blanco (Siret and Siret [1887] in Morant, 1928)
196	Sardinia	SARDN		Sardinia, Italy (Maxia et al. [1951, 1963, 1964] in Chamla, 1976)
197	Nuoro & Cagliari	NUORO		Nuoro and Cagliari, Sardinia, Italy (Maxia [1951-1952] in Chamla, 1976)
198	Son Real	SON-R		Son Real, Majorca, Spain (Font, Serra [1975] in Chamla, 1976)
199	S'Illot des Porros	SILLO		S'Illot des Porros, Majorca, Spain (Malgosa, 1988)
200	Majorca	MAJOR		Majorca, Spain (Garralda [1973] in Chamla, 1976)
201	Minorca	MINOR		Minorca, Spain (Fusté [1950] in Chamla, 1976)
202	Greeks 1	GREE1	GREE1T4	Greeks [Neolithic and Early Helladic] (Angel, 1944)
203	Greeks 2	GREE2	GREE1T4	Greeks [Middle Helladic to Late Helladic II] (Angel, 1944)
204	Greeks 4	GREE4	GREE1T4	Greeks [Neolithic to Mycenaean] (Angel, 1946)
205	Greeks 5	GREE5	GREE5T6	Greeks, mainland Greece [Early Iron Age] (Angel, 1943, 1944)
206	Greeks 6	GREE6	GREE5T6	Greeks [Early Iron Age] (Angel, 1946)
207	Greeks 9	GREE9		Greece II [Classic] (Angel [1945, 1951] in Schwidetzky, 1972)
208	Greeks 10	GRE10		Greece III [Hellenistic to Roman] (Angel [1945, 1951] and Fürst [1930] in Schwidetzky, 1972)
209	Isthmian	ISTHM		Greeks, Isthmian region, mainland Greece [Mycenaean or Late Helladic III] (Angel, 1943, 1944)
210	Cephallenians	CEPHA		Cephallenians, Greece (Angel, 1943, 1944)
211	N.W. Siculans	SICUL		N.W. Siculans, Isnello, Italy (Giuffrida-Ruggeri [1901/1905] in Angel, 1944)
212	Ikiztepe	IKIZT		Ikiztepe, Turkey (Wittwer-Backofen in Schwidetzky und Rösing, 1989)
213	Shar-i-Sokhtra	SHARI		Shar-i-Sokhtra, Afghanistan (Pardini [1977] in Schwidetzky und Rösing, 1989)
214	Tepe Hissar (Medit.)	MD-TP		Mediterranean cranial type, Tepe Hissar, Iran (Krogman, 1940)
215	Tepe Hissar (Proto-N.)	PN-TP		Proto-Nordics, Tepe Hissar, North Iran (Krogman [1933-1940] in Angel, 1944; Krogman, 1940)
216	Tepe Hissar III	TP-HS		Tepe Hissar III, Iran (Krogman [1940] cited in Kurth [1973], further cited in Schwidetzky und Rösing, 1989)
217	Timargarha	TIMAR		Timargarha, Dir-State, Pakistan (Bernhard, 1968)
218	Butkara II	BUTKR		Butkara II, Swat-State, Pakistan (Alciati [1967] in Bernhard, 1968)
219	Cypriotes	CYPRI		Cypriotes, N.E. Cyprus (Fürst [1930-1933] and Buxton [1920-1924] in Angel, 1944)
220	Minoans	MINOA		Minoans, E. Crete, Greece (Duckworth [1913] and von Luschan [1913] in Angel, 1944)
221	Baghouz & Doura Europos	BAGHZ		Baghouz and Doura Europos, eastern Syria (Chamla, 1976)
222	Harappans	HARAP		Harappans (Square R37 + Area G), Pakistan (Dutta, 1972)
223	Lachish	LACHI		Lachish, southern Palestine (Risdon [1939] in Chamla, 1976)
224	En Gedi caves 1	EN-G1		En Gedi caves, Israel [Hellenistic period] (Arensburg et al., 1980)
225	En Gedi caves 2	EN-G2		En Gedi caves, Israel [Roman period] (Arensburg et al., 1980)
226	Gizeh	GIZEH		Gizeh, Egypt (Pearson and Davin, 1924)
227	Sakkara 3	SAKKA		Sakkara 3, Egypt (Broca in Chantre [1904], further in Schwidetzky und Rösing, 1989)
228	Heluan	HELUA		Heluan, Egypt (Wiercinski [1965] in Schwidetzky und Rösing, 1989)
229	Oase Siwah	SIWAH		Oase Siwah (Derry [1927] and Wiercinski [1959] in Schwidetzky und Rösing, 1975)
230	N. Egyptians	N-EGY		N. Egyptians, Sedment, Lower Egypt (Woo [1930] in Angel, 1944; Woo [1930-1931] in Schwidetzky und Rösing, 1989)
231	Naga ed-Der 2	NAG-E		Naga ed-Der 2, Egypt (Strouhal and Jungwirth [1984] in Schwidetzky und Rösing, 1989)
232	Denderah	DENDR		Denderah (26. Dyn.--Ptol.), Upper Egypt (Chantre et al. in Morant [1925], further in Schwidetzky, 1972)
233	Denderah 3	DEND3		Denderah (Roman), Upper Egypt (Thomson and Randall-MacIver [1905] in Chamla, 1976)
234	Thebes	THEBS		Thebes, Egypt (Schmidt in Pearson and Davin, 1924)
235	Abydos	ABYDS		Abydos, Upper Egypt (Thomson and Randall-MacIver [1905] in Chamla, 1976)
236	Abydos I	ABY-I		Abydos I, Egypt (Morant [1925] in Schwidetzky und Rösing, 1989)
237	El Khozan	EL-KH		El Khozan, Egypt (Chantre [1904] in Schwidetzky und Rösing, 1989)
238	Kawamil	KAWML		Kawamil, Egypt (Fouquet [1897] in Schwidetzky und Rösing, 1989)
239	Sebua	SEBUA		Sebua, Lower Nubia [Egypt] (Batrawi [1945] in Chamla, 1976)
240	Theben 1	THEBN		Theben 1, Egypt (Batrawi and Morant [1947] in Schwidetzky und Rösing, 1989)
241	Qubbet el Hawa	QUBBT		Qubbet el Hawa, Egypt (Rösing [1990] in Schwidetzky und Rösing, 1989[1990])
242	El-Kubanieh Nord	EL-KN		El-Kubanieh Nord, Egypt (Toldt [1919] in Schwidetzky und Rösing, 1989)
243	El-Kubanieh Süd	EL-KS		El-Kubanieh Süd, Egypt (Toldt [1919] in Schwidetzky und Rösing, 1989)
244	Elephantine	ELEPH		Elephantine, Egypt (Rösing [1990] in Schwidetzky und Rösing, 1989[1990])
245	Lower Nubia (Group A)	LNU-A		Lower Nubia, Egypt [Group A] (Batrawi [1945] in Billy, 1986, and in De Villiers, 1968)
246	Lower Nubia (Group D)	LNU-D		Lower Nubia, Egypt [Group D] (Batrawi [1945] in Billy, 1986, and in De Villiers, 1968)
247	Lower Nubia (Meroitic)	L NUB		Lower Nubia, Egypt [Meroitic] (Batrawi [1945] in Schwidetzky und Rösing, 1975, in Billy, 1986, and in De Villiers, 1968)
248	Upper Nubia (Meroitic)	U NUB		Upper Nubia, Sudan [Meroitic] (Nielsen [1970] in Schwidetzky und Rösing, 1975)
249	Wadi-Halfa (Group C)	WAD-C		Wadi-Halfa, Sudan [Group C] (Nielsen [1970] in Billy, 1986)
250	Wadi-Halfa (Group D)	WAD-D		Wadi-Halfa, Sudan [Group D] (Nielsen [1970] in Billy, 1986)
251	Wadi-Halfa (Meroitic)	WAD-M		Wadi-Halfa, Sudan [Meroitic] (Nielsen [1970] in Billy, 1986)
252	Mirgissa	MIRGS		Mirgissa, Sudan (Billy [1976] in Billy, 1986)
253	Aksha	AKSHA		Aksha, Sudan (Chamla [1970] in Schwidetzky und Rösing, 1975; Chamla [1967] in Billy, 1986)
254	Djebel Moya	DJ-MO		Djebel Moya, Upper Nubia [Sudan] (Mukherjee et al. [1955] in Chamla, 1976)
255	Abri-Missiminia 1	AB-M1		Abri-Missiminia, Sudan [Pre-Meroitic] (Billy [1985] in Billy, 1986)
256	Abri-Missiminia 2	AB-M2		Abri-Missiminia, Sudan [Meroitic] (Billy [1985] in Billy, 1986)
257	Kerma	KERMA		Kerma, Sudan (Colett [1933] in Billy, 1986)
258	Sesebi	SESEB		Sesebi, Sudan (Lisowski [1954] in Billy, 1986)
259	West-central Illinois	WCILL		West-central Illinois, U.S.A. (Bridges et al., 2000)
260	Susuya	SUSYA		Susuya shell mound, Sakhalin Island (Ishida, 1994)
261	Omisaki	OMISK	OKHOTSKM	Omisaki, Wakkanai, Hokkaido (Ishida, 1988; Mitsuhashi and Yamaguchi, 1961, 1962a, b)
262	Omagari 7	OMAG7	OKHOTSKM	Omagari 7 Cave Site, Abashiri, eastern Hokkaido (Ishida and Yonemura, 1993)
263	Moyoro I	MOYR1	OKHOTSKM	Moyoro I, Abashiri, Hokkaido (Ito, 1965)
264	Moyoro II	MOYR2	OKHOTSKM	Moyoro II, Abashiri, Hokkaido (Ito, 1965)
265	Moyoro 21	MOY21	OKHOTSKM	Moyoro 21, Abashiri, Hokkaido (Ishida et al., 2000)
266	Usu (Satsumon)	USU-S		Usu (Satsumon), southwestern Hokkaido (Kanda, 1978)
267	Tekiana Cave	TEKIA	KOFTOHKM	Tekiana Cave, Tobi-shima, Yamagata (Yamaguchi and Ishida, 2000)
268	Goshozan Cave	GOSHZ	KOFTOHKM	Goshozan Cave, Miyagi (Yamaguchi, 1988)
269	Kumanodo	KUMND	KOFTOHKM	Kumanodo, Miyagi (Matsumura and Ishida, 1995)
270	Suzu cave	SUZU	KOFTOHKM	Suzu cave, Miyagi (Mizoguchi, 1995a)
271	Yamoto	YAMOT	KOFTOHKM	Yamoto, Miyagi (Takigawa, 2008)
272	Fukaado B	FUKAD	KOFTOHKM	Fukaado B, Fukushima (Ishida and Matsumura, 1991)
273	Kawarazuka	KAWRZ	KOFKANTM	Kawarazuka, Chiba (Suzuki and Sano, 1959)
274	Kusakari	KSAKR	KOFKANTM	Kusakari, Chiba (Hiramoto and Mizoguchi, 1986)
275	Moriya-Nagaami	MOR-N	KOFKANTM	Moriya-Nagaami, Chiba (Koizumi et al., 1986)
276	Ichijuku	ICHJK	KOFKANTM	Ichijuku, Chiba (Inoue and Kageoka, 1996)
277	Akabanedai	AKABN	KOFKANTM	Akabanedai No. 13, Tokyo (Yamaguchi, 1989)
278	Sengen-Zinzya	SENGN	KOFKANTM	Sengen-Zinzya-Nishigawa, Kanagawa (Kimura and Takahashi, 1972)
279	Tottori	TOTTR	KOFSANNM	Midoriyama, Itodani, Yonesato, Kokooge, Kaichidani, Tsuyudani, Yaizu, Nekoyama, Takaaze, Tenjinno, Okiyama, Mukaihata, Yura, Tsumanami, Koya, Terayama, Unomura, Arahama, Asakane, Yamakuradaira, Shojomine, Onashibara, and Taira sites, Tottori (Ikeda, 2001)
280	Shimane	SHIMN	KOFSANNM	Kamo, Komaruyama, Matoba, Hinosan, Obagatani, Hongo-Kamiguchi, Ushirodani, Koura, Ai, Gakuto, Inome, Egetani, Iwaizako, Sekido, Nakayama, and Hoso sites, Shimane (Ikeda, 2001)
281	Asakawa	ASAKW	KOFSANYM	Asakawa, Okayama (Ikeda, 1998)
282	Okayama	OKAYM	KOFSANYM	Okayama (Ikeda, 1993b)
283	Hiroshima	HIROS	KOFSANYM	Hiroshima (Ikeda, 1993b)
284	Maedayama	MAEDA	KOFFKOKM	Maedayama, Fukuoka (Kyushu D.I.K.2K., 1988)
285	Takenami	TAKNM	KOFFKOKM	Takenami, Fukuoka (Kyushu D.I.K.2K., 1988)
286	Fukuoka	FUKOK	KOFFKOKM	Asakura, Asakura-Tosho, Asamachi-Myoken, Biwanokuma, Hotokemunaoka, Donoue, Fushimaru-Otsuka, Gionyama, Hadaka, Goya, Hebitani, Hiratsuka, Hotarugaoka, Ichinose, Ibori, Ikenoue, Hushuyama, Inamoto-Kubo, Ishinami, Iwaya, Iyama, Kakibara, Kamishibayama, Kodera, Oguchisako-Ikenoue, Konosu, Kozaki, Fujiroyama, and Kyozuka sites, Fukuoka (Kyushu D.I.K.2K., 1988)
287	Fukuoka, Part 2	FUKO2	KOFFKOKM	Miyanomoto, Myoken, Nagino, Nishinoura, Nogimatsu, Ohashi, Roji, Shigetome, Tachiyamayama, and Takata sites, Fukuoka (Kyushu D.I.K.2K., 1988)
288	Fukuoka, Part 3	FUKO3	KOFFKOKM	Tebika, Tokushigetakada, Uranotani, Uratani, Yame, and Yashikitayama sites, Fukuoka (Kyushu D.I.K.2K., 1988)
289	Saga	SAGA		Hiratabara, Imamachi, Inasajinja, Kinryu, Oguma, Maruyama, and Taniguchi sites, Saga (Kyushu D.I.K.2K., 1988)
290	Oita	OITA		Fukiage, Kusaba II, Juichi-Oketsu, Jurokuyama, Okazaki, Shimoyama, Terayama, Udo, Uenohara, and Uranosako sites, Oita (Kyushu D.I.K.2K., 1988)
291	Kumamoto	KMAMT		Kita-akahobara, Tanokawachi, and Terashima sites, Kumamoto (Kyushu D.I.K.2K., 1988)
292	Miyazaki	MIYZK		Isenohama, Iimori, and Nekozaka sites, Miyazaki (Kyushu D.I.K.2K., 1988)
293	Ueazakou	UEAZA		Ueazakou, Tanegashima, Kagoshima (Takenaka, 2009)
294	Kagoshima	KAGSH		Koyashiki, Masumaru, and Matsunoo sites, Kagoshima (Kyushu D.I.K.2K., 1988)
295	Yean-ri	YEANR		Yean-ri, Korea (Kim et al., 1993)
296	Nord-Kamagebiet	N-KAM		Nord-Kamagebiet, Russia (Debetz [1948] and Akimova [1968] in Schwidetzky und Rösing, 1975)
297	Birsk	BIRSK		Birsk, Russia (Akimova [1968] in Schwidetzky und Rösing, 1975)
298	Kokel'	KOKEL		Kokel', Russia (Alekseev and Gochman [1970] in Schwidetzky und Rösing, 1975)
299	Kamenka	KAMNK		Kamenka, Russia (Konduktorova [1957, 1968] in Rösing und Schwidetzky, 1977)
300	Volgagebiet	VOLGA		Volgagebiet (Saratov), Russia (Firštejn [1970] in Schwidetzky und Rösing, 1975)

301	Saltovo	SALTV		Saltovo, Russia (Alekseev [1962] and Zinevič [1967] in Rösing und Schwidetzky, 1977)
302	Sarkel 1	SRKL1		Sarkel (grave yard), Russia (Ginzburg [1963], Firštejn [1963], and Vuič [1963] in Rösing und Schwidetzky, 1977)
303	Sarkel 2	SRKL2		Sarkel (great tumulus), Russia (Ginzburg [1951] in Rösing und Schwidetzky, 1977)
304	Poljanen 1	POLJ1		Poljanen, Perejaslav, Ukraine (Alekseeva [1966, 1973] in Rösing und Schwidetzky, 1977)
305	Poljanen 2	POLJ2		Poljanen, Černigov, Ukraine (Alekseeva [1966, 1973] in Rösing und Schwidetzky, 1977)
306	Ukraine	UKRAI		Ukraine (Konduktorova [1958, 1972], Debetz [1948], and Zinevič [1967] in Schwidetzky und Rösing, 1975)
307	Skalistoe	SKALI		Skalistoe III, Ukraine (Zinevič [1973] in Rösing und Schwidetzky, 1977)
308	Eski-Kermen	ESKIK		Eski-Kermen, Ukraine (Debetz [1948] in Rösing und Schwidetzky, 1977)
309	Inkerman-Doline	INKER		Inkerman-Doline, Crimea (Sokolova [1963] in Schwidetzky und Rösing, 1975)
310	Crimean Goths	CR-GO		Crimean Goths, Chersonesus (Debetz [1948] in Rösing und Schwidetzky, 1977)
311	Turks 1	TURK1		Turks (nomad), Altai foothills (Debetz [1948] in Rösing und Schwidetzky, 1977)
312	Turks 2	TURK2		Turks (nomad), Tianshan (Ginzburg [1954] and Miklaševskaja [1959] in Rösing und Schwidetzky, 1977)
313	Goldene Horde	GOLDN		Goldene Horde, Lower Volga (Trofimova [1949] in Schwidetzky und Rösing, 1975)
314	Southern Aral	S-ARA		Southern Aral region (Trofimova [1959] and Ginzburg und Trofimova [1959] in Schwidetzky und Rösing, 1975)
315	Tok-kala	TOK-K		Tok-kala [Ossuarien] (Chodzajow [1970] in Ginzburg und Trofimova [1972], further in Rösing und Schwidetzky, 1977)
316	Mingečaur	MINGE		Mingečaur [wood- and catacomb graves] (Kasimova [1960] in Schwidetzky und Rösing, 1975)
317	Bajram Ali	BAJRA		Bajram Ali, Turkmenistan (Trofimova [1959] in Schwidetzky und Rösing, 1975)
318	Kivutkalis	KIVUT		Kivutkalis, Latvia (Denisova [1975] in Schwidetzky und Rösing, 1989)
319	Ostrów Lednicki	OSTRO		Ostrów Lednicki, Poland (Wokroj [1953] in Rösing und Schwidetzky, 1977)
320	Cedynia	CEDYN		Cedynia, Poland (Wokroj [1971] in Rösing und Schwidetzky, 1977)
321	Wiślica	WISLC		Wiślica, Poland (Wiercinski [1971] in Rösing und Schwidetzky, 1977)
322	Lahovice	LAHOV		Lahovice near Prague, Czech (Chochol [1973] in Rösing und Schwidetzky, 1977)
323	Libice nad Cidlinou	LIBIC		Libice nad Cidlinou, Czech (Hanáková [1969] in Rösing und Schwidetzky, 1977)
324	Mikulčice 2	MIKU2		Mikulčice 2, Czech (Stloukal [1967] in Rösing und Schwidetzky, 1977)
325	Želovce	ZELOV		Želovce, Slovakia (Stloukal und Hanáková [1974] in Rösing und Schwidetzky, 1977)
326	Nové Zámky	NOV-Z		Nové Zámky I+II, Slovakia (Hanáková und Stloukal [1965] and Vladarova und Hanulik [1970] in Rösing und Schwidetzky, 1977)
327	Holiare	HOLIA		Holiare, Slovakia (Mala [1965] in Rösing und Schwidetzky, 1977)
328	Fehértó-A	FEHER		Fehértó-A, Hungary (Lipták und Vámos [1969] in Rösing und Schwidetzky, 1977)
329	Alattyán	ALATT		Alattyán, Hungary (Wenger [1957] in Rösing und Schwidetzky, 1977)
330	Üllö	ULLO		Üllö I, Hungary (Lipták [1955] in Rösing und Schwidetzky, 1977)
331	Kecel	KECEL		Kecel I+II, Hungary (Lipták [1954] in Rösing und Schwidetzky, 1977)
332	Veszprém	VESZP		Veszprém, Hungary (Acsádi und Nemeskéri [1957] in Rösing und Schwidetzky, 1977)
333	Orosháza	OROSH		Orosháza, Hungary (Lipták und Farkas [1962] and Farkas und Lipták [1965] in Rösing und Schwidetzky, 1977)
334	Szentes-Kaján	SZE-K		Szentes-Kaján, Hungary (Wenger [1955] in Rösing und Schwidetzky, 1977)
335	Szeged-Kundomb	SZEGD		Szeged-Kundomb, Hungary (Lipták und Marcsik [1966] in Rösing und Schwidetzky, 1977)
336	Northern Transdanubia	N-TRN		Northern Transdanubia, Hungary (Ery [1968] and Nemeskéri [1954, 1956] in Schwidetzky und Rösing, 1975)
337	Southern Transdanubia	S-TRN		Southern Transdanubia, Hungary (Wenger [1968] and Toth [1962] in Schwidetzky und Rösing, 1975)
338	Gepids	GEPID		Gepids, Kiszombor, Hungary (Bartucz [1936] in Rösing und Schwidetzky, 1977)
339	Homokmégy	HOMOK		Homokmégy, Hungary (Lipták [1957] in Rösing und Schwidetzky, 1977)
340	Ptuj	PTUJ		Ptuj, Slovenia (Ivaniček [1951] in Rösing und Schwidetzky, 1977)
341	Dregovičen	DREGV		Dregovičen, Serbia (Alekseeva [1966, 1973] in Rösing und Schwidetzky, 1977)
342	Varna	VARNA		Varna, Bulgaria (Postnikova [1968] and Hajniš [1965] in Schwidetzky und Rösing, 1975)
343	Preslav	PRSLV		Preslav, Bulgaria (Postnikova [1962] in Rösing und Schwidetzky, 1977)
344	Anglo-Saxons	ANGLS		Anglo-Saxons, England and Scotland (Morant [1926] in Morant, 1928)
345	Gallen Priory	GALLN		Gallen Priory, Ireland (Howells [1941] in Rösing und Schwidetzky, 1977)
346	Ciply	CIPLY		Ciply, Belgium (Houzé [1913] in Rösing und Schwidetzky, 1977)
347	Franken 1	FRNK1		Franken, Haute Normandie, France (Hamy [1908] in Rösing und Schwidetzky, 1977)
348	Franken 2	FRNK2		Franken, Basse Normandie, France (Doranlo [1921] in Rösing und Schwidetzky, 1977)
349	Franken 3	FRNK3		Franken, Rheingau, Germany (Matthäus [1940] in Rösing und Schwidetzky, 1977)
350	Merovingians	MERVG		Merovingians, French Vexin (Ménard, 1977)
351	Wenden	WENDS		Wenden, Mecklenburg, Germany (Asmus [1902] in Rösing und Schwidetzky, 1977)
352	Bremen	BREMN		Bremen, Germany (Gildemeister [1879] and v. Krogh [1940] in Rösing und Schwidetzky, 1977)
353	Anderten	ANDRT		Anderten, Germany (Hauschild [1926] in Rösing und Schwidetzky, 1977)
354	Mannheim	MANNH		Mannheim-Vogelstang, Germany (Rösing [1975] in Rösing und Schwidetzky, 1977)
355	Eltville	ELTVL		Eltville, Germany (Schollmayer, 1983)
356	Kaiserslautern	KAISR		Kaiserslautern, Barbarossaburg, Germany (Roth-Lutra [1974] in Rösing und Schwidetzky, 1977)
357	Giesing	GIESN		Giesing, Bajuwaren, Germany (Henckel [1925] and Kramp [1938] in Rösing und Schwidetzky, 1977)
358	Alamannen	ALAMN		Alamannen, Württemberg I, Germany (Lieven [1949] in Rösing und Schwidetzky, 1977)
359	Nusplingen	NUSPL		Nusplingen, Germany (Eble [1955] in Rösing und Schwidetzky, 1977)
360	Weingarten	WEING		Weingarten, Germany (Huber [1967] in Rösing und Schwidetzky, 1977)
361	Hainburg	HAINB		Hainburg, Austria (Ehgartner [1959] in Schwidetzky und Rösing, 1989)
362	Aaregebiet	AARE		Aaregebiet, Burgunder, Switzerland (Hug [1940] in Rösing und Schwidetzky, 1977)
363	Bonaduz	BONAD		Bonaduz, Switzerland (Brunner [1972] in Rösing und Schwidetzky, 1977)
364	Etruscans	ETRUS		Etruscans, Tarquinia, Italy (Leipzig Catalogue [1887] in Morant, 1928)
365	Tarragona	TARRG		Tarragona, Spain (Pons [1949] in Schwidetzky und Rösing, 1975)
366	West Goths	W-GOT		West Goths, Castile I, Spain (Schwidetzky [1957] and Rösing [1975] in Rösing und Schwidetzky, 1977)
367	Lcasen	LCASN		Lcasen, Kauk., Ackerbauer (Babusan [1972] in Alekseev and Gochman [1983], further in Schwidetzky und Rösing, 1989)
368	Shurafa	SHURF		Shurafa, Egypt (Derry [1915] in Schwidetzky und Rösing, 1975)
369	Abydos 2	ABYD2		Abydos 2, Egypt (Schmidt [1888] in Morant [1925], further in Schwidetzky und Rösing, 1989)
370	Theben 4	THEB4		Theben 4, Egypt (Stahr [1907] in Morant [1925], further in Schwidetzky und Rösing, 1989)
371	Theben 5	THEB5		Theben 5, Egypt (Schmidt [1888] in Schwidetzky und Rösing, 1989)
372	Wadi-Qitna	WAD-Q		Wadi-Qitna, Egypt (Strouhal [1973] in Billy, 1986)
373	Lower Nubia 1	L-NB1		Lower Nubia [Christian period], Egypt (Batrawi [1945] in Billy, 1986)
374	Lower Nubia 2	L-NB2		Lower Nubia [Group X], Egypt (Batrawi [1945] in Billy, 1986, and in Schwidetzky und Rösing, 1975)
375	Upper Nubia	U-NUB		Upper Nubia [Group X] (Nielsen [1970] in Schwidetzky und Rösing, 1975)
376	Wadi-Halfa 1	W-HL1		Wadi-Halfa [Christian period], Sudan (Nielsen [1970] in Billy, 1986)
377	Wadi-Halfa 2	W-HL2		Wadi-Halfa [Group X], Sudan (Nielsen [1970] in Billy, 1986)
378	Mirgissa	MIRGS		Mirgissa, Sudan (Billy [1976] in Schwidetzky und Rösing, 1989)
379	Abri-Missiminia 1	AB-M1		Abri-Missiminia [Christian period], Sudan (Billy [1985] in Billy, 1986)
380	Abri-Missiminia 2	AB-M2		Abri-Missiminia [Group X], Sudan (Billy [1985] in Billy, 1986)
381	Kerma	KERMA		Kerma, Sudan (Collett [1933] in Schwidetzky und Rösing, 1989)
382	West-central Illinois 2	WCIL2		West-central Illinois [Earlier Late Woodland], U.S.A. (Bridges et al., 2000)
383	West-central Illinois 3	WCIL3		West-central Illinois [Later Late Woodland], U.S.A. (Bridges et al., 2000)
384	Usu (Muromachi)	USU-M	MEDHOKKM	Usu (Muromachi), southwestern Hokkaido (Kanda, 1978)
385	Etomo	ETOMO	MEDHOKKM	Etomo, Muroran, Hokkaido (Oba et al., 1978)
386	Zaimokuza	ZAIMK	MEDKAMKM	Zaimokuza, Kamakura, Kanagawa (Suzuki et al., 1956; Kohara, 1956)
387	Yuigahama	YUIGH	MEDKAMKM	Yuigahama-minami, Kanagawa (Matsushita, 2002)
388	Yuigahama 2	YUIG2	MEDKAMKM	Yuigahama-minami (individual burials), Kanagawa (Nagaoka et al., 2006, 2008)
389	Yuigahama 3	YUIG3	MEDKAMKM	Yuigahama Chusei-Shudan-Bochi (No. 372), Kanagawa (Nagaoka et al., 2006)
390	Gokurakuji	GOKRK	MEDKAMKM	Gokurakuji, Kanagawa (Nagaoka et al., 2006)
391	Kajibashi	KAJBS	MEDTOKYM	Kajibashi, Tokyo (Nagaoka et al., 2006)
392	Marunouchi	MARNC	MEDTOKYM	Marunouchi, Tokyo (Nagaoka et al., 2006)
393	Yoshimohama	YOSHM		Yoshimohama, Yamaguchi (Nakahashi and Nagai, 1985)
394	Okubo	OKUBO		Okubo, Kumamoto (Naito [1973] in Nakahashi and Nagai, 1985)
395	Mekaru	MEKAR		Mekaru, Okinawa (Wakebe et al., 1999)
396	Kodiak Island 1	KODK1		Kodiak Island [Koniags] (Hrdlička, 1944)
397	Kodiak Island 2	KODK2		Kodiak Island [Pre-Koniag] (Hrdlička, 1944)
398	Iroquoians	IROQU		Iroquoians, southern Ontario, Canada (Yamaguchi, 1977)
399	West-central Illinois 4	WCIL4	MEDILLIM	American Natives [undeformed skulls], West-central Illinois, U.S.A. (Droessler [1981] in Brown and Mizoguchi, 2011)
400	West-central Illinois 5	WCIL5	MEDILLIM	West-central Illinois [Mississippian], U.S.A. (Bridges et al., 2000)
401	Peruvians	PERUV		Peruvians [undeformed skulls], Urubamba, Peru (MacCurdy [1923] in Brown and Mizoguchi, 2011)
402	Chamorro	CHAMR	MEDCHAMM	Chamorros, Guam Island (Hanihara, 1993a)
403	Chamorro 2	CHAM2	MEDCHAMM	Chamorro, Mariana Islands (Ishida, 1993)
404	Mariana	MARIA		Saipan and Tinian islands, Mariana (Hanihara, 1993b)
405	Hawaiian Islands	HAWAI		Hawaii, Molokai, Lanai, and Maui Islands, Hawaiian Islands (Hanihara, 1993a)
406	Mokapu	MOKAP		Mokapu, Oahu Island (Hanihara, 1993a; Ishida, 1993)
407	Tonga & Samoa	TO-SA		Tonga and Samoa (Hanihara, 1993b)
408	Trondheim	TROND		Trondheim, Norway (Schreiner [1939] in Rösing und Schwidetzky, 1981)
409	Oslo	OSLO		Oslo, Norway (Schreiner [1939] in Rösing und Schwidetzky, 1981)
410	Čuden	CUDEN		Čuden, Novgorod, Russia (Sedov [1952] in Rösing und Schwidetzky, 1981)
411	Slovenes	SLOVN		Slovenes, Novgorod, Russia (Sedov [1952] and Alekseev [1969] in Rösing und Schwidetzky, 1981)
412	Krivičen 1	KRIV1		Krivičen, Kostroma (Alekseeva, 1965)
413	Krivičen 2	KRIV2		Krivičen, Jaroslav, Russia (Alekseeva, 1965)
414	Krivičen 3	KRIV3		Krivičen, Tver, Russia (Alekseeva, 1965)
415	Krivičen 4	KRIV4		Krivičen, Smolensk, Russia (Alekseeva, 1965)
416	Dregovičen	DREGV		Dregovičen, Belarus (Alekseeva, 1965)
417	Vjatičen	VJATC		Vjatičen, Russia (Alekseeva, 1965)
418	Radimičen	RADIM		Radimičen, Belarus (Alekseeva, 1965)
419	Severjanen	SEVRJ		Severjanen, Russia (Alekseeva, 1965)
420	Gródek nad Bugiem	GRODK		Gródek nad Bugiem, Poland (Belniak et al. [1961] in Rösing und Schwidetzky, 1981)
421	Cedynia	CEDYN		Cedynia, Poland (Nowak and Piontek, 2002)
422	Poljanen	POLJN		Poljanen, Černigov, Ukraine (Alekseeva, 1965)
423	Poljanen 2	POLJ2		Poljanen, Perejaslav, Ukraine (Alekseeva, 1965)
424	Drevljanen	DREVL		Drevljanen, Ukraine (Alekseeva, 1965)
425	Bohemians	BOHMN		Bohemians, Prague, Czech (Matiegka [1891] in Morant, 1928)
426	Mikulčice	MIKUL		Mikulčice-II, Czech (Stloukal [1967] in Bergman und Hauser, 1982)
427	Dniestr-Gebiet	DNIES		Old Slavs, Dniestr-Gebiet, Romania (Velikanova [1975] in Rösing und Schwidetzky, 1981)
428	Nové Zámky	NOV-Z		Nové Zámky, Slovakia (Vladárová and Hanulik [1970] in Bergman und Hauser, 1982)
429	Magyars	MAGYR		Magyars, old Hungary (Bartucz [1916] in Morant, 1928)
430	Kerpuszta	KERPS		Kerpuszta, Hungary (Lipták [1953] in Rösing und Schwidetzky, 1981)
431	Szatymaz	SZATY		Szatymaz, Hungary (Lipták und Farkas [1967] in Rösing und Schwidetzky, 1981)
432	Zalavár	ZALVR		Zalavár (Horizon 1-Horizon 3 together), Hungary (Wolff et al., 2012)
433	Fészerlak	FESZR		Fészerlak, Hungary (Fóthi, 1988)
434	Vukovar	VUKVR		Vukovar, Croatia (Pilarić und Schwidetzky, 1987)
435	Bribir	BRIBR		Bribir I, Croatia (Pilarić und Schwidetzky, 1987)
436	Vinča	VINCA		Vinča, Serbia (Mikić, 1982)
437	Bugojno	BUGJN		Bugojno, Bosnia-Herzegovina (Klug, 1987)
438	Raška Gora	RASKA		Raška Gora, Bosnia-Herzegovina (Mikić, 1982)
439	Devín	DEVIN		Devín, Bulgaria (Frankenberger [1935] in Rösing und Schwidetzky, 1981)
440	Georgia 1	GEOR1		Georgia [Early Feudal Period] (Abdushelishvili, 1984)
441	Georgia 2	GEOR2		Georgia [Middle Feudal Period] (Abdushelishvili, 1984)
442	Georgia 3	GEOR3		Georgia [Late Feudal Period] (Abdushelishvili, 1984)
443	Kiel Gertrudenfriedhof	KIEL		Kiel Gertrudenfriedhof, Germany (Henke, 1972)
444	Reihengräber	REIHN		Reihengräber skulls, Bavaria and western Germany (Morant, 1928)
445	München-Giesing	MUNCH		München-Giesing, Bayern, Germany (Kramp [1938] in Bergman und Hauser, 1982)
446	Zwentendorf	ZWENT		Zwentendorf, Austria (Heinrich in Bergman und Hauser, 1982)
447	Pitten	PITTN		Pitten, Austria (Fabrizii and Reuer [1975-1977] in Bergman und Hauser, 1982)
448	Zwölfaxing	ZWOLF		Zwölfaxing, Austria (Szilvássy [1970] in Bergman und Hauser, 1982)
449	Austrians	AUSTR		Austrians, Lower Austria and Moravia (Toldt [1912] in Morant, 1928)
450	Geneva	GENEV		Geneva, Switzerland (Voss [1950] in Rösing und Schwidetzky, 1981)
451	Sierre	SIERR		Swiss, Sierre, Switzerland (Pittard [1909-1910] in Morant, 1928)
452	Valais	VALAI		Swiss, Valais, Switzerland (Pittard [1909-1910] in Morant, 1928)
453	Irish	IRISH		Irish monks (Angel, 1946)
454	Hythe	HYTHE	MEDENGM	Hythe, England (Stoessiger und Morant [1932] in Rösing und Schwidetzky, 1981)
455	English	ENGLS	MEDENGM	English (Parsons [1914] in Davivongs, 1963)
456	Greeks	GREEK		Greeks (Angel, 1944)
457	Greeks 2	GREE2		Greeks (Angel, 1946)
458	En Gedi	EN-GD		Kibbutz En Gedi, Israel (Arensburg et al., 1980)
459	Copts	COPTS		Copts, Magageh, Egypt (Münter [1924] in Morant, 1928)
460	Canary Islands	CANRY		Canary Islands (Schwidetzky [1963 and unpublished data] in Rösing und Schwidetzky, 1981)
461	Guanches	GUANC		Guanches, Canary Islands, Spain (v. Behr [1908] in Morant, 1928)
462	Galdar	GALDR		Galdar, Great Canary, Canary Islands (Fusté [1961-1962] in Chamla, 1976)
463	Great Canary	G-CAN		Great Canary, Canary Islands (Schwidetzky [1963] in Chamla, 1976)
464	Usu (Edo)	USU-E		Usu (Edo), southwestern Hokkaido (Kanda, 1978)
465	Northern Tohoku	N-TOH		Aomori, Akita, and Iwate Prefectures, Northern Tohoku (Kawakubo et al., 2009a)
466	Yushima-Muenzaka 2	YUSH2	EDOTKYM	Yushima-Muenzaka, Tokyo (Morita and Kawagoe, 1960)
467	Kamiyoshi-cho	KAMYS	EDOTKYM	Kamiyoshi-cho, Tokyo (Sato, 1962)
468	Hitotsubashi-Koko	HITOT	EDOTKYM	Hitotsubashi-Koko, Tokyo (Morimoto et al., 1985)
469	Tentokuji	TENTK	EDOTKYWM	Tentokuji (warrior class), Tokyo (Kato, 1991)
470	Shiba-koen	SHIBK	EDOTKYWM	Shiba-koen (warrior class), Tokyo (Kato, 1991)
471	Gofunai	GOFNA		Shugyoji-ato, Ennoji-ato, Hokoji-ato II, Shiodome III, Yaesu-Kitaguchi, Hacchobori-Sanchome II, Ginza-Hacchome, Sotokanda-Yonchome, Asakusa-Kikuyabashi, Taito-ku No. 57, and Toyosumi-cho sites, Gofunai (Tokyo urban area), Tokyo (Kajigayama and Mizoguchi, 2004)
472	Ikenohata-Shichikencho	IKENH		Ikenohata-Shichikencho, Tokyo (Kawakubo et al., 2009b)
473	Mifuku-Maetabata	MIFKM		Mifuku-Maetabata, Shizuoka (Sakura and Yamaguchi, 1981)
474	Aichi	AICHI		Shirakawa Park and Entsuji sites, Aichi (Nagaoka, 2003)
475	Yoshihara	YOSHH		Yoshihara, Osaka (Kanda, 1959)
476	Sakai	SAKAI		Sakai-kango-toshi and Kosenji sites, Sakai, Osaka (Nagaoka et al., 2009)
477	Tsubue	TSUBE		Tsubue, Okayama (Watanabe et al., 1982)
478	Tempukuji	TEMPK	EDOFKOKM	Tempukuji, Fukuoka (Kyushu D.I.K.2K., 1988)
479	Kamitsukiguma	KAMIT	EDOFKOKM	Kamitsukiguma, Fukuoka (Nakahashi, 1991b)
480	Mushiroda-Aoki	MUSHR	EDOFKOKM	Mushiroda-Aoki, Fukuoka (Nakahashi, 1993)
481	Sogenji-ato	SOGNJ		Sogenji-ato (warrior class), Fukuoka (Matsushita, 1995)
482	Kyomachi 1	KYOM1	EDOFKO2M	Kokura-Kyomachi, Fukuoka (Nakahashi, 1994b)
483	Kyomachi 2	KYOM2	EDOFKO2M	Kyomachi, Fukuoka (Matsushita, 1999)
484	Kyomachi 3	KYOM3	EDOFKO2M	Shooji (probably warrior class), Kyomachi 3, Fukuoka (Matsushita, 2002)
485	Kamishozu	KAMIS	EDOFKO2M	Kamishozu, Fukuoka (Matsushita and Saiki, 1992)
486	Shirahama	SHIRH		Shirahama, Kashiragajima, Nagasaki (Matsushita, 1996)
487	Kuwashima	KUWSM		Kuwashima, Kumamoto (Waki [1970] in Nakahashi, 1991a, and in Matsushita, 1996; Tateshi [1970] in Matsushita and Saiki, 1992)
488	Wano-Tofuru	WANOT		Wano-Tofuru, Amami-Oshima, Kagoshima (Ogata et al., 1988b)
489	Amami Islands	AMAMI		Amami Islands (Dodo et al., 2012)
490	Okinawa Island	OKINW	EDOOKI2M	Okinawa Island (Dodo et al., 2012)
491	Ryukyu Islanders	RYKYU	EDOOKI2M	Ryukyu Islanders, Kumejima and Okinawa (Fukumine et al. [2001] in Kudaka et al., 2013)
492	Sakishima Islands	SAKSM		Sakishima Islands (Dodo et al., 2012)
493	Kata	KATA	EDOYONGM	Kata, Yonaguni-jima, Okinawa (Doi, 2004)
494	Suubaru	SUUBR	EDOYONGM	Suubaru, Yonaguni-jima, Okinawa (Doi, 2007)
495	Ainu (Russia)	R-AIN		Ainu, Russia (Debets, 1951)
496	Ainu (Sakhalin)	S-AIN		Sachalin Ainu (Hirai, 1927; Seki, 1930a, 1930b)
497	Yakumo Ainu	Y-AIN	HOKKAINM	Yakumo Ainu, Hokkaido (Watanabe, 1938)
498	Kitami Ainu	K-AIN	HOKKAINM	Kitami Ainu, Hokkaido (Ito, 1965)
499	Hidaka Ainu	H-AIN	HOKKAINM	Hidaka Ainu, Hokkaido (Oba, 1973)
500	Otoshibe Ainu	O-AIN	HOKKAINM	Otoshibe Ainu, Hokkaido (Sakakibara [1940] in Oba, 1973)
501	Urahoro Ainu	U-AIN	HOKKAINM	Urahoro Ainu, Hokkaido (Hanzawa in Oba, 1973)
502	Ainu 3	AINU3	HOKKAINM	Ainu, Hokkaido (Takigawa, 2005)
503	Tohoku 1	TOHK1	TOHOKUM	Miyagi, Yamagata, Fukushima, Akita, and Iwate Prefectures, Tohoku (Yamasaki et al., 1967)
504	Tohoku 4	TOHK4	TOHOKUM	Tohoku (Takigawa, 2006)
505	Kanto 1	KANT1	KANTOM	Kanto (Morita, 1950)
506	Kanto 4	KANT4	KANTOM	Chiba, Kanagawa, Saitama, Ibaraki, Gumma, and Tochigi Prefectures, Kanto (Takigawa, 2005)
507	Southern Kanto	S-KNT	KANTOM	Mainly Chiba, Ibaraki, and Tochigi Prefectures, Southern Kanto (Mitsuhashi, 1958)
508	Chubu	CHUBU		Chubu (Suzuki and Takahashi, 1975; Takahashi, 1975a, b, 1976; Takahashi [1969, 1970, 1975, 1976, 1977] in Takigawa, 2006)
509	Hokuriku 1	HKRK1	HOKRKM	Hokuriku (Otsuki [1930-1933] in Oba, 1973)
510	Hokuriku 3	HKRK3	HOKRKM	Hokuriku (Sunada, 1931a, b, c, d, e; Saito, 1931, 1932a, b)
511	Kinai	KINAI		Kinai [including Shiga Prefecture] (Miyamoto, 1924 [recalculated by Mizoguchi, 2007b, 2008]; Kikitsu, 1930 [Mizoguchi, 1999]; Miyamoto, 1925 [Mizoguchi, 2000a, 2001, 2002]; Miyamoto, 1927 [Mizoguchi, 2005]; Hirai and Tabata, 1928a [Mizoguchi, 2003a, b]; Hirai and Tabata, 1928b [Mizoguchi, 2004a])
512	Chugoku	CHUGK		Chugoku (Adachi [1899-1928] in Oba, 1973)
513	Kyushu 1	KYSH1	KYUSHUM	Kyushu (Hara in Oba, 1973)
514	Kyushu 3	KYSH3	KYUSHUM	Kyushu (Abe, 1955; Inabe, 1955; Mizoguchi, 1957; Sendo, 1957)
515	Yoro-jima	YORJM		Yoro-jima Islanders, Kagoshima (Kikuchi, 1959)
516	Yorontou	YORON		Yorontou Islanders, Kagoshima (Oyama, 1956; Hirozawa, 1959; Hirata, 1958)
517	Okinawa-Honto 1	OK-H1		Okinawa-Honto (Hsü, 1948)
518	Haimi	HAIMI		Haimi, Iriomote, Ryukyu Islands (Tagaya and Ikeda, 1976)
519	Karimata	KARMT		Karimata, Miyako, Ryukyu Islands (Tagaya and Ikeda, 1976)
520	Tokunoshima	TOKNS		Tokunoshima, Ryukyu Islands (Tagaya and Ikeda, 1976)
521	Kikai	KIKAI		Kikai, Ryukyu Islands (Tagaya and Ikeda, 1976)
522	Greenland Eskimo	GR-ES		Greenland Eskimo [mainly Northwest Greenland] (Hrdlička, 1942)
523	North & East Eskimos	NE-ES		Northern and Eastern Eskimos [including Southampton Island] (Hrdlička, 1942)
524	Kuskokwim (Upper River)	KSK-U		Kuskokwim River [Upper River, above Bethel] Eskimo, Alaska (Hrdlička, 1942)
525	Kuskokwim (Lower River)	KSK-L		Kuskokwim River [Lower River, below Bethel] Eskimo, Alaska (Hrdlička, 1942)
526	Lower Yukon River	L-YUK		Lower Yukon River Eskimo, Alaska (Hrdlička, 1942)
527	Nunivak Island	NUNVK		Nunivak Island Eskimo, Bering Sea (Hrdlička, 1942)
528	Golovin Bay	GOLVN		Golovin Bay Eskimo, Alaska (Hrdlička, 1942)
529	Wales	WALES		Wales Eskimo, Alaska (Hrdlička, 1942)
530	St. Lawrence Island 1	ST-L1	STLIESKM	St. Lawrence Island Eskimo [Northwest End and North Coast] (Hrdlička, 1942)
531	St. Lawrence Island 2	ST-L2	STLIESKM	St. Lawrence Island Eskimo [Tundra and Rocks near Kukulik] (Hrdlička, 1942)
532	St. Lawrence Island 3	ST-L3	STLIESKM	St. Lawrence Island Eskimo [Kialegak] (Hrdlička, 1942)
533	St. Lawrence Island 4	ST-L4	STLIESKM	St. Lawrence Island Eskimo (Hrdlička, 1942)
534	Point Hope	PT-HP	PTHPESKM	Point Hope Eskimo, Alaska (Hrdlička, 1942)
535	Point Hope 2	PT-H2	PTHPESKM	Point Hope Eskimo, Alaska (Hrdlička, 1942)
536	Barrow (Igloo)	IGLOO	BARRESKM	Barrow Eskimo [Igloo Mounds near Barrow], Alaska (Hrdlička, 1942)
537	Barrow (Point Barrow)	PT-BR	BARRESKM	Barrow Eskimo [Point Barrow], Alaska (Hrdlička, 1942)
538	Naukan	NAUKN		Eskimo, Naukan, Russia (Debets, 1951)
539	Asian Eskimo	AS-ES		Asian Eskimo (Ishida, 1997)
540	Aleuts	ALEUT	ALEUTM	Aleuts (Hrdlička, 1944)
541	Aleuts 2	ALEU2	ALEUTM	Aleuts (Debets, 1951)
542	Aleuts 3	ALEU3	ALEUTM	Aleuts, Kagamil Caves (Hrdlička, 1944)
543	American Natives	AM-NT		American Natives [undeformed skulls from Haida and Salish tribes] (Oetteking [1930] in Brown and Mizoguchi, 2011)
544	Dolgans	DOLGN		Dolgans, Central Siberia (Alexseev, 1979)
545	Nenets	NENET		Nenets, Russia (Debets, 1951)
546	Ostiak	OSTIA		Ostiak, Siberia (Hrdlička, 1944)
547	Khantys	KHANT		Khantys, Russia (Debets, 1951)
548	Mansi	MANSI		Mansi, Russia (Debets, 1951)
549	Selkups	SELKP		Selkups, Western Siberia (Alexseev, 1979)
550	Chulym Tatars	CHULY		Chulym Tatars, Western Siberia (Alexseev, 1979)
551	Shors	SHORS		Shors, Southern Siberia (Alekseev, 1965)
552	Beltyren	BELTY		Beltyren [one of Khakas peoples] (Alekseev, 1965)
553	Sagaizen	SAGZN		Sagaizen [one of Khakas peoples] (Alekseev, 1965)
554	Katschinzen	KATSC		Katschinzen [one of Khakas peoples] (Alekseev, 1965)
555	Khakass	KHAKS		Khakass, Southern Siberia (Alexseev, 1979)
556	Soyots	SOYOT		Soyots, Southern Siberia, Russia (Alexseev, 1979)
557	Telengets	TELNG		Telengets, Southern Siberia (Alekseev, 1965)
558	Western Buryats	W-BUR		Western Buryats, Russia (Debets, 1951)
559	Buryats (Tunka)	B-TUN		Buryats, Tunka range, Russia (Debets, 1951)
560	Buryats (Trans-Baikal)	B-T-B		Buryats, Trans-Baikal region, Russia (Debets, 1951)
561	Buryats 2	BURY2	BURYATM	Buryats (Ishida, 1997)
562	Buryats (East Baikal)	BU-EB	BURYATM	Buryats, East coast of Lake Baikal, Russia (Kudaka et al., 2013)
563	Yakuts	YAKUT		Yakuts, Russia (Debets, 1951)
564	Chukchi	CHUKC		Chukchi, Chukchi Peninsula (Hrdlička, 1944)
565	Chukchi 2	CHUK2		Chukchi, Anadyr Region (Hrdlička, 1944)
566	Chukchi 3	CHUK3		Coastal Chukchi, Russia (Debets, 1951)
567	Evenks	EVENK		Evenks, Central Siberia (Alexseev, 1979)
568	Nivkhs	NIVKH		Nivkhs, Russia (Debets, 1951)
569	Ulchs	ULCHS		Ulchs, Russia (Debets, 1951)
570	Negidals	NEGDL		Negidals, Far East (Alexseev, 1979)
571	Nanays	NANAY		Nanays, Far East (Alexseev, 1979)
572	Orochs	OROCH		Orochs, Far East (Alexseev, 1979)
573	Yukagir	YUKAG		Yukagir, Russia (Debets, 1951)
574	Kalmyks	KALMY		Kalmyks, Russia (Debets, 1951)
575	Tuva	TUVA		Tuva (Alekseev, 1965)
576	Kazakh	KAZKH		Kazakh, Kazakhstan (Ishida, 1997)
577	Urga	URGA		Urga, Mongolia (Hrdlička, 1944)
578	Mongols	MONGL		Mongols (Debets, 1951)
579	Inner Mongolia	I-MON		Mongolians, Shilingol, Inner Mongolia, China (Shima [1941] in Takenaka, 1994)
580	Northern Chinese	N-CHI		Northern Chinese [Chihli, Shandong, and Manchuria] (Koganei, 1902)
581	Fushun Chinese	FUSHN		Fushun Chinese (Shima, 1933)
582	Liaoning	LIAON		Chinese [Han], Liaoning (Ishida, 1997)
583	Kirin	KIRIN		Chinese, Kirin, China (Hanihara, 1993a)
584	Peking	PEKNG		Chinese, Peking (Black [1928] in Imamura and Shima, 1935)
585	Taiyuan	TAIYU		Taiyuan, Shanxi, China (Wang and Sun, 1988)
586	Fukien	FUKIE		Chinese, Fukien (Harrower [1928] in Imamura and Shima, 1935)
587	Hailam	HAILM		Chinese, Hailam (Harrower [1928] in Imamura and Shima, 1935)
588	Southern Chinese	S-CHI		Chinese, Guangdong and Fujian (King, 1997)
589	Zhuang	ZHUAN		Zhuang Nationality, Guangxi (Zhu et al., 1989)
590	Hong Kong	HON-K		Hong Kong (Wang, 1989)
591	Keelung Chinese	KEELN		Keelung Chinese, Northern Taiwan (Uweda [1929-1931] in Shima, 1933)
592	Koreans	KOREA	KOREAM	Koreans (Shima, 1932, 1934)
593	Koreans 2	KORE2	KOREAM	Koreans (Uweda [1929-1931] in Shima, 1933)
594	Koreans 3	KORE3	KOREAM	Koreans (Arase, 1931, 1932, 1933)
595	Southern Korea 2	S-KO2	KOREAM	Koreans, Southern Korea (Takahashi [1932] in Kim et al., 1993)
596	Tibetans 2	TIBE2		Tibetans (Morant [1923/1924] in Olivier, 1966)
597	Khas	KHAS		Khas, mainly Nepal (Olivier, 1966)
598	Nepalese	NEPAL		Nepalese (Morant [1924] in Imamura and Shima, 1935)
599	Tamils	TAMIL		Tamils, India (Harrower [1928] in Imamura and Shima, 1935)
600	Hindu	HINDU		Hindu, India (Woo and Morant [1932] in Imamura and Shima, 1935)

601	Dravida	DRAVD		Dravida, India (Morant [1924] in Imamura and Shima, 1935)
602	Andamanese	ANDMN		Andamanese, India (Bonin [1931] in Imamura and Shima, 1935)
603	Vedda	VEDDA		Vedda, Sri Lanka (Woo and Morant [1932] in Imamura and Shima, 1935)
604	Burmese	BURMS		Burmese (Tildesley [1920-1921] in Imamura and Shima, 1935)
605	Thais	THAIS		Thais, Chiang Mai, Thailand (King, 1997)
606	Laotians	LAOTI		Laotians (Olivier, 1966)
607	Vietnamese	VIETN		Vietnamese (Olivier, 1966)
608	Khmers	KHMER		Khmers, Cambodia (Olivier, 1966)
609	Dayak	DAYAK		Dayak, Borneo (Bonin [1931] in Imamura and Shima, 1935, and in Olivier, 1966)
610	Aeta	AETA		Aeta, Philippines (Bonin [1931] in Imamura and Shima, 1935)
611	Tagalogs	TAGLG		Tagalogs, Philippines (Bonin [1931] in Imamura and Shima, 1935)
612	Javanese	JAVA		Javanese, Middle and East Java (Bonin [1931] in Imamura and Shima, 1935)
613	Fiji 2	FIJI2		Fiji islanders (Hanihara, 1996)
614	Swanport	SWANP		Swanport, Australia (Brown, 2001)
615	South Australia	S-AUS	SAUSTM	Australian Aborigines, Adelaide, South Australia (Hanihara, 1996)
616	South Australia 2	S-AU2	SAUSTM	Australian aborigines, South Australia (van Dongen, 1963)
617	South Australia 3	S-AU3	SAUSTM	Australian aborigines, South Australia (Davivongs, 1963)
618	Papuans	PAPUA		Papuans, Papua New Guinea (Hanihara, 1996)
619	Solomon	SOLOM		Solomon islanders (Hanihara, 1996)
620	New Britain	N-BRI		New Britain islanders, Papua New Guinea (Hanihara, 1996)
621	New Hebrides	N-HEB		New Hebrides islanders, Vanuatu (Hanihara, 1996)
622	New Caledonia	N-CAL		New Caledonia islanders (Hanihara, 1996)
623	New Ireland	N-IRL		New Ireland islanders, Papua New Guinea (Hanihara, 1996)
624	Maori	MAORI		Maori (Schofield [1959] in Davivongs, 1963)
625	Lapps	LAPPS		Lapps (Schreiner [1935] in Schwidetzky, 1963)
626	Finns	FINNS		Finns (Alekseev, 1966)
627	Russians 1	RUSS1		Great Russians of peasant origin [northern and middle regions of European Russia] (Tarenetzky [1884] in Morant, 1928)
628	Russians 2	RUSS2		Russians [northwestern region] (Alekseev, 1966)
629	Estonians	ESTON		Estonians (Alekseev, 1966)
630	Eastern Latvians	E-LAT		Eastern Latvians (Alekseev, 1966)
631	Lithuanians	LITHU		Lithuanians (Alekseev, 1966; Alekseev [1969] in Schwidetzky und Rösing, 1984)
632	Dutchmen	DUTCH		Dutchmen (de Froe [1938] in Schwidetzky und Rösing, 1984)
633	Warsaw	WARSW		Warsaw, Poland (Kaczanowski [1965] in Schwidetzky und Rösing, 1984)
634	Württemberger	WUERT		Württemberger, Germany (Tübingen Catalogue [1902] in Morant, 1928)
635	Bavarians 1	BAVR1		Bavarians, Waischenfeld (Ranke [1883 etc.] in Morant, 1928)
636	Bavarians 2	BAVR2		Bavarians [Altbayerisch], Aufkirchen (Ranke [1883 etc.] in Morant, 1928)
637	Carinthians	CARIN		Carinthians, Greifenberg, S.C. Austria (Shapiro [1929] in Angel, 1944)
638	Alsatians	ALSAT		Alsatians, France (Adams [1917] in Morant, 1928)
639	French	FRENC		French (Munich Catalogue [1892] in Morant, 1928)
640	Basques	BASQU		Basques, Zaraus, Guipuzcoa, Spain (Morant, 1928)
641	Glasgow	GLASG		Glasgow, Scotland, U.K. (Young [1931] in Schwidetzky und Rösing, 1984)
642	Farringdon	FARRN		English, Farringdon Street, London (Hooke [1926] in Morant, 1928)
643	Whitechapel	WHITE		English, Whitechapel, London (Macdonell [1904] in Morant, 1928)
644	Spitalfields	SPITL		Spitalfields, England (Molleson and Cox, 1993)
645	English	ENGLS		English (Holtby [1918] in Davivongs, 1963)
646	Elbingeralp	ELBIN		Elbingeralp, Tyrol, Austria (Schweiger [1967] and Caselitz [1980] in Schwidetzky und Rösing, 1984)
647	Tyrolese	TYROL		Tyrolese, Austria (Holl [1884] in Morant, 1928)
648	Vorarlberger	VORAR		Vorarlberger, Austria (Holl [1888] in Morant, 1928)
649	Magyars	MAGYR		Magyars, Hungary (Weisbach [1864] in Morant, 1928)
650	Slovenes	SLOVN		Slovenes, Carniola, Slovenia (Weisbach [1912] in Morant, 1928; Weisbach [1881] in Morant, further in Angel, 1944)
651	Czechs	CZECH		Czechs, Bohemia (Schiff [1912] in Morant, 1928)
652	Hradek b. Mikolov	HRADK		Hradek b. Mikolov, Czech (Ferak [1962] in Schwidetzky und Rösing, 1984)
653	Rumanians	RUMAN		Rumanians (Weisbach [1870] in Morant, 1928)
654	Serbo-Croats	SE-CR		Serbo-Croats, Adriatic coast (Weisbach [1884] in Morant, 1928)
655	Ossetians-Ironen	OSS-I		Ossetians-Ironen, Russia (Alekseev [1974] in Schwidetzky und Rösing, 1984)
656	Ossetians-Digoren	OSS-D		Ossetians-Digoren, Russia (Alekseev [1974] in Schwidetzky und Rösing, 1984)
657	Sofia	SOFIA		Sofia, Bulgaria (Kadanoff et al. [1974] in Schwidetzky und Rösing, 1984)
658	North-central Bulgaria	NC-BL		North-central Bulgaria (Kadanoff et al. [1974] in Schwidetzky und Rösing, 1984)
659	Bulgarians (Nordbalkan)	NB-BL		Bulgarians, Nordbalkan (Kadanoff et al. [1974] in Schwidetzky und Rösing, 1984)
660	Northwest Bulgaria	NW-BL		Northwest Bulgaria (Kadanoff et al. [1974] in Schwidetzky und Rösing, 1984)
661	Bulgarians (Thrakien)	BUL-T		Bulgarians, Thrakien (Kadanoff et al. [1974] in Schwidetzky und Rösing, 1984)
662	Bulgarians (Südbalkan)	BUL-S		Bulgarians, Südbalkan (Kadanoff et al. [1974] in Schwidetzky und Rösing, 1984)
663	Tashkent	TASHK		Tashkent, Uzbekistan (Ginzburg [1963] in Schwidetzky und Rösing, 1984)
664	Turks	TURKS		Turks, Constantinople (Weisbach [1873] in Morant, 1928)
665	Armenians	ARMEN		Armenians (Alekseev [1974] and Bunak [1927] in Schwidetzky und Rösing, 1984)
666	Siena	SIENA		Italians, Siena (Vincenzo [1918] in Morant, 1928)
667	Sardinians 1	SARD1		Sardinians, Italy (Maxia and Fenu [1963] in Schwidetzky und Rösing, 1984)
668	Sardinians 2	SARD2		Sardinians (Duckworth [1911] in Morant, 1928)
669	Sicilians	SICIL		Sicilians (Mondio [1897] in Morant, 1928)
670	Greeks	GREEK		Greeks (Weisbach [1881] in Morant, 1928)
671	Maltese	MALTA		Maltese, Malta (Buxton [1922] in Morant, 1928)
672	Algeria	ALGER		Algier and Oran, Algeria (Demoulin, 1981)
673	Kabylie	KABYL		Kabylie, Algeria (Demoulin, 1981)
674	Biskra	BISKR		Biskra, Algeria (Demoulin, 1981)
675	Cameroon	CAMRN		Cameroon (Kiston [1931] and Trevor [1955] in De Villiers, 1968)
676	Uganda	UGAND		Uganda (Górnay [1957] in De Villiers, 1968)
677	Fernand Vaz	FERNA		Fernand Vaz, Gabon (Trevor [1949] in De Villiers, 1968)
678	Haya	HAYA		Haya, Tanzania (Czekanowski [1951] in De Villiers, 1968)
679	Bugoye	BUGOY		Bugoye, Ruanda (Czekanowski [1951] in De Villiers, 1968)
680	Mulera	MULRA		Mulera, Ruanda (Czekanowski [1951] in De Villiers, 1968)
681	Taita	TAITA		Taita, Kenya (Kiston [1931] in De Villiers, 1968)
682	Tetela	TETLA		Tetela, Congo (Trevor [1949] in De Villiers, 1968)
683	Natal Nguni	N-NGU		Natal Nguni, South Africa (De Villiers, 1968; Lundy, 1986)
684	Cape Nguni	C-NGU		Cape Nguni, South Africa (De Villiers, 1968; Lundy, 1986)
685	Sotho	SOTHO		Sotho, South Africa (De Villiers, 1968; Lundy, 1986)
686	Shangana-Tonga	SHANG		Shangana-Tonga, South Africa (De Villiers, 1968)
687	Bushman	BUSHM		Bushman, South Africa (De Villiers, 1968)

[1]In some cases, the same label was assigned to two or more samples, for example, of different ages found at the same site. Even so, however, they were treated as separate samples when used in analyses.

Appendix 2. *Homo sapiens sapiens* female samples of the Neolithic to modern times from all over the world.[1)]

	Original sample	Label of the sample	Label of the pooled sample containing the relevant sample	Site (reference)
1	Kitakogane K-13	KIT13	JOM1EJF	Kitakogane K-13, Date, Hokkaido (Dodo et al., 1986)
2	Furuyashiki	FRYSH	JOM1EJF	Furuyashiki, Aomori (Morimoto, 1986)
3	Jaou	JAOU	JOM1EJF	Jaou Cave, Iwate (Chiboi, 1997)
4	Enshoji	ENSHJ	JOM1EJF	Enshoji, Saitama (Baba, 1992)
5	Yugura	YUGRA	JOM1EJF	Yugura Cave, Nagano (Morimoto and Takahashi, 1986)
6	Tochibara	TOCHB	JOM1EJF	Tochibara rock-shelter, Nagano (Kohara et al., 2011)
7	Muroya No. 2	MURY2	JOM1EJF	Muroya No. 2, Niigata (Ogata, 1962)
8	Odake	ODAKE	JOM1WJF	Odake, Toyama (Sakaue et al., 2014)
9	Odake 1	ODAK1	JOM1WJF	Odake 1, Toyama (Mizoguchi, n.d.)
10	Mibiki	MIBIK	JOM1WJF	Mibiki 0-1 and 0-3, Ishikawa (Yamaguchi, 2004)
11	Hashima	HASHM	JOM1WJF	Hashima, Okayama (Hasebe, 1941a)
12	Nakatsugawa	NAKTS	JOM1WJF	Nakatsugawa cave site, Ehime (Dodo, 1976)
13	Kamikuroiwa	KAMKR	JOM1WJF	Kamikuroiwa rock shelter site, Ehime (Nakahashi and Okazaki, 2009)
14	Hegi	HEGI	JOM1WJF	Hegi Cave, Oita (Naito, 1977)
15	Todoroki	TODRK	JOM1WJF	Todoroki, Kumamoto (Kaifu et al., 1998)
16	Shimomotoyama 6	SHMM6	JOM1WJF	Shimomotoyama 6, Nagasaki (Kaifu et al., 2017b)
17	Funadomari	FNDMR	JOM2HKDF	Funadomari, Rebun Island, Hokkaido (Matsumura et al., 2001)
18	Oyachi	OYACH	JOM2HKDF	Oyachi 1-1, Yoichi, western Hokkaido (Ishida et al., 2000)
19	Takasago (Ishida)	TKS I	JOM2HKDF	Takasago, Abuta, Hokkaido (Ishida et al., 1987)
20	Usu C16	USC16	JOM2HKDF	Usu C16, southwestern Hokkaido (Kanda, 1978)
21	Usujiri B No. 1	USJB1	JOM2HKDF	Usujiri B No. 1, Minami-Kayabe, Hokkaido (Dodo and Yamaguchi, 1980)
22	Kaitori	KAITR	JOM2THKF	Kaitori, Iwate (Ogata and Morisawa, 1971)
23	Ebishima	EBSHM	JOM2THKF	Ebishima, Iwate (Mizoguchi and Dodo, 2001; Yamaguchi, 1983)
24	Nakazawahama 97-1	NK971	JOM2THKF	Nakazawahama 97-1, Rikuzen-Takada, Iwate (Nara et al., 1999)
25	Aoshima	AOSHM	JOM2THKF	Aoshima, Miyagi (Ikeda and Shigehara, 1975)
26	Satohama	SATHM	JOM2THKF	Satohama, Miyagi (Dodo, 1981)
27	Sanganji	SNGNJ	JOM2THKF	Sanganji, Fukushima (Hanihara and Uchida, 1988; Baba, 1988)
28	Nakatsuma	NAKTS	JOM2KNTF	Nakatsuma, Ibaraki (Matsumura et al., 1996)
29	Horinouchi	HRNCH	JOM2KNTF	Horinouchi, Chiba (Suzuki et al., 1957)
30	Ubayama	UBAYM	JOM2KNTF	Ubayama, Chiba (Kondo, 1993)
31	Kasori (Suzuki)	KSR S	JOM2KNTF	Kasori, Chiba (Suzuki et al., 1976)
32	Kosaku	KOSAK	JOM2KNTF	Kosaku, Chiba (Koizumi et al., 1985)
33	Kusakari	KSKAR	JOM2KNTF	Kusakari, Chiba (Hiramoto and Mizoguchi, 1986)
34	Yahagi	YAHAG	JOM2KNTF	Yahagi shell-mound, Chiba (Hiramoto, 1981)
35	Kitamura	KITMR	JOM2CHBF	Kitamura, Nagano (Shigehara, 1993)
36	Shimekake	SHMKK	JOM2CHBF	Shimekake, Nagano (Tanaka, 2003)
37	Do-no-Kaizuka No. 7	DONK7	JOM2CHBF	Do-no-Kaizuka No. 7, Sado, Niigata (Ogata and Morisawa, 1977)
38	Shijimizuka	SHJMZ	JOM2TKAF	Shijimizuka, Shizuoka (Hirai, 1928)
39	Yoshiko	YOSHK	JOM2TKAF	Yoshiko, Aichi (Kintaka, 1928; Ohba, 1935; Ishisawa, 1931)
40	Ikawazu	IKAWZ	JOM2TKAF	Ikawazu, Aichi (Suzuki et al., 1972; Ehara et al., 1988)
41	Kawaji SK02	KAWJ2	JOM2TKAF	Kawaji SK02, Aichi (Ikeda and Mouri, 1995)
42	Hazawa	HAZAW	JOM2TKAF	Hazawa, Gifu (Ikeda and Tagaya, 2000)
43	Tsukumo	TSUKM	JOM2SNYF	Tsukumo, Okayama (Kiyono and Miyamoto, 1926; Kiyono and Hirai, 1928a, b)
44	Tsubue	TSUB	JOM2SNYF	Tsubue, Okayama (Hasebe, 1941b)
45	Taishaku-Yosekura	TAISH	JOM2SNYF	Taishaku-Yosekura, Hiroshima (Suzuki and Fukushima, 1976)
46	Toyomatsu-Domen	TOYMT	JOM2SNYF	Toyomatsu-Domen Cave, Hiroshima (Nakahashi, 1984; Kyushu D.I.K.2K., 1988)
47	Yamaga	YAMAG	JOM2KYSF	Yamaga shell-mound, Fukuoka (Kyushu D.I.K.2K., 1988)
48	Fukuoka	FUKOK	JOM2KYSF	Einomaru and Kojo shell-mounds, Fukuoka (Kyushu D.I.K.2K., 1988)
49	Hegi (Late Jomon)	HEGIL	JOM2KYSF	Hegi Cave, Oita (Naito, 1977)
50	Kakiwara	KAKWR	JOM2KYSF	Kakiwara, Kumamoto (Matsuno et al., 1967)
51	Ataka	ATAKA	JOM2KYSF	Ataka, Kumamoto (Omori, 1960)
52	Goryo	GORYO	JOM2KYSF	Goryo shell-mound, Kumamoto (Kyushu D.I.K.2K., 1988)
53	Shimoyamada	SHMYM		Shimoyamada II, Amami-Oshima, Kagoshima (Ogata et al., 1988a)
54	Upper Lena River	ULENA		Upper Lena River, Siberia (Hrdlička, 1942)
55	Angara River	ANGRA		Angara River, Siberia (Hrdlička, 1944)
56	Baikal	BAIKL		Baikal, Russia (Debets, 1951)
57	Yangshao	YANGS		Yangshao, Qinghai, China (Han, 1990)
58	Baoji	BAOJI	NEOSHNXF	Baoji, Shaanxi, China (Yen et al., 1960)
59	Banpo	BANPO	NEOSHNXF	Banpo, Shaanxi, China (Yan et al. [1960] in Wu and Zhang, 1985)
60	Huaxian	HUAXI	NEOSHNXF	Huaxian, Shaanxi, China (Yan [1962] in Wu and Zhang, 1985)
61	Shigu	SHIGU	NEOHENNF	Shigu, Henan, China (Chen and Wu, 1985)
62	Xiawanggang	XIAWN	NEOHENNF	Xiawanggang, Henan, China (Zhang and Chen [n.d.] in Wu and Zhang, 1985)
63	Dawenkou	DAWNK	NEOSHNDF	Dawenkou, Shandong, China (Yan [1972] in Wu and Zhang, 1985)
64	Hsi-hsia-hou	HSI-H	NEOSHNDF	Hsi-hsia-hou, Shandong, China (Yen, 1973)
65	Longqiuzhuang	LONGQ		Longqiuzhuang, Jiangsu, China (Han, 1999)
66	Tanshishan	TANSH		Tanshishan, Fujian, China (Han et al., 1976)
67	Zhenpiyan	ZHENP		Zhenpiyan, Guangxi, China (Zhang et al., 1977)
68	Hedang	HEDNG		Hedang, Guangdong, China (Han and Pan, 1982)
69	Ban Kao	BANKA		Ban Kao, Thailand (Sangvichien et al., 1969)
70	Liang Toge	LTOGE		Liang Toge, Flores (Jacob [1967] in Van Heekeren, 1972)
71	Lepenski Vir	LEPNS	NEOSRBF	Lepenski Vir (Group I), Serbia (Zoffmann, 1983)
72	Vlasac	VLASC	NEOSRBF	Vlasac, Serbia (Zoffmann, 1983)
73	Atlit-Yam	ATLIT		Homo I, Atlit-Yam, Israel (Hershkovitz and Galili, 1991)
74	Naqada	NAQAD		Naqada, Egypt (Fawcett in Pearson and Davin, 1924)
75	Onkoromanai	ONKRM	EPJHKKDF	Onkoromanai, Wakkanai, Hokkaido (Yamaguchi, 1963b)
76	Ebetsu	EBETS	EPJHKKDF	Ebetsu, Hokkaido (Kono, 1933)
77	Etomo	ETOMO	EPJHKKDF	Etomo, Muroran, Hokkaido (Oba et al., 1978)
78	Minami-Usu 6	M-US6	EPJHKKDF	Minami-Usu 6 site, Date, Hokkaido (Dodo, 1983)
79	Hinata-I Cave	HINAT	YAYOIEJF	Hinata-I Cave site, Yamagata (Kato and Ishida, 1991)
80	Iwatsubo Cave	IWATS	YAYOIEJF	Iwatsubo Cave site, Gumma (Kaifu, 1992)
81	Hokaiji 1	HOK-1		Hokaiji 1, Aichi (Ikeda, 1993a)
82	Aoyakamijichi	AOYKM	YAYOSNNF	Aoyakamijichi, Tottori (Inoue and Matsumoto, 2002)
83	Koura	KOURA	YAYOSNNF	Koura, Shimane (Kyushu D.I.K.2K., 1988)
84	Doigahama	DOIGH	YAYOYMGF	Doigahama, Yamaguchi (Kyushu D.I.K.2K., 1988)
85	Nakanohama	NAKNH	YAYOYMGF	Nakanohama, Yamaguchi (Kyushu D.I.K.2K., 1988)
86	Yoshimohama	YOSHM	YAYOYMGF	Yoshimohama, Yamaguchi (Nakahashi and Nagai, 1985)
87	Kanenokuma	KNNKM	YAYOFUKF	Kanenokuma, Fukuoka (Nakahashi et al., 1985)
88	Maedayama	MAEDA	YAYOFUKF	Maedayama I, Fukuoka (Doi et al., 1987)
89	Shinmachi	SHNMC	YAYOFUKF	Shinmachi, Fukuoka (Kyushu D.I.K.2K., 1988)
90	Arita	ARITA	YAYOFUKF	Arita, Fukuoka (Nakahashi, 1991a)
91	Hara	HARA	YAYOFUKF	Hara, Fukuoka (Kyushu D.I.K.2K., 1988)
92	Kamitsukiguma	KMTSK	YAYOFUKF	Kamitsukiguma, Fukuoka (Nakahashi, 1991b)
93	Ichinotani	ICHNT	YAYOFUKF	Ichinotani, Fukuoka (Kyushu D.I.K.2K., 1988)
94	Yoshigaura	YSHGA	YAYOFUKF	Yoshigaura, Fukuoka (Kyushu D.I.K.2K., 1988)
95	Karumeru-Shudoin	KARMR	YAYOFUKF	Karumeru-Shudoin-nai Site, Fukuoka (Nakahashi, 1992)
96	Nagaoka	NAGAO	YAYOFUKF	Nagaoka, Fukuoka (Nakahashi, 1990)
97	Hasakonomiya	HASKN	YAYOFUKF	Hasakonomiya, Fukuoka (Kyushu D.I.K.2K., 1988)
98	Kocho Jinja	KOCHO	YAYOFUKF	Kocho-Jinja, Fukuoka (Nakahashi, 1995a)
99	Fukuoka	FKOKA	YAYOFUKF	Dojoyama and Hakugensha sites, Fukuoka (Kyushu D.I.K.2K., 1988)
100	Fukuoka, Part 2	FKOK2	YAYOFUKF	Hayamadai, Hikata, and Fujisaki sites, Fukuoka (Kyushu D.I.K.2K., 1988)
101	Fukuoka, Part 3	FKOK3	YAYOFUKF	Ishigaki and Kamenoko sites, Fukuoka (Kyushu D.I.K.2K., 1988)
102	Fukuoka, Part 4	FKOK4	YAYOFUKF	Kuma No. 5, Kuriyama, Mamezukayama, Misawa, Monden, Monden-Kitadaichi, Morooka, Motomatsubara, and Kitauchihara sites, Fukuoka (Kyushu D.I.K.2K., 1988)
103	Fukuoka, Part 5	FKOK5	YAYOFUKF	Nishihiratsuka, Nishijima, Nishijin-cho, Odoi, Okuma, Okuma-toge, Onojo, Sakemi-Shell-mound, and Shobaru sites, Fukuoka (Kyushu D.I.K.2K., 1988)
104	Fukuoka, Part 6	FKOK6	YAYOFUKF	Tateiwa site, Fukuoka (Kyushu D.I.K.2K., 1988)
105	Mitsu	MITSU	YAYOSAGF	Mitsu, Saga (Ushijima, 1954; Kyushu D.I.K.2K., 1988)
106	Otomo (1st-to-4th exc.)	OTM14	YAYOSAGF	Otomo (the 1st-to-4th excavations), Saga (Matsushita [1981] in Nakahashi and Nagai, 1987b; Matsushita [1981] in Nakahashi and Nagai, 1989; Matsushita [1981] in Nakahashi, 1990)
107	Otomo (5th & 6th exc.)	OTM56	YAYOSAGF	Otomo (the 5th and 6th excavations), Saga (Nakahashi, 2003)
108	Ukikunden	UKKND	YAYOSAGF	Ukikunden, Saga (Nakahashi and Nagai, 1987b)
109	Saga, Part 1	SAGA1	YAYOSAGF	Agechi, Asahi, Kiridoshi, and Kiyama sites, Saga (Kyushu D.I.K.2K., 1988)
110	Saga, Part 2	SAGA2	YAYOSAGF	Obuchi and Yubi sites, Saga (Kyushu D.I.K.2K., 1988)
111	Nejiko-men	NEJKM	YAYONAGF	Nejiko-men, Hirado Island, Nagasaki (Kanaseki et al., 1954)
112	Nagasaki	NAGSK	YAYONAGF	Fukabori, Hamago, and Matsubara sites, Nagasaki (Naito, 1971)
113	Hatakenaka	HATKN		Hatakenaka, Kumamoto (Hojo, 1989)
114	Torinomine	TORNM	YAYOTANF	Torinomine, Tanegashima, Kagoshima (Kyushu D.I.K.2K., 1988)
115	Hirota 1	HIRT1	YAYOTANF	Hirota, Tanegashima, Kagoshima (Kyushu D.I.K.2K., 1988)
116	Ekwen	EKVE2		Asian Eskimos, Ekwen, Russia (Fedosova, 1991)
117	Wusun	WUSUN		Wusun, Xinjiang, China (Han and Pan, 1987)
118	Chawuhu	CHAWH		Chawuhu No. 4 cemetery, Xinjiang Uygur, China (Han et al., 1999)
119	Gumu Gou	GUMUG		Gumu Gou, Xinjiang, China (Han, 1986)
120	Wayaogou	WAYAO		Wayaogou, Shaanxi, China (Chen, 2000)
121	Shanpula	SHANP		Shanpula, Xinjiang, China (Shao et al., 1988)
122	An-yang	ANYNG		Da-si-kong, An-yang, Honan, China (Han and Pan, 1985)
123	Man Bac	MANBC		Man Bac, northern Vietnam (Matsumura, 2011; Matsumura et al., 2011)
124	Ban Chiang (P. & D.)	BNC P		Ban Chiang, Northeast Thailand (Pietrusewsky and Douglas, 2002)
125	Murray River Valley	MURRY		Murray River Valley, Australia (Brown, 2001)
126	Paris	PARIS		Paris, France (Auboire, 1982)
127	S'Illot des Porros	SILLO		S'Illot des Porros, Majorca, Spain (Malgosa, 1988)
128	Greeks 5	GREE5		Greeks, mainland Greece [Early Iron Age] (Angel, 1943)
129	Isthmian	ISTHM		Greeks, Isthmian region, mainland Greece [Mycenaean or Late Helladic III] (Angel, 1943)
130	Cephallenians	CEPHA		Cephallenians, Greece (Angel, 1943)
131	Tepe Hissar (Medit.)	MD-TP		Mediterranean cranial type, Tepe Hissar, Iran (Krogman, 1940)
132	Timargarha	TIMAR		Timargarha, Dir-State, Pakistan (Bernhard, 1968)
133	Harappans	HARAP		Harappans (Square R37 + Area G), Pakistan (Dutta, 1972)
134	En Gedi caves 1	EN-G1		En Gedi caves, Israel [Hellenistic period] (Arensburg et al., 1980)
135	En Gedi caves 2	EN-G2		En Gedi caves, Israel [Roman period] (Arensburg et al., 1980)
136	Gizeh	GIZEH		Gizeh, Egypt (Pearson and Davin, 1924)
137	Thebes	THEBS		Thebes, Egypt (Schmidt in Pearson and Davin, 1924)
138	Lower Nubia (Group A)	LNU-A		Lower Nubia, Egypt [Group A] (Batrawi [1945] in Billy, 1986)
139	Lower Nubia (Group D)	LNU-D		Lower Nubia, Egypt [Group D] (Batrawi [1945] in Billy, 1986)
140	Lower Nubia (Meroitic)	L NUB		Lower Nubia, Egypt [Meroitic] (Batrawi [1945] in Billy, 1986)
141	Wadi-Halfa (Group C)	WAD-C		Wadi-Halfa, Sudan [Group C] (Nielsen [1970] in Billy, 1986)
142	Wadi-Halfa (Group D)	WAD-D		Wadi-Halfa, Sudan [Group D] (Nielsen [1970] in Billy, 1986)
143	Wadi-Halfa (Meroitic)	WAD-M		Wadi-Halfa, Sudan [Meroitic] (Nielsen [1970] in Billy, 1986)
144	Mirgissa	MIRGS		Mirgissa, Sudan (Billy [1976] in Billy, 1986)
145	Aksha	AKSHA		Aksha, Sudan (Chamla [1967] in Billy, 1986)
146	Abri-Missiminia 1	AB-M1		Abri-Missiminia, Sudan [Pre-Meroitic] (Billy [1985] in Billy, 1986)
147	Abri-Missiminia 2	AB-M2		Abri-Missiminia, Sudan [Meroitic] (Billy [1985] in Billy, 1986)
148	Kerma	KERMA		Kerma, Sudan (Colett [1933] in Billy, 1986)
149	West-central Illinois	WCILL		West-central Illinois, U.S.A. (Bridges et al., 2000)
150	Susuya	SUSYA		Susuya and Susuya-Minami shell mounds, Sakhalin Island (Ishida, 1994)
151	Omisaki	OMISK	OKHOTSKF	Omisaki, Wakkanai, Hokkaido (Ishida, 1988; Mitsuhashi and Yamaguchi, 1961, 1962a, b)
152	Oshonnai	OSHNN	OKHOTSKF	Oshonnai, Rebun Island, Hokkaido (Ishida, 1991)
153	Hamanaka-2	HM2I3	OKHOTSKF	HM2-I-3, Hamanaka-2 site, Rebun Island, Hokkaido (Ishida et al., 1994)
154	Moyoro I	MOYR1	OKHOTSKF	Moyoro I, Abashiri, Hokkaido (Ito, 1965)
155	Moyoro II	MOYR2	OKHOTSKF	Moyoro II, Abashiri, Hokkaido (Ito, 1965)
156	Jinja-yama	JINJY	OKHOTSKF	Jinja-yama, Utoro Site, eastern Hokkaido (Ishida et al., 1993, 1994)
157	Tekiana Cave	TEKIA	KOFTOHKF	Tekiana Cave, Tobi-shima, Yamagata (Yamaguchi and Ishida, 2000)
158	Goshozan Cave	GOSHZ	KOFTOHKF	Goshozan Cave, Miyagi (Yamaguchi, 1988)
159	Kumanodo	KUMND	KOFTOHKF	Kumanodo, Miyagi (Matsumura and Ishida, 1995)
160	Suzu cave	SUZU	KOFTOHKF	Suzu cave, Miyagi (Mizoguchi, 1995a)
161	Yamoto	YAMOT	KOFTOHKF	Yamoto, Miyagi (Takigawa, 2008)
162	Fukaado B	FUKAD	KOFTOHKF	Fukaado B, Fukushima (Ishida and Matsumura, 1991)
163	Kusakari	KSAKR	KOFKANTF	Kusakari, Chiba (Hiramoto and Mizoguchi, 1986)
164	Mizuho	MIZHO	KOFKANTF	Mizuho, Chiba (Koizumi, 1986)
165	Moriya-Nagaami	MOR-N	KOFKANTF	Moriya-Nagaami, Chiba (Koizumi et al., 1986)
166	Ichijuku	ICHJK	KOFKANTF	Ichijuku, Chiba (Inoue and Kageoka, 1996)
167	Akabanedai	AKABN	KOFKANTF	Akabanedai No. 19, Tokyo (Yamaguchi, 1989)
168	Sengen-Zinzya	SENGN	KOFKANTF	Sengen-Zinzya-Nishigawa, Kanagawa (Kimura and Takahashi, 1972)
169	Tottori	TOTTR	KOFSANNF	Itodani, Kaichidani, Engoji, Nagatani, Dakyoji, Mukaihata, Minami-Mukoyama, Tsumanami, Okamidani, Nagasetakahama, Togomura, Terayama, Yamakuradaira, Hakutsukabara, and Onashibara sites, Tottori (Ikeda, 2001)
170	Shimane	SHIMN	KOFSANNF	Kamo, Sanematsu, Juomen, Hongo-Kamiguchi, Ushirodani, Shirao, Nima, and Hoso sites, Shimane (Ikeda, 2001)
171	Tsunesada	TSNSD	KOFHIRSF	Tsunesada, Hiroshima (Sawano et al., 1957)
172	Fukuura	FUKUU	KOFHIRSF	Fukuura, Hiroshima (Sawano et al., 1957)
173	Hinosako	HINSK	KOFHIRSF	Hinosako, Hiroshima (Sawano et al., 1957)
174	Ryuozan	RYUOZ	KOFHIRSF	Ryuozan, Hiroshima (Suzuki and Ikeda, 1951)
175	Maedayama	MAEDA	KOFFKOKF	Maedayama, Fukuoka (Kyushu D.I.K.2K., 1988)
176	Takenami	TAKNM	KOFFKOKF	Takenami, Fukuoka (Kyushu D.I.K.2K., 1988)
177	Fukuoka	FUKOK	KOFFKOKF	Asamachi-Myoken, Biwanokuma, Donoue, Fujiwara-Umenoki, Gionyama, Hushuyama, Ibori, Inamoto-Kubo, Hadaka, Habu-Koen, Hiratsuka, Hotarugaoka, Hanzaki, Kakibara, Kodera, Oguchisako-Ikenoue, and Konosu sites, Fukuoka (Kyushu D.I.K.2K., 1988)
178	Fukuoka, Part 2	FUKO2	KOFFKOKF	Miyanomoto, Mochimaru, Nagahata, Nagaihama, Nagino, Nogimatsu, Shigetome, and Takata sites, Fukuoka (Kyushu D.I.K.2K., 1988)
179	Fukuoka, Part 3	FUKO3	KOFFKOKF	Tanabataike, Toninzuka, Tokushigetakada, and Yashikitayama sites, Fukuoka (Kyushu D.I.K.2K., 1988)
180	Saga	SAGA		Hiratabara, Inasajinja, Maruyama, Otsuboyama, and Tsumayama sites, Saga (Kyushu D.I.K.2K., 1988)
181	Oita	OITA		Fukiage, Kusaba II, Jurokuyama, Shimoyama, Udo, Uenohara, and Tonoo sites, Oita (Kyushu D.I.K.2K., 1988)
182	Kumamoto	KMAMT		Tanokawachi and Terashima sites, Kumamoto (Kyushu D.I.K.2K., 1988)
183	Miyazaki	MIYZK		Iimori and Kotozuka sites, Miyazaki (Kyushu D.I.K.2K., 1988)
184	Kagoshima	KAGSH		Shintomi-higashiyokoma and Yamakawa sites, Kagoshima (Kyushu D.I.K.2K., 1988)
185	Yean-ri	YEANR		Yean-ri, Korea (Kim et al., 1993)
186	Merovingians	MERVG		Merovingians, French Vexin (Ménard, 1977)
187	Eltville	ELTVL		Eltville, Germany (Schollmayer, 1983)
188	Lower Nubia 1	L-NB1		Lower Nubia [Christian period], Egypt (Batrawi [1945] in Billy, 1986)
189	Lower Nubia 2	L-NB2		Lower Nubia [Group X], Egypt (Batrawi [1945] in Billy, 1986)
190	Wadi-Halfa 1	W-HL1		Wadi-Halfa [Christian period], Sudan (Nielsen [1970] in Billy, 1986)
191	Wadi-Halfa 2	W-HL2		Wadi-Halfa [Group X], Sudan (Nielsen [1970] in Billy, 1986)
192	Abri-Missiminia 1	AB-M1		Abri-Missiminia [Christian period], Sudan (Billy [1985] in Billy, 1986)
193	Abri-Missiminia 2	AB-M2		Abri-Missiminia [Group X], Sudan (Billy [1985] in Billy, 1986)
194	West-central Illinois 2	WCIL2		West-central Illinois [Earlier Late Woodland], U.S.A. (Bridges et al., 2000)
195	West-central Illinois 3	WCIL3		West-central Illinois [Later Late Woodland], U.S.A. (Bridges et al., 2000)
196	Usu (Muromachi)	USU-M		Usu (Muromachi), southwestern Hokkaido (Kanda, 1978)
197	Zaimokuza	ZAIMK	MEDKAMKF	Zaimokuza, Kamakura, Kanagawa (Suzuki et al., 1956; Kohara, 1956)
198	Yuigahama	YUIGH	MEDKAMKF	Yuigahama-minami, Kanagawa (Matsushita, 2002)
199	Yoshimohama	YOSHM		Yoshimohama, Yamaguchi (Nakahashi and Nagai, 1985)
200	Okubo	OKUBO		Okubo, Kumamoto (Naito [1973] in Nakahashi and Nagai, 1985)
201	Mekaru	MEKAR		Mekaru, Okinawa (Wakebe et al., 1999)
202	Kodiak Island 1	KODK1		Kodiak Island [Koniags] (Hrdlička, 1944)
203	Kodiak Island 2	KODK2		Kodiak Island [Pre-Koniag] (Hrdlička, 1944)
204	West-central Illinois 4	WCIL4	MEDILLIF	American Natives [undeformed skulls], West-central Illinois, U.S.A. (Droessler [1981] in Brown and Mizoguchi, 2011)
205	West-central Illinois 5	WCIL5	MEDILLIF	West-central Illinois [Mississippian], U.S.A. (Bridges et al., 2000)
206	Peruvians	PERUV		Peruvians [undeformed skulls], Urubamba, Peru (MacCurdy [1923] in Brown and Mizoguchi, 2011)
207	Chamorro 2	CHAM2		Chamorro, Mariana Islands (Ishida, 1993)
208	Mokapu	MOKAP		Mokapu, Oahu Island (Ishida, 1993)
209	Cedynia	CEDYN		Cedynia, Poland (Nowak and Piontek, 2002)
210	Zalavár	ZALVR		Zalavár (Horizon 1-Horizon 3 together), Hungary (Wolff et al., 2012)
211	Fészerlak	FESZR		Fészerlak, Hungary (Fóthi, 1988)
212	Vukovar	VUKVR		Vukovar, Croatia (Pilarić und Schwidetzky, 1987)
213	Bribir	BRIBR		Bribir I, Croatia (Pilarić und Schwidetzky, 1987)
214	Vinča	VINCA		Vinča, Serbia (Mikić, 1982)
215	Bugojno	BUGJN		Bugojno, Bosnia-Herzegovina (Klug, 1987)
216	Raška Gora	RASKA		Raška Gora, Bosnia-Herzegovina (Mikić, 1982)
217	Georgia 1	GEOR1		Georgia [Early Feudal Period] (Abdushelishvili, 1984)
218	Georgia 2	GEOR2		Georgia [Middle Feudal Period] (Abdushelishvili, 1984)
219	Georgia 3	GEOR3		Georgia [Late Feudal Period] (Abdushelishvili, 1984)
220	Kiel Gertrudenfriedhof	KIEL		Kiel Gertrudenfriedhof, Germany (Henke, 1972)
221	English	ENGLS		English (Parsons [1914] in Davivongs, 1963)
222	En Gedi	EN-GD		Kibbutz En Gedi, Israel (Arensburg et al., 1980)
223	Yushima-Muenzaka 2	YUSH2	EDOTKYF	Yushima-Muenzaka, Tokyo (Morita and Kawagoe, 1960)
224	Kamiyoshi-cho	KAMYS	EDOTKYF	Kamiyoshi-cho, Tokyo (Sato, 1962)
225	Hitotsubashi-Koko	HITOT	EDOTKYF	Hitotsubashi-Koko, Tokyo (Morimoto et al., 1985)
226	Tentokuji	TENTK	EDOTKYWF	Tentokuji (warrior class), Tokyo (Kato, 1991)
227	Shiba-koen	SHIBK	EDOTKYWF	Shiba-koen (warrior class), Tokyo (Kato, 1991)
228	Gofunai	GOFNA		Shugyoji-ato, Ennoji-ato, Hokoji-ato II, Yaesu-Kitaguchi, Hacchobori-Sanchome II, Horyuji-ato, Ginza-Hacchome, Asakusa-Kikuyabashi, and Taito-ku No. 57 sites, Gofunai (Tokyo urban area), Tokyo (Kajigayama and Mizoguchi, 2004)
229	Yoshihara	YOSHH		Yoshihara, Osaka (Kanda, 1959)
230	Tsubue	TSUBE		Tsubue, Okayama (Watanabe et al., 1982)
231	Tempukuji	TEMPK	EDOFKOKF	Tempukuji, Fukuoka (Kyushu D.I.K.2K., 1988)
232	Kamitsukiguma	KAMIT	EDOFKOKF	Kamitsukiguma, Fukuoka (Nakahashi, 1991b)
233	Mushiroda-Aoki	MUSHR	EDOFKOKF	Mushiroda-Aoki, Fukuoka (Nakahashi, 1993)
234	Sogenji-ato	SOGNJ		Sogenji-ato (warrior class), Fukuoka (Matsushita, 1995)
235	Kyomachi 1	KYOM1	EDOFKO2F	Kokura-Kyomachi, Fukuoka (Nakahashi, 1994b)
236	Kyomachi 2	KYOM2	EDOFKO2F	Kyomachi, Fukuoka (Matsushita, 1999)
237	Kyomachi 3	KYOM3	EDOFKO2F	Shooji (probably warrior class), Kyomachi 3, Fukuoka (Matsushita, 2002)
238	Kamishozu	KAMIS	EDOFKO2F	Kamishozu, Fukuoka (Matsushita and Saiki, 1992)
239	Shirahama	SHIRH		Shirahama, Kashiragajima, Nagasaki (Matsushita, 1996)
240	Kuwashima	KUWSM		Kuwashima, Kumamoto (Waki [1970] in Nakahashi, 1991a, and in Matsushita, 1996; Tateshi [1970] in Matsushita and Saiki, 1992)
241	Wano-Tofuru	WANOT		Wano-Tofuru, Amami-Oshima, Kagoshima (Ogata et al., 1988b)
242	Mekaru-Minami B+E	M-BE	EDOOKINF	Mekaru-Minami B+E, Okinawa (Doi and Hojo, 1998)
243	Mekaru-Minami A+C+D	M-ACD	EDOOKINF	Mekaru-Minami A+C+D, Okinawa (Doi and Fukumine, 1999)
244	Suubaru	SUUBR		Suubaru, Yonaguni-jima, Okinawa (Doi, 2007)
245	Ainu (Russia)	R-AIN		Ainu, Russia (Debets, 1951)
246	Ainu (Sakhalin)	S-AIN		Sachalin Aino (Hirai, 1927; Seki, 1930a, 1930b)
247	Yakumo Ainu	Y-AIN	HOKKAINF	Yakumo Ainu, Hokkaido (Watanabe, 1938)
248	Kitami Ainu	K-AIN	HOKKAINF	Kitami Ainu, Hokkaido (Ito, 1965)
249	Hidaka Ainu	H-AIN	HOKKAINF	Hidaka Ainu, Hokkaido (Oba, 1973)
250	Otoshibe Ainu	O-AIN	HOKKAINF	Otoshibe Ainu, Hokkaido (Sakakibara [1940] in Oba, 1973)
251	Urahoro Ainu	U-AIN	HOKKAINF	Urahoro Ainu, Hokkaido (Hanzawa in Oba, 1973)
252	Ainu 3	AINU3	HOKKAINF	Ainu, Hokkaido (Takigawa, 2005)
253	Tohoku 1	TOHK1	TOHOKUF	Miyagi, Yamagata, and Fukushima Prefectures, Tohoku (Yamasaki et al., 1967)
254	Tohoku 4	TOHK4	TOHOKUF	Tohoku (Takigawa, 2006)
255	Kanto 1	KANT1	KANTOF	Kanto (Morita, 1950)
256	Kanto 4	KANT4	KANTOF	Chiba, Kanagawa, Saitama, Ibaraki, Gumma, and Tochigi Prefectures, Kanto (Takigawa, 2005)
257	Southern Kanto	S-KNT	KANTOF	Mainly Chiba, Ibaraki, and Tochigi Prefectures, Southern Kanto (Mitsuhashi, 1958)
258	Chubu	CHUBU		Chubu (Suzuki and Takahashi, 1975; Takahashi, 1975a, b, 1976; Takahashi [1969, 1970, 1975, 1976, 1977] in Takigawa, 2006)
259	Hokuriku 2	HKRK2	HOKRKF	Ishikawa Prefecture, Hokuriku (Miyazaki, 1944a, b)
260	Hokuriku 3	HKRK3	HOKRKF	Hokuriku (Sunada, 1931a, b, c, d, e; Saito, 1931, 1932a, b)
261	Kinai	KINAI		Kinai (Miyamoto, 1924 [recalculated by Mizoguchi, 2007b, 2008]; Kikitsu, 1930 [Mizoguchi, 1999]; Miyamoto, 1925 [Mizoguchi, 2000a, 2001, 2002]; Miyamoto, 1927 [Mizoguchi, 2005]; Hirai and Tabata, 1928a [Mizoguchi, 2003a, b]; Hirai and Tabata, 1928b [Mizoguchi, 2004a])
262	Chugoku	CHUGK		Chugoku (Adachi [1899-1928] in Oba, 1973)
263	Kyushu 1	KYSH1	KYUSHUF	Kyushu (Hara in Oba, 1973)
264	Kyushu 3	KYSH3	KYUSHUF	Kyushu (Abe, 1955; Inabe, 1955; Mizoguchi, 1957; Sendo, 1957)
265	Yoro-jima	YORJM		Yoro-jima Islanders, Kagoshima (Kikuchi, 1959)
266	Yorontou	YORON		Yorontou Islanders, Kagoshima (Oyama, 1956; Hirozawa, 1959; Hirata, 1958)
267	Okinawa-Honto 1	OK-H1		Okinawa-Honto (Hsü, 1948)
268	Greenland Eskimo	GR-ES		Greenland Eskimo [mainly Northwest Greenland] (Hrdlička, 1942)
269	North & East Eskimos	NE-ES		Northern and Eastern Eskimos [including Southampton Island] (Hrdlička, 1942)
270	Kuskokwim (Upper River)	KSK-U		Kuskokwim River [Upper River, above Bethel] Eskimo, Alaska (Hrdlička, 1942)
271	Kuskokwim (Lower River)	KSK-L		Kuskokwim River [Lower River, below Bethel] Eskimo, Alaska (Hrdlička, 1942)
272	Lower Yukon River	L-YUK		Lower Yukon River Eskimo, Alaska (Hrdlička, 1942)
273	Nunivak Island	NUNVK		Nunivak Island Eskimo, Bering Sea (Hrdlička, 1942)
274	Golovin Bay	GOLVN		Golovin Bay Eskimo, Alaska (Hrdlička, 1942)
275	Wales	WALES		Wales Eskimo, Alaska (Hrdlička, 1942)
276	St. Lawrence Island 1	ST-L1	STLIESKF	St. Lawrence Island Eskimo [Northwest End and North Coast] (Hrdlička, 1942)
277	St. Lawrence Island 2	ST-L2	STLIESKF	St. Lawrence Island Eskimo [Tundra and Rocks near Kukulik] (Hrdlička, 1942)
278	St. Lawrence Island 3	ST-L3	STLIESKF	St. Lawrence Island Eskimo [Kialegak] (Hrdlička, 1942)
279	St. Lawrence Island 4	ST-L4	STLIESKF	St. Lawrence Island Eskimo (Hrdlička, 1942)
280	Point Hope	PT-HP	PTHPESKF	Point Hope Eskimo, Alaska (Hrdlička, 1942)
281	Point Hope 2	PT-H2	PTHPESKF	Point Hope Eskimo, Alaska (Hrdlička, 1942)
282	Barrow (Igloo)	IGLOO	BARRESKF	Barrow Eskimo [Igloo Mounds near Barrow], Alaska (Hrdlička, 1942)
283	Barrow (Point Barrow)	PT-BR	BARRESKF	Barrow Eskimo [Point Barrow], Alaska (Hrdlička, 1942)
284	Naukan	NAUKN		Eskimo, Naukan, Russia (Debets, 1951)
285	Aleuts	ALEUT	ALEUTF	Aleuts (Hrdlička, 1944)
286	Aleuts 2	ALEU2	ALEUTF	Aleuts (Debets, 1951)
287	Aleuts 3	ALEU3	ALEUTF	Aleuts, Kagamil Caves (Hrdlička, 1944)
288	American Natives	AM-NT		American Natives [undeformed skulls from Haida and Salish tribes] (Oetteking [1930] in Brown and Mizoguchi, 2011)
289	Nenets	NENET		Nenets, Russia (Debets, 1951)
290	Ostiak	OSTIA		Ostiak, Siberia (Hrdlička, 1944)
291	Khantys	KHANT		Khantys, Russia (Debets, 1951)
292	Mansi	MANSI		Mansi, Russia (Debets, 1951)
293	Shors	SHORS		Shors, Southern Siberia (Alekseev, 1965)
294	Beltyren	BELTY		Beltyren [one of Khakas peoples] (Alekseev, 1965)
295	Sagaizen	SAGZN		Sagaizen [one of Khakas peoples] (Alekseev, 1965)
296	Katschinzen	KATSC		Katschinzen [one of Khakas peoples] (Alekseev, 1965)
297	Telengets	TELNG		Telengets, Southern Siberia (Alekseev, 1965)
298	Western Buryats	W-BUR		Western Buryats, Russia (Debets, 1951)
299	Buryats (Tunka)	B-TUN		Buryats, Tunka range, Russia (Debets, 1951)
300	Buryats (Trans-Baikal)	B-T-B		Buryats, Trans-Baikal region, Russia (Debets, 1951)
301	Chukchi	CHUKC		Chukchi, Chukchi Peninsula (Hrdlička, 1944)
302	Chukchi 2	CHUK2		Chukchi, Anadyr Region (Hrdlička, 1944)
303	Chukchi 3	CHUK3		Coastal Chukchi, Russia (Debets, 1951)
304	Nivkhs	NIVKH		Nivkhs, Russia (Debets, 1951)
305	Ulchs	ULCHS		Ulchs, Russia (Debets, 1951)
306	Yukagir	YUKAG		Yukagir, Russia (Debets, 1951)
307	Kalmyks	KALMY		Kalmyks, Russia (Debets, 1951)
308	Tuva	TUVA		Tuva (Alekseev, 1965)
309	Urga	URGA		Urga, Mongolia (Hrdlička, 1944)
310	Mongols	MONGL		Mongols (Debets, 1951)
311	Fushun Chinese	FUSHN		Fushun Chinese (Shima, 1933)
312	Taiyuan	TAIYU		Taiyuan, Shanxi, China (Wang and Sun, 1988)
313	Southern Chinese	S-CHI		Chinese, Guangdong and Fujian (King, 1997)
314	Zhuang	ZHUAN		Zhuang Nationality, Guangxi (Zhu et al., 1989)
315	Hong Kong	HON-K		Hong Kong (Wang, 1989)
316	Keelung Chinese	KEELN		Keelung Chinese, Northern Taiwan (Uweda [1929-1931] in Shima, 1933)
317	Koreans	KOREA	KOREAF	Koreans (Shima, 1932, 1934)
318	Koreans 2	KORE2	KOREAF	Koreans (Uweda [1929-1931] in Shima, 1933)
319	Koreans 3	KORE3	KOREAF	Koreans (Arase, 1931, 1932, 1933)
320	Southern Korea 2	S-KO2	KOREAF	Koreans, Southern Korea (Takahashi [1932] in Kim et al., 1993)
321	Thais	THAIS		Thais, Chiang Mai, Thailand (King, 1997)
322	Swanport	SWANP		Swanport, Australia (Brown, 2001)
323	South Australia 2	S-AU2	SAUSTF	Australian aborigines, South Australia (van Dongen, 1963)
324	South Australia 3	S-AU3	SAUSTF	Australian aborigines, South Australia (Davivongs, 1963)
325	Maori	MAORI		Maori (Schofield [1959] in Davivongs, 1963)
326	Lapps	LAPPS		Lapps (Schreiner [1935] in Schwidetzky, 1963)
327	Finns	FINNS		Finns (Alekseev, 1966)
328	Russians 2	RUSS2		Russians [northwestern region] (Alekseev, 1966)
329	Estonians	ESTON		Estonians (Alekseev, 1966)
330	Eastern Latvians	E-LAT		Eastern Latvians (Alekseev, 1966)
331	Lithuanians	LITHU		Lithuanians (Alekseev, 1966)
332	London	LONDN		English, London, U.K. (Hooke [1926] in Angel, 1976)
333	Spitalfields	SPITL		Spitalfields, England (Molleson and Cox, 1993)
334	English	ENGLS		English (Holtby [1918] in Davivongs, 1963)
335	Algeria	ALGER		Algier and Oran, Algeria (Demoulin, 1981)
336	Kabylie	KABYL		Kabylie, Algeria (Demoulin, 1981)
337	Biskra	BISKR		Biskra, Algeria (Demoulin, 1981)
338	Natal Nguni	N-NGU		Natal Nguni, South Africa (De Villiers, 1968; Lundy, 1986)
339	Cape Nguni	C-NGU		Cape Nguni, South Africa (De Villiers, 1968; Lundy, 1986)
340	Sotho	SOTHO		Sotho, South Africa (De Villiers, 1968; Lundy, 1986)

[1)] In some cases, the same label was assigned to two or more samples, for example, of different ages found at the same site. Even so, however, they were treated as separate samples when used in analyses.

Appendix 3. The sample means for the first variable set of the skull (Table 1) in 117 male samples of the Neolithic to modern times from all over the world.[1)]

	Sample	Martin's No. 1	No. 5	No. 9	No. 8	No. 17	No. 48	No. 45	No. 52	No. 54	No. 55	Av. temp.	Av. precip.	Av. rel. humid.	Chrono. age	Abs (latitude)	Gr. cir. distance	Av. sample size
1	JOM2KNTM	184.5	104.4	97.0	143.8	139.6	67.3	141.3	32.0	26.5	49.3	14.1	1511.0	66.8	4330.0	36.0	10899.5	52
2	BAI I	187.1	102.7	92.8	143.0	130.7	73.9	138.9	33.7	26.1	53.4	-1.0	367.3	73.4	7100.0	53.0	8199.0	49
3	S-EGY	182.5	100.3	91.1	131.6	134.1	68.5	123.6	31.5	24.8	48.8	22.9	0.6	42.0	6000.0	27.0	2456.6	66
4	NAQAD	185.1	99.3	91.1	134.9	135.2	67.6	125.6	31.9	25.1	48.9	24.6	1.3	41.1	5700.0	26.0	2310.4	105
5	YAYOYMGM	183.0	100.4	96.9	142.0	135.2	72.6	139.2	34.6	26.9	52.9	15.0	1620.0	76.0	2333.3	34.0	10131.3	47
6	YAYOFUKM	183.9	102.0	95.8	142.4	137.9	74.7	139.8	34.3	27.0	52.6	15.9	854.2	68.5	2200.0	33.7	10075.9	94
7	EKVEN	192.8	108.3	96.2	134.3	138.9	76.7	140.5	35.4	24.4	55.2	-7.0	300.0	85.0	2000.0	66.0	11754.6	50
8	TAGAR	186.3	105.1	98.8	142.2	136.6	72.0	137.5	32.4	24.9	52.1	2.0	260.0	64.0	2500.0	51.0	7032.9	68
9	CHAWH	183.4	100.7	94.2	136.5	135.8	70.7	131.1	31.8	24.8	51.3	8.0	60.0	54.0	3300.0	42.0	6386.0	45
10	SHANP	188.5	103.5	95.7	137.6	140.2	75.0	131.7	33.1	25.0	54.4	12.0	45.7	43.3	2600.0	37.0	5679.4	26
11	MURRY	189.1	102.5	87.0	130.5	133.5	70.6	135.6	32.9	28.4	50.0	17.0	260.0	52.0	2100.0	35.0	11897.8	46
12	BRITS	187.4	101.6	98.0	141.4	132.9	69.1	130.6	33.6	23.7	50.6	8.0	780.0	84.0	2000.0	52.0	6185.6	67
13	ETR-R	183.0	101.0	96.1	143.7	133.4	70.7	131.9	32.9	24.1	51.6	16.3	662.8	72.8	2400.0	42.0	4704.8	84
14	POMPE	181.6	99.3	98.7	142.6	131.3	70.7	131.7	34.1	24.1	52.2	15.5	1007.0	72.3	1921.0	41.0	4517.3	53
15	PN-TP	191.7	104.8	97.2	136.0	138.5	71.2	130.0	32.2	25.5	51.2	14.8	180.5	47.7	4500.0	36.0	3868.9	38
16	GIZEH	185.3	101.6	94.8	138.9	134.1	70.4	128.7	33.7	24.4	51.7	21.8	19.8	54.7	2500.0	30.0	2782.3	882
17	N-EGY	181.9	100.8	92.6	138.3	137.4	71.5	127.2	33.3	24.5	51.4	21.8	7.2	51.9	4100.0	29.0	2673.5	38
18	THEBS	181.9	100.6	93.8	136.6	136.1	68.8	128.3	33.0	25.3	50.6	23.9	1.6	41.0	3300.0	26.0	2310.4	168
19	LNU-A	182.8	100.7	93.2	134.0	133.7	69.7	127.5	32.2	25.1	50.7	26.1	0.4	27.6	4600.0	23.0	1981.0	98
20	LNU-D	185.6	101.3	91.3	135.6	133.9	68.5	126.6	32.2	25.1	50.3	26.1	0.4	27.6	2900.0	23.0	1981.0	124
21	L NUB	182.3	100.8	93.3	132.7	132.2	68.7	126.0	32.3	26.1	48.8	26.1	0.4	27.6	2000.0	23.0	1966.9	111
22	AKSHA	182.3	100.0	93.1	133.9	133.5	67.5	127.1	32.5	26.7	47.5	25.6	0.4	26.8	2000.0	22.0	1919.5	35
23	KOFFKOKM	181.6	100.8	94.9	141.0	135.7	72.1	138.7	34.1	26.3	51.6	15.6	1261.6	72.0	1300.0	34.0	10131.3	48
24	ELTVL	191.0	102.4	96.8	140.9	133.6	70.8	134.1	33.1	24.1	51.9	10.0	490.0	74.0	1400.0	50.0	5600.6	45
25	ETRUS	183.0	101.0	96.1	143.7	133.4	70.7	131.9	32.9	24.1	50.8	16.3	662.8	72.8	2400.0	42.0	4704.8	84
26	L-NB2	183.3	99.7	91.5	131.9	131.2	67.5	123.7	32.3	25.5	48.8	26.1	0.4	27.6	1500.0	23.0	1981.0	67
27	MEDKAMKM	184.8	103.5	94.4	137.6	137.7	66.0	135.6	33.7	26.4	51.5	16.0	1600.0	72.0	700.0	35.0	10923.9	238
28	IROQU	188.3	106.1	95.5	140.0	137.8	73.5	140.3	34.7	27.2	54.6	8.2	785.9	71.3	500.0	44.0	17410.7	57
29	PERUV	179.4	99.2	92.4	135.5	137.1	67.7	134.8	34.7	24.2	49.3	7.9	779.1	59.1	500.0	13.0	23467.6	66
30	MEDCHAMM	181.6	104.4	96.6	140.4	142.1	69.3	140.7	35.2	26.6	54.3	27.3	2126.0	80.9	750.0	15.0	11927.1	60
31	HAWAI	182.0	106.1	95.9	144.1	141.9	68.6	136.6	35.0	26.4	54.5	22.4	1692.0	77.0	500.0	20.0	16894.7	87
32	MOKAP	185.9	106.7	97.2	146.2	144.2	68.2	136.9	34.9	26.3	53.0	24.4	815.3	73.1	600.0	21.0	16700.0	63
33	BOHMN	186.2	101.8	98.0	141.9	138.0	68.1	131.5	32.4	25.2	51.3	8.0	470.0	79.2	1200.0	50.0	5363.5	49
34	MAGYR	179.7	100.8	96.7	147.6	135.6	72.9	134.7	34.6	25.6	53.8	10.0	620.0	70.4	1200.0	47.0	4868.0	28
35	FESZR	184.5	102.8	97.4	138.4	136.8	69.0	133.9	32.1	24.7	51.4	10.8	700.0	73.3	1300.0	46.0	4831.4	33
36	GEOR1	184.6	102.9	97.1	139.7	135.8	71.5	133.3	33.6	24.8	53.4	15.0	1290.0	72.0	1100.0	42.0	4145.1	88
37	GEOR2	179.8	102.0	100.0	148.1	135.7	70.1	137.3	33.3	24.9	52.7	15.0	1290.0	72.0	800.0	42.0	4145.1	287
38	GEOR3	179.5	102.8	101.1	149.1	136.3	71.7	138.8	34.4	25.3	53.3	15.0	1290.0	72.0	400.0	42.0	4145.1	120
39	REIHN	189.4	102.6	97.7	139.8	135.6	70.2	132.2	32.9	24.9	52.6	8.5	718.5	76.5	1400.0	50.0	5557.9	113
40	SIERR	182.1	101.0	99.9	149.0	133.5	69.7	137.2	32.5	23.8	49.8	9.2	603.3	72.0	500.0	46.0	5251.8	65
41	VALAI	177.7	100.2	99.6	151.0	132.9	70.9	136.3	32.8	24.1	50.1	9.2	603.3	72.0	500.0	46.0	5251.8	355
42	COPTS	181.3	98.4	94.3	141.0	129.0	71.3	127.9	34.0	25.0	53.8	21.8	5.5	50.6	1200.0	29.0	2673.5	38
43	GUANC	185.8	99.9	97.2	143.8	131.1	69.6	134.5	32.9	23.7	50.7	20.7	134.0	68.0	600.0	28.0	5918.8	77
44	EDOTKYM	182.7	102.4	94.0	140.3	137.9	70.2	135.6	35.1	25.4	53.0	15.0	1520.0	62.0	300.0	36.0	10899.5	158
45	EDOTKYWM	182.1	100.9	95.0	141.1	137.2	70.2	134.6	34.9	25.4	52.3	15.0	1520.0	62.0	275.0	36.0	10899.5	65
46	GOFNA	181.4	102.5	93.7	137.5	136.4	70.6	130.0	35.9	25.9	51.6	15.0	1520.0	62.0	250.0	36.0	10899.5	45
47	IKENH	181.9	102.1	93.8	139.9	137.0	71.8	136.1	34.4	26.3	51.8	15.0	1520.0	62.0	250.0	36.0	10899.5	73
48	EDOFKOKM	183.4	103.0	94.5	138.9	138.5	73.1	137.1	34.0	26.6	51.7	16.0	796.0	68.0	216.7	34.0	10039.9	67
49	R-AIN	187.6	105.7	95.4	141.0	136.2	73.4	138.6	34.4	25.9	50.6	-0.2	774.1	82.0	49.0	52.0	11252.9	38
50	HOKKAINM	188.3	105.3	96.7	141.0	137.7	68.8	135.8	34.2	26.2	49.7	6.7	1071.2	76.3	80.7	42.7	10902.2	120
51	TOHOKUM	181.2	101.5	94.1	139.5	136.3	69.0	133.4	35.1	25.7	52.0	10.8	1326.0	76.3	51.5	39.0	10908.8	61
52	KANTOM	179.8	101.5	93.9	140.9	138.4	71.2	134.0	34.4	25.3	52.1	13.5	1586.3	73.4	47.3	36.0	10899.5	213
53	HOKRKM	183.0	100.9	93.0	139.8	134.5	70.0	135.0	35.2	24.9	51.5	14.0	2560.0	72.0	68.5	37.0	10614.4	30
54	KINAI	178.4	102.3	93.1	141.0	139.8	72.9	133.4	34.3	26.3	52.5	15.0	1330.0	72.0	76.0	35.0	10567.0	30
55	KYUSHUM	182.2	103.9	94.0	140.5	141.6	70.7	134.1	34.5	25.5	52.3	16.2	1831.0	73.2	62.0	33.0	10145.4	64
56	YORON	185.4	101.7	95.2	142.8	136.5	70.0	138.8	34.0	27.3	51.4	21.5	2500.0	75.0	130.0	27.0	9933.9	35
57	OK-H1	179.1	99.6	92.5	140.3	137.9	65.9	134.3	34.4	25.6	49.7	22.0	2100.0	75.3	72.0	27.0	9933.9	38
58	HAIMI	180.8	102.1	93.4	139.5	137.5	67.1	135.7	32.6	26.1	51.9	24.0	2150.0	78.0	173.0	24.0	9562.8	33
59	AS-ES	182.5	102.9	95.1	141.4	135.9	77.7	138.1	35.8	24.8	55.3	-8.5	392.7	76.0	3.0	65.0	11851.8	71
60	ALEUTM	180.3	99.6	92.2	149.4	128.8	74.9	143.8	36.0	25.3	51.8	5.0	1381.7	75.4	53.7	53.7	13108.5	133
61	NENET	179.2	98.2	94.2	146.6	129.0	73.9	139.1	34.4	25.0	53.0	-5.4	531.0	81.0	200.0	68.0	7289.5	37
62	KHANT	181.1	100.8	95.9	143.7	127.2	73.9	139.4	35.4	25.9	53.8	-1.3	500.0	77.0	200.0	62.0	6884.6	114
63	MANSI	183.9	99.6	92.8	139.5	126.1	70.8	135.3	34.3	26.3	52.5	-1.3	500.0	77.0	200.0	62.0	6884.6	28
64	SHORS	175.8	97.4	91.2	143.5	132.9	73.0	136.6	33.8	25.0	52.4	2.1	447.0	74.0	150.0	54.0	7130.4	31
65	BELTY	176.2	99.1	92.0	146.0	130.9	73.2	139.3	34.1	25.1	52.7	1.5	476.2	73.2	150.0	53.0	7194.7	45
66	SAGZN	177.5	99.6	93.6	148.0	133.8	75.0	141.5	34.7	26.3	54.2	1.5	476.2	73.2	150.0	53.0	7194.7	31
67	KATSC	181.0	101.7	95.1	147.7	133.4	76.6	141.2	35.4	25.8	55.2	1.5	476.2	73.2	150.0	53.0	7194.7	44
68	TELNG	176.7	100.5	94.8	151.5	130.6	74.2	142.1	34.2	27.0	53.9	2.0	260.0	64.0	150.0	51.0	7032.9	49
69	W-BUR	183.6	102.9	96.5	147.5	135.4	79.1	143.0	35.7	26.8	56.4	-0.4	410.0	72.0	49.0	52.0	7975.2	36
70	B-TUN	181.7	102.0	94.9	150.3	132.6	76.9	142.6	35.3	26.6	55.5	-1.3	396.7	72.0	49.0	52.0	7909.2	36
71	B-T-B	181.9	102.7	95.6	154.6	131.9	77.2	143.5	36.2	27.3	56.1	-1.2	373.0	72.7	49.0	53.0	8527.4	44
72	BURYATM	181.1	102.2	96.2	154.1	131.5	78.0	142.4	35.8	27.5	56.2	-1.3	318.8	75.5	1.5	51.5	8331.9	71
73	YAKUT	184.6	103.8	94.1	147.6	135.8	79.6	143.4	35.2	28.0	57.2	-11.5	315.5	71.0	49.0	66.0	9592.3	40
74	CHUK3	182.9	102.8	95.7	142.3	133.8	78.0	140.8	36.3	24.6	55.7	-10.6	253.9	85.5	49.0	68.0	11404.6	28
75	ULCHS	183.3	103.3	92.5	142.3	134.4	77.6	139.9	35.7	26.7	55.4	-1.6	508.6	75.0	200.0	52.0	10479.0	30
76	KALMY	185.1	101.6	94.4	148.4	130.3	76.7	142.2	34.9	26.8	56.2	10.1	266.3	68.0	49.0	47.0	4704.0	42
77	TUVA	183.1	102.2	95.8	150.6	131.3	76.4	142.4	34.8	27.0	55.3	1.0	430.0	73.0	150.0	52.0	7520.1	54
78	KAZKH	180.1	102.6	96.0	151.1	131.4	75.8	142.5	34.6	26.9	54.4	2.7	260.7	65.8	3.0	48.0	6006.3	74
79	MONGL	182.2	100.5	94.3	149.0	131.4	78.0	141.8	35.8	27.4	56.5	-0.8	318.2	60.4	49.0	47.0	7911.7	79
80	FUSHN	180.8	101.3	90.8	139.7	139.2	76.2	134.3	35.5	25.7	55.1	12.9	747.0	63.0	67.0	36.0	8937.2	75
81	LIAON	180.1	100.2	91.7	140.4	137.2	76.6	134.7	35.4	25.0	54.1	8.3	706.4	64.0	3.0	42.0	9359.1	106
82	TAIYU	175.5	99.2	91.7	137.7	135.2	75.8	132.0	36.0	24.5	54.2	10.0	420.0	59.5	12.0	38.0	8501.4	68
83	S-CHI	177.9	99.6	93.6	140.1	137.7	69.4	132.6	33.5	25.9	52.9	20.9	1817.0	77.9	18.0	25.0	8749.9	55
84	ZHUAN	178.3	98.8	94.3	140.6	136.6	69.4	135.5	33.9	26.2	51.8	21.5	1501.0	77.1	11.0	24.0	8041.0	67
85	HON-K	179.3	101.4	92.4	139.6	140.2	72.9	133.4	33.8	26.2	53.3	23.0	2180.0	75.0	11.0	22.0	8549.9	143
86	KOREAM	175.8	99.6	91.9	142.5	139.3	73.9	135.5	35.1	25.8	53.5	11.8	1080.0	70.4	68.3	37.8	9750.5	299
87	TIBE2	179.6	97.4	93.5	139.4	132.6	73.0	133.8	35.7	26.2	53.4	7.0	400.0	45.0	77.0	30.0	6364.3	32
88	THAIS	171.7	99.4	94.8	144.5	135.3	68.8	133.8	33.4	27.1	53.8	26.0	1200.0	72.9	5.0	19.0	6980.1	67
89	VIETN	174.5	98.8	94.3	139.1	136.8	67.4	133.5	33.6	26.0	51.5	25.0	2980.0	79.0	34.0	16.0	7924.2	66
90	KHMER	173.7	98.6	94.6	140.4	136.8	67.6	132.5	32.8	27.6	51.5	27.6	1553.0	77.9	34.0	13.0	7604.4	33
91	DAYAK	176.6	99.4	93.3	138.2	134.8	69.7	132.9	33.5	27.2	52.9	26.4	3201.0	84.5	69.0	0.0	8350.3	50
92	SAUSTM	188.5	101.6	95.6	123.0	129.7	65.7	131.0	33.6	27.4	49.8	18.7	226.7	44.7	26.0	31.7	11362.8	97
93	PAPUA	182.7	98.9	94.0	129.1	131.7	66.8	128.3	34.1	25.7	50.8	20.1	2210.0	78.9	4.0	6.0	12055.5	81
94	SOLOM	181.7	99.6	92.2	130.3	135.0	64.4	131.0	33.5	25.6	49.9	26.0	2770.0	83.0	4.0	10.0	13829.7	38
95	FINNS	182.4	101.4	99.1	143.7	133.8	70.7	132.5	33.1	25.5	52.1	3.0	610.0	83.0	34.0	62.0	6343.4	70
96	RUSS2	178.2	100.4	98.1	145.6	135.2	69.4	133.7	32.1	25.0	50.2	3.7	748.9	79.0	34.0	59.0	5957.3	86
97	ESTON	181.2	100.5	96.1	141.5	135.0	69.2	132.9	31.2	24.9	50.2	5.3	745.0	81.0	300.0	59.0	6030.0	38
98	E-LAT	182.9	101.9	97.4	144.6	134.8	70.9	134.4	32.4	24.9	51.2	5.5	560.0	80.7	34.0	57.0	5800.2	45
99	LITHU	180.8	100.4	97.6	144.7	131.4	68.1	132.6	33.2	24.3	52.5	6.0	660.0	81.3	200.0	55.0	5614.6	209
100	WUERT	179.5	98.6	98.6	147.9	129.9	71.5	133.3	34.1	23.9	50.7	7.0	1100.0	79.0	98.0	49.0	5425.6	93
101	BAVR2	180.6	100.3	101.0	150.5	132.8	70.8	135.0	33.7	24.8	50.9	8.0	920.0	79.6	117.0	48.0	5250.7	78
102	CARIN	178.3	98.1	97.6	146.9	128.7	69.3	133.6	33.5	24.6	50.6	6.6	836.0	75.0	250.0	48.0	5171.7	246
103	FRENC	181.6	99.7	96.2	143.4	129.7	68.4	130.7	33.3	23.1	50.4	11.8	737.1	79.0	130.0	46.0	5567.3	56
104	BASQU	185.8	99.6	97.1	143.5	130.8	70.7	128.8	33.6	23.2	51.9	13.2	1565.0	78.0	132.0	43.0	5592.3	37
105	FARRN	188.8	100.1	96.8	142.4	129.7	70.5	131.0	34.3	24.6	51.0	11.4	629.9	77.0	350.0	52.0	6136.4	104
106	WHITE	189.1	101.6	98.0	140.7	132.0	70.2	130.1	33.4	24.3	50.3	11.4	629.9	77.0	350.0	52.0	6136.4	98
107	TYROL	180.1	100.6	101.0	151.2	132.6	74.5	135.7	36.0	25.5	53.0	8.4	1177.0	72.9	116.0	47.0	5158.2	127
108	VORAR	177.0	99.0	100.0	148.0	130.0	71.8	131.8	33.4	24.2	50.6	5.6	1908.0	76.9	112.0	47.0	5245.4	304
109	SLOVN	175.5	99.9	97.5	146.1	133.6	71.0	134.2	33.0	23.9	49.7	8.0	620.0	81.3	150.0	46.0	4981.8	60
110	CZECH	175.9	98.7	97.4	145.6	131.4	67.3	131.3	32.9	23.9	49.8	8.0	470.0	79.2	88.0	50.0	5363.5	107
111	SE-CR	175.4	102.1	98.2	147.5	136.4	70.2	136.5	33.4	24.5	51.7	14.0	800.0	72.0	116.0	44.0	4751.4	80
112	GREEK	176.4	101.0	97.1	143.1	136.1	71.8	132.1	34.3	24.5	51.8	18.5	364.8	60.5	119.0	38.0	3818.5	89
113	MALTA	180.5	101.1	96.6	139.0	135.6	68.1	132.3	33.3	24.4	51.3	18.8	570.0	75.8	300.0	36.0	4071.3	439
114	ALGER	182.9	102.6	93.9	136.6	134.7	71.0	128.3	34.0	25.0	52.0	17.6	516.7	67.5	150.0	37.0	4988.5	32
115	C-NGU	187.3	101.3	98.0	136.0	133.0	65.5	129.9	33.5	27.9	49.2	16.8	681.6	66.9	23.0	32.0	4240.3	123
116	SOTHO	186.1	100.4	97.4	133.6	131.7	66.6	128.8	33.6	27.2	49.5	16.2	691.0	60.3	23.0	26.0	3568.7	149
117	SHANG	187.1	101.8	97.7	132.6	134.5	66.8	130.6	33.8	27.5	49.5	22.4	529.4	65.4	32.0	24.0	3310.7	55

[1)] Both average and minimum sample sizes across craniofacial measurements in each sample are 25 or more (Class A in Table 1).

Appendix 4. The sample means for the third variable set of the skull (Table 1) in 237 male samples of the Neolithic to modern times from all over the world.[1)]

	Sample	Martin's No. 1	No. 9	No. 8	No. 17	No. 48	No. 45	No. 52	No. 54	No. 55	Av. temp.	Av. precip.	Av. rel. humid.	Chrono. age	Abs (latitude)	Gr. cir. distance	Av. sample size
1	JOM2KNTM	184.5	97.0	143.8	139.6	67.3	141.3	32.0	26.5	49.3	14.1	1511.0	66.8	4330.0	36.0	10899.5	54
2	BAI I	187.1	92.8	143.0	130.7	73.9	138.9	33.7	26.1	53.4	-1.0	367.3	73.4	7100.0	53.0	8199.0	49
3	CERNC	189.9	98.5	141.0	140.5	68.8	129.1	32.5	25.7	51.3	11.0	580.0	77.1	5900.0	44.0	4398.1	56
4	S-EGY	182.5	91.1	131.6	134.1	68.5	123.6	31.5	24.8	48.8	22.9	0.6	42.0	6000.0	27.0	2456.6	65
5	NAQAD	185.1	91.1	134.9	135.2	67.6	125.6	31.9	25.1	48.9	24.6	1.3	41.1	5700.0	26.0	2310.4	104
6	YAYOYMGM	183.0	96.9	142.0	135.2	72.6	139.2	34.6	26.9	52.9	15.0	1620.0	76.0	2333.3	34.0	10131.3	48
7	YAYOFUKM	183.9	95.8	142.4	137.9	74.7	139.8	34.3	27.0	52.6	15.9	854.2	68.5	2200.0	33.7	10075.9	95
8	YAYOSAGM	183.4	96.1	143.2	135.7	70.2	139.8	33.8	27.4	51.1	15.5	1280.4	68.0	2260.0	33.4	10047.7	43
9	EKVEN	192.8	96.2	134.3	138.9	76.7	140.5	35.4	24.4	55.2	-7.0	300.0	85.0	2000.0	66.0	11754.6	50
10	TASTY	181.7	96.2	140.0	130.7	72.6	134.2	33.6	25.5	51.8	1.4	311.2	69.0	1900.0	54.0	7303.7	30
11	TAGAR	186.3	98.8	142.2	136.6	72.0	137.5	32.4	24.9	52.1	2.0	260.0	64.0	2500.0	51.0	7032.9	68
12	ZOLTJ	185.2	96.1	140.5	134.6	71.3	133.8	32.8	25.0	51.0	10.3	435.0	74.0	2000.0	47.0	4626.8	40
13	SARMT	184.0	98.0	146.8	135.0	71.6	137.0	33.3	25.1	51.8	10.4	387.7	76.8	2000.0	47.0	4624.0	28
14	NPLSK	185.7	97.1	140.2	136.7	71.7	133.4	32.9	24.8	51.0	10.0	530.0	71.5	2000.0	45.0	4404.8	97
15	TIANS	183.6	95.2	141.8	135.7	71.8	131.1	33.1	25.0	52.1	9.4	222.8	57.8	2800.0	44.0	6626.8	30
16	HUNNN	177.9	96.1	142.2	136.0	73.3	136.7	34.4	25.5	52.8	2.7	382.4	53.4	1800.0	42.0	5947.8	73
17	USUNN	179.1	96.6	145.7	132.8	71.4	136.3	33.7	25.6	52.1	2.7	382.4	53.4	1900.0	42.0	5947.8	40
18	CHAWH	183.4	94.2	136.5	135.8	70.7	131.1	31.8	24.8	51.3	8.0	60.0	54.0	3300.0	42.0	6386.0	45
19	SHANP	188.5	95.7	137.6	140.2	75.0	131.7	33.1	25.0	54.4	12.0	45.7	43.3	2600.0	37.0	5679.4	26
20	MURRY	189.1	87.0	130.5	133.5	70.6	135.6	32.9	28.4	50.0	17.0	260.0	52.0	2100.0	35.0	11897.8	46
21	BRITS	187.4	98.0	141.4	132.9	69.1	130.6	33.6	23.7	50.6	8.0	780.0	84.0	2000.0	52.0	6185.6	67
22	LABAY	182.2	96.2	143.0	137.1	67.1	132.5	30.2	24.4	49.2	9.0	690.0	84.0	2300.0	50.0	5830.9	83
23	GAULS	186.6	96.5	143.2	132.9	70.1	132.3	32.6	24.0	51.5	10.0	630.0	80.0	2000.0	49.0	5700.3	73
24	ETRUS	184.2	96.1	143.2	134.3	70.8	132.2	33.1	24.3	51.0	13.1	816.0	75.3	2500.0	43.0	4794.1	150
25	ETR-R	183.0	96.1	143.7	133.4	70.7	131.9	32.9	24.1	51.6	16.3	662.8	72.8	2400.0	42.0	4704.8	84
26	POMPE	181.6	98.7	142.6	131.3	70.7	131.7	34.1	24.1	52.2	15.5	1007.0	72.3	1921.0	41.0	4517.3	53
27	TARRG	186.8	96.8	142.0	133.6	71.9	134.8	33.7	24.9	52.9	16.0	590.0	70.0	2100.0	41.0	5260.2	87
28	GREE9	186.7	96.8	140.8	133.0	69.0	131.0	32.9	24.7	50.8	16.5	573.8	65.3	2500.0	39.0	3988.3	50
29	GRE10	184.4	96.7	142.5	133.2	69.7	131.1	33.5	24.8	50.8	16.5	573.8	65.3	2100.0	39.0	3988.3	60
30	IKIZT	188.5	99.5	142.1	138.1	70.4	133.8	31.5	25.3	50.7	13.5	778.0	71.0	2400.0	42.0	4068.5	66
31	SHARI	186.4	96.0	136.5	137.7	70.1	129.7	32.0	25.7	51.4	20.0	80.0	43.0	2500.0	32.0	4009.0	38
32	PN-TP	191.7	97.2	136.0	138.5	71.2	130.0	32.2	25.5	51.2	14.8	180.5	47.7	4500.0	36.0	3868.9	38
33	LACHI	184.5	95.5	136.8	133.8	70.1	128.4	32.9	25.2	51.4	19.7	514.5	61.0	2700.0	32.0	2957.7	199
34	GIZEH	185.3	94.8	138.9	134.1	70.4	128.7	33.7	24.4	51.7	21.8	19.8	54.7	2500.0	30.0	2782.3	880
35	SAKKA	185.0	95.0	141.0	137.0	76.7	131.0	33.0	24.0	52.0	21.8	19.8	54.7	2600.0	30.0	2782.3	31
36	HELUA	186.7	94.2	139.4	135.1	71.0	129.4	33.3	26.4	51.3	21.3	20.0	53.8	2800.0	30.0	2782.3	35
37	SIWAH	184.2	92.6	135.6	131.5	68.5	125.0	33.1	23.4	50.5	21.5	12.3	45.1	1900.0	29.0	2823.0	68
38	N-EGY	181.9	92.6	138.3	137.4	71.5	127.2	33.3	24.5	51.4	21.8	7.2	51.9	4100.0	29.0	2673.5	38
39	NAG-E	185.1	91.5	137.1	136.6	72.1	127.6	33.3	25.6	50.7	22.0	10.0	45.0	2000.0	27.0	2456.6	37
40	DENDR	182.5	95.3	135.8	131.5	71.0	128.5	32.4	25.6	51.4	23.9	1.6	41.0	2300.0	26.0	2310.4	100
41	THEBS	181.9	93.8	136.6	136.1	68.8	128.3	33.0	25.3	50.6	23.9	1.6	41.0	3300.0	26.0	2310.4	168
42	ABY-I	184.9	93.0	136.2	132.1	74.7	129.7	33.5	25.5	53.9	24.2	0.5	41.2	2900.0	26.0	2327.1	34
43	SEBUA	185.6	91.3	135.6	133.9	68.5	126.6	32.2	25.1	50.3	25.2	1.2	34.1	3300.0	25.0	2200.5	121
44	THEBN	181.8	93.6	138.3	137.1	72.0	127.6	33.1	25.0	51.8	25.0	1.1	35.2	2100.0	25.0	2218.1	47
45	QUBBT	185.6	94.4	138.7	137.7	71.5	128.9	33.6	26.2	52.3	25.0	1.1	35.2	1900.0	25.0	2218.1	265
46	EL-KN	182.2	90.4	134.2	135.9	70.1	125.5	32.3	24.8	49.8	25.0	1.1	35.2	2000.0	25.0	2218.1	35
47	EL-KS	182.7	92.7	135.9	132.9	70.2	125.7	32.8	25.0	49.4	25.0	1.1	35.2	2100.0	25.0	2218.1	66
48	ELEPH	183.4	92.6	136.5	137.4	70.4	127.6	33.1	25.6	51.2	25.8	0.5	30.5	2100.0	24.0	2090.7	35
49	LNU-A	182.8	93.2	134.0	133.7	69.7	127.5	32.2	25.1	50.7	26.1	0.4	27.6	4600.0	23.0	1981.0	97
50	LNU-D	185.6	91.3	135.6	133.9	68.5	126.6	32.2	25.1	50.3	26.1	0.4	27.6	2900.0	23.0	1981.0	121
51	L NUB	182.3	93.3	132.7	132.2	68.7	126.0	32.3	26.1	48.8	26.1	0.4	27.6	2000.0	23.0	1966.9	111
52	U NUB	184.9	93.7	133.4	133.0	68.6	126.6	32.3	25.8	49.4	25.6	0.4	26.8	1900.0	22.0	1919.5	34
53	AKSHA	182.3	93.1	133.9	133.5	67.5	127.1	32.5	26.7	47.5	25.6	0.4	26.8	2000.0	22.0	1919.5	35
54	KOFFKOKM	181.6	94.9	141.0	135.7	72.1	138.7	34.1	26.3	51.6	15.6	1261.6	72.0	1300.0	34.0	10131.3	49
55	N-KAM	186.3	96.9	141.4	135.3	70.7	133.7	32.4	26.4	51.5	2.5	625.6	77.3	1500.0	58.0	6029.9	41
56	KOKEL	185.0	95.8	145.3	135.3	75.4	139.5	34.3	25.4	54.2	1.5	476.2	73.2	1700.0	53.0	7375.7	132
57	KAMNK	180.3	96.9	144.7	132.0	73.6	136.4	32.5	25.4	52.5	4.5	544.5	76.0	1000.0	53.0	5340.9	29
58	VOLGA	184.1	98.5	145.1	135.7	71.6	137.6	33.4	25.0	51.9	7.1	410.0	70.0	1800.0	52.0	5261.0	57
59	SALTV	185.7	97.2	138.3	138.2	73.3	131.8	32.8	25.6	53.4	7.4	399.5	69.3	1200.0	51.0	5170.7	45
60	SRKL1	183.7	97.3	141.5	136.6	71.7	134.6	33.7	25.7	52.9	9.4	524.3	75.0	1100.0	48.0	4769.3	134
61	POLJ1	186.6	96.3	138.1	134.9	69.8	132.5	31.7	25.1	50.1	7.0	690.0	75.8	1100.0	50.0	4978.0	81
62	UKRAI	186.9	95.2	137.6	137.7	70.8	131.3	33.0	24.9	51.8	9.0	442.0	73.5	1700.0	47.0	4631.6	56
63	SKALI	180.3	97.3	141.8	136.8	69.7	133.1	33.2	25.4	49.9	10.0	530.0	71.5	1200.0	45.0	4404.8	55
64	ESKIK	175.0	97.0	147.8	132.6	69.3	136.8	32.5	24.6	51.1	10.0	530.0	71.5	1000.0	45.0	4404.8	118
65	CR-GO	180.1	98.7	145.2	133.4	71.2	136.0	33.2	25.0	52.1	10.5	454.5	71.5	1000.0	45.0	4410.0	90
66	GOLDN	176.9	96.2	146.2	132.6	71.2	135.2	32.8	25.5	51.8	9.9	187.9	67.8	1600.0	47.0	4789.4	38
67	S-ARA	181.7	100.6	143.1	137.1	73.7	135.4	33.5	25.9	54.2	10.9	120.0	62.0	1800.0	44.0	4844.7	34
68	TOK-K	181.5	98.3	145.4	137.5	75.3	134.3	34.8	25.9	54.2	12.3	108.8	61.3	1300.0	42.0	4711.7	34
69	MINGE	188.5	98.6	135.0	135.1	71.5	130.8	33.1	25.2	53.7	15.2	410.0	64.2	1700.0	40.0	4061.5	32
70	BAJRA	187.4	101.3	140.4	137.8	74.0	133.9	33.0	25.4	53.9	15.0	186.0	49.9	1600.0	38.0	4479.0	43
71	KIVUT	192.0	96.4	136.9	141.0	72.5	129.3	34.6	23.8	53.1	6.0	560.0	80.4	1800.0	57.0	5845.4	42
72	OSTRO	185.2	97.3	140.9	136.0	65.0	132.4	31.8	24.6	49.5	8.0	510.0	79.2	1100.0	53.0	5564.0	324
73	CEDYN	189.0	97.6	139.3	134.7	68.1	132.5	32.9	24.4	51.6	8.0	540.0	82.0	1200.0	53.0	5654.4	80
74	LIBIC	189.3	97.9	141.8	136.9	71.2	132.8	33.5	24.9	51.8	8.0	470.0	79.2	1000.0	50.0	5328.6	52
75	MIKU2	188.4	99.5	142.4	137.2	72.7	134.2	33.9	25.6	52.5	9.3	470.0	72.9	1100.0	49.0	5163.4	116
76	ZELOV	185.5	99.3	142.2	136.2	70.6	133.0	31.9	25.8	50.9	8.6	618.5	74.5	1300.0	48.0	4999.9	45
77	NOV-Z	184.1	97.6	139.8	133.3	71.5	133.9	33.4	25.5	52.0	10.2	530.0	74.6	1300.0	48.0	5031.2	64
78	HOLIA	185.5	97.1	140.8	134.0	72.5	133.0	32.7	25.3	54.2	10.0	490.0	73.0	1300.0	48.0	5031.2	54
79	FEHER	182.2	98.1	139.5	131.5	70.9	134.5	34.2	25.8	52.6	10.0	490.0	73.0	1400.0	48.0	5064.1	68
80	ALATT	185.4	98.5	147.7	130.5	69.4	136.4	34.1	26.5	52.6	10.0	620.0	72.2	1400.0	47.0	4868.0	89
81	KECEL	181.1	97.4	145.4	129.3	70.2	133.6	32.7	25.3	51.5	10.5	500.0	72.3	1300.0	47.0	4898.7	29
82	OROSH	185.4	95.5	137.3	134.0	71.9	130.5	33.3	24.7	50.5	11.0	500.0	70.5	1000.0	47.0	4838.9	107
83	SZEGD	182.6	96.8	145.0	129.5	68.9	134.0	32.8	25.3	50.6	11.0	500.0	70.5	1000.0	46.0	4766.0	54
84	HOMOK	181.9	97.4	145.2	133.2	72.2	134.3	33.1	25.0	51.4	11.0	500.0	70.5	1300.0	46.0	4797.9	33
85	PTUJ	189.3	99.5	143.6	136.5	70.6	133.2	32.9	24.7	53.4	9.0	782.0	76.5	1000.0	46.0	4903.5	73
86	DREGV	188.0	95.0	137.0	136.8	68.7	132.8	31.3	25.2	50.5	12.0	660.0	66.0	1000.0	45.0	4664.4	47
87	VARNA	182.2	97.2	141.3	133.8	68.8	131.5	33.2	25.1	51.3	12.0	440.0	78.5	1600.0	43.0	4250.7	29
88	GALLN	190.4	98.5	145.3	134.7	72.0	135.6	33.1	24.2	51.4	9.0	880.0	86.0	1200.0	53.0	6618.9	90
89	CIPLY	188.3	95.6	142.4	133.1	68.8	132.3	33.7	24.2	55.1	10.0	870.0	82.5	1400.0	50.0	5782.6	37
90	FRNK1	188.4	97.5	142.3	133.1	72.8	133.9	33.8	24.8	52.6	10.5	670.0	83.0	1400.0	50.0	5930.4	35
91	FRNK3	187.0	96.6	138.2	132.2	71.8	129.0	33.4	24.4	52.0	10.0	490.0	74.0	1400.0	50.0	5600.6	48
92	BREMN	187.9	96.6	143.0	128.9	71.3	133.1	33.4	24.6	51.2	8.0	690.0	79.5	1000.0	53.0	5829.9	58
93	ANDRT	191.7	97.8	140.7	133.5	70.7	132.3	32.5	25.0	52.0	8.0	600.0	81.0	1400.0	52.0	5700.0	32
94	MANNH	189.4	97.0	140.8	134.1	70.9	132.7	33.3	24.4	52.0	11.0	550.0	75.5	1400.0	50.0	5557.9	84
95	ELTVL	191.0	96.8	140.9	133.6	70.8	134.1	33.1	24.1	51.9	10.0	490.0	74.0	1400.0	50.0	5600.6	47
96	KAISR	189.5	97.1	141.6	130.7	67.8	132.7	32.1	24.1	49.2	8.0	700.0	73.0	1300.0	49.0	5512.4	70
97	ALAMN	192.0	98.1	142.3	137.5	71.7	134.5	34.6	25.2	52.9	8.0	730.0	75.0	1400.0	48.0	5424.9	42
98	HAINB	179.8	98.0	143.9	139.6	69.7	132.1	31.5	24.2	49.1	11.4	547.9	72.0	1700.0	48.0	5064.1	55
99	AARE	186.6	99.1	145.9	133.6	71.6	136.5	32.6	24.7	52.6	7.9	1028.0	78.2	1400.0	47.0	5386.1	37
100	BONAD	188.3	97.2	143.6	133.1	69.6	133.0	32.9	24.2	50.9	9.7	848.6	70.0	1500.0	47.0	5291.1	71
101	ETRUS	183.0	96.1	143.7	133.4	70.7	131.9	32.9	24.1	50.8	16.3	662.8	72.8	2400.0	42.0	4704.8	84
102	TARRG	186.8	96.9	142.0	133.7	72.0	134.9	33.7	24.9	52.9	15.9	560.5	70.0	1600.0	41.0	5260.2	87
103	LCASN	189.3	100.3	140.5	135.3	73.0	132.6	33.6	25.2	52.8	5.0	580.0	70.0	1800.0	41.0	4037.0	85
104	SHURF	182.8	95.8	138.9	132.2	68.0	128.9	34.4	25.4	52.4	21.4	4.6	49.6	1600.0	28.0	2564.9	62
105	ABYD2	182.4	96.1	140.2	130.8	70.8	129.7	33.5	24.8	51.5	24.2	0.5	41.2	1400.0	26.0	2327.1	31
106	THEB4	183.5	94.9	137.3	133.7	70.1	128.6	32.8	25.6	50.8	24.2	1.3	40.1	1300.0	26.0	2327.1	55
107	THEB5	181.9	93.8	136.6	131.9	68.8	128.3	33.0	25.3	50.6	24.2	1.3	40.1	1300.0	26.0	2327.1	168
108	L-NB2	183.3	91.5	131.9	131.2	67.5	123.7	32.3	25.5	48.8	26.1	0.4	27.6	1500.0	23.0	1981.0	67
109	U-NUB	186.0	92.6	132.2	131.2	67.9	126.1	32.0	26.3	48.4	25.6	0.4	26.8	1600.0	22.0	1919.5	38
110	MIRGS	186.0	92.2	138.2	134.3	70.8	127.8	33.2	25.6	50.9	26.2	8.7	25.5	1700.0	21.0	1847.8	189
111	KERMA	185.2	92.8	133.6	133.4	69.6	127.5	32.7	25.8	50.0	27.3	8.7	24.9	1800.0	20.0	1744.5	114
112	MEDKAMKM	184.8	94.4	137.6	137.7	66.0	135.6	33.7	26.4	51.5	16.0	1600.0	72.0	700.0	35.0	10923.9	244
113	IROQU	188.3	95.5	140.0	137.8	73.5	140.3	34.7	27.2	54.6	8.2	785.9	71.3	500.0	44.0	17410.7	57
114	PERUV	179.4	92.4	135.5	137.1	67.7	134.8	34.7	24.2	49.3	7.9	779.1	59.1	500.0	13.0	23467.6	66
115	MEDCHAMM	181.6	96.6	140.4	142.1	69.3	140.7	35.2	26.6	54.3	27.3	2126.0	80.9	750.0	15.0	11927.1	60
116	HAWAI	182.0	95.9	144.1	141.9	68.6	136.6	35.0	26.4	54.5	22.4	1692.0	77.0	500.0	20.0	16894.7	87
117	MOKAP	185.9	97.2	146.2	144.2	68.2	136.9	34.9	26.3	53.0	24.4	815.3	73.1	600.0	21.0	16700.0	63
118	TROND	183.8	95.1	140.2	129.0	71.1	131.3	34.2	24.2	51.4	4.8	855.0	75.5	600.0	63.0	6738.9	109
119	OSLO	187.4	96.9	140.8	132.1	72.0	133.9	33.7	24.7	51.9	6.0	760.0	77.9	600.0	60.0	6423.3	448
120	CUDEN	184.1	99.4	142.9	136.7	68.7	136.0	31.2	25.2	49.8	3.6	619.7	80.0	800.0	59.0	5971.7	116
121	SLOVN	183.9	97.6	141.9	136.5	68.7	132.5	31.5	24.9	49.5	4.2	687.4	80.0	800.0	59.0	5971.7	99
122	GRODK	186.3	97.3	139.7	136.8	68.7	133.3	31.6	25.1	50.9	7.0	448.0	78.5	600.0	52.0	5313.7	122
123	BOHMN	186.2	98.0	141.9	138.0	68.1	131.5	32.4	25.2	51.3	8.0	470.0	79.2	1200.0	50.0	5363.5	51
124	MIKUL	188.4	99.5	142.4	137.2	72.7	134.2	33.9	25.6	52.5	9.3	470.0	72.9	1200.0	49.0	5163.4	116
125	DNIES	184.1	97.6	142.6	135.4	71.5	135.8	33.4	25.7	51.6	8.0	565.5	76.0	900.0	48.0	4809.7	63
126	NOV-Z	184.1	97.6	139.8	133.3	71.5	133.9	33.4	25.5	52.0	10.2	530.0	74.6	1300.0	48.0	5031.2	64
127	MAGYR	179.7	96.7	147.6	135.6	72.9	134.7	34.6	25.6	53.8	10.0	620.0	70.4	1200.0	47.0	4868.0	29
128	KERPS	183.4	99.1	142.6	135.1	69.3	133.7	32.8	25.2	50.6	10.0	620.0	70.4	800.0	47.0	4868.0	76
129	SZATY	184.5	97.5	139.1	133.6	71.3	131.2	33.0	25.3	51.5	11.0	500.0	70.5	1000.0	46.0	4766.0	70
130	ZALVR	185.4	96.9	141.5	134.8	69.4	132.4	32.7	25.0	50.5	10.0	490.0	72.0	900.0	47.0	4965.1	83
131	FESZR	184.5	97.4	138.4	136.8	69.0	133.9	32.1	24.7	51.4	10.8	700.0	73.3	1300.0	46.0	4831.4	33
132	VUKVR	182.9	98.9	144.1	134.2	78.1	129.2	32.9	23.8	52.2	10.5	641.0	75.5	1100.0	45.0	4697.4	70
133	VINCA	181.1	99.8	143.7	146.6	69.2	132.2	32.9	24.9	50.9	12.0	660.0	66.0	800.0	45.0	4633.2	69
134	DEVIN	180.7	97.7	147.0	134.2	69.3	133.5	34.2	25.7	52.1	7.0	1290.0	69.0	1000.0	42.0	4235.2	64
135	GEOR1	184.6	97.1	139.7	135.8	71.5	133.3	33.6	24.8	53.4	15.0	1290.0	72.0	1100.0	42.0	4145.1	89
136	GEOR2	179.8	100.0	148.1	135.7	70.1	137.3	33.3	24.9	52.7	15.0	1290.0	72.0	800.0	42.0	4145.1	290
137	GEOR3	179.5	101.1	149.1	136.3	71.7	138.8	34.4	25.3	53.3	15.0	1290.0	72.0	400.0	42.0	4145.1	120
138	REIHN	189.4	97.7	139.8	135.6	70.2	132.2	32.9	24.9	52.6	8.5	718.5	76.5	1400.0	50.0	5557.9	116
139	ZWENT	187.8	99.0	142.0	134.4	68.5	133.6	32.1	24.4	49.6	8.0	690.0	78.0	1000.0	48.0	5098.4	40
140	ZWOLF	187.7	96.4	142.6	132.5	70.9	133.8	33.2	25.3	52.1	9.9	514.5	71.9	1200.0	48.0	5098.4	45
141	SIERR	182.1	99.9	149.0	133.5	69.7	137.2	32.5	23.8	49.8	9.2	603.3	72.0	500.0	46.0	5251.8	65
142	VALAI	177.7	99.6	151.0	132.9	70.9	136.3	32.8	24.1	50.1	9.2	603.3	72.0	500.0	46.0	5251.8	354
143	MEDENGM	177.9	98.6	146.7	134.1	69.9	134.3	33.0	24.8	51.1	9.5	605.9	82.5	850.0	51.5	6097.5	107
144	COPTS	181.3	94.3	141.0	129.0	71.3	127.9	34.0	25.0	53.8	21.8	5.5	50.6	1200.0	29.0	2673.5	38
145	CANRY	187.0	97.5	140.9	133.5	69.2	132.0	32.5	24.3	50.6	21.3	116.0	67.0	800.0	28.0	6108.6	1316
146	GUANC	185.8	97.2	143.8	131.1	69.6	134.5	32.9	23.7	50.7	20.7	134.0	68.0	600.0	28.0	5918.8	77
147	G-CAN	187.9	98.6	140.4	134.6	69.8	132.2	32.5	24.5	50.9	20.3	160.0	71.0	1453.0	28.0	6013.6	784
148	EDOTKYM	182.7	94.0	140.3	137.9	70.2	135.6	35.1	25.4	53.0	15.0	1520.0	62.0	300.0	36.0	10899.5	162
149	EDOTKYWM	182.1	95.0	141.1	137.2	70.2	134.6	34.9	25.4	52.3	15.0	1520.0	62.0	275.0	36.0	10899.5	66
150	GOFNA	181.4	93.7	137.5	136.4	70.6	130.0	35.9	25.9	51.6	15.0	1520.0	62.0	250.0	36.0	10899.5	45
151	IKENH	181.9	93.8	139.9	137.0	71.8	136.1	34.4	26.3	51.8	15.0	1520.0	62.0	250.0	36.0	10899.5	73
152	EDOFKOKM	183.4	94.5	138.9	138.5	73.1	137.1	34.0	26.6	51.7	16.0	796.0	68.0	216.7	34.0	10039.9	66
153	R-AIN	187.6	95.4	141.0	136.2	73.4	138.6	34.4	25.9	50.6	-0.2	774.1	82.0	49.0	52.0	11252.9	38
154	HOKKAINM	188.3	96.7	141.0	137.7	68.8	135.8	34.2	26.2	49.7	6.7	1071.2	76.3	80.7	42.7	10902.2	120
155	TOHOKUM	181.2	94.1	139.5	136.3	69.0	133.4	35.1	25.7	52.0	10.8	1326.0	76.3	51.5	39.0	10908.8	61
156	KANTOM	179.8	93.9	140.9	138.4	71.2	134.0	34.4	25.3	52.1	13.5	1586.3	73.4	47.3	36.0	10899.5	213
157	HOKRKM	183.0	93.0	139.8	134.5	70.0	135.0	35.2	24.9	51.5	14.0	2560.0	72.0	68.5	37.0	10614.4	30
158	KINAI	178.4	93.1	141.0	139.8	72.9	133.4	34.3	26.3	52.5	15.0	1330.0	72.0	76.0	35.0	10567.0	30
159	KYUSHUM	182.2	94.0	140.5	141.6	70.7	134.1	34.5	25.5	52.3	16.2	1831.0	73.2	62.0	33.0	10145.4	64
160	YORON	185.4	95.2	142.8	136.5	70.0	138.8	34.0	27.3	51.4	21.5	2500.0	75.0	130.0	27.0	9933.9	35
161	OK-H1	179.1	92.5	140.3	137.9	65.9	134.3	34.4	25.6	49.7	22.0	2100.0	75.3	72.0	27.0	9933.9	39
162	HAIMI	180.8	93.4	139.5	137.5	67.1	135.7	32.6	26.1	51.9	24.0	2150.0	78.0	173.0	24.0	9562.8	33
163	AS-ES	182.5	95.1	141.4	135.9	77.7	138.1	35.8	24.8	55.3	-8.5	392.7	76.0	3.0	65.0	11851.8	71
164	ALEUTM	180.3	92.2	149.4	128.8	74.9	143.8	36.0	25.3	51.8	5.0	1381.7	75.4	53.7	53.7	13108.5	132
165	NENET	179.2	94.2	146.6	129.0	73.9	139.1	34.4	25.0	53.0	-5.4	531.0	81.0	200.0	68.0	7289.5	37
166	KHANT	181.1	95.9	143.7	127.2	73.9	139.4	35.4	25.9	53.8	-1.3	500.0	77.0	200.0	62.0	6884.6	114
167	MANSI	183.9	92.8	139.5	126.1	70.8	135.3	34.3	26.3	52.5	-1.3	500.0	77.0	200.0	62.0	6884.6	28
168	SHORS	175.8	91.2	143.5	132.9	73.0	136.6	33.8	25.0	52.4	2.1	447.0	74.0	150.0	54.0	7130.4	31
169	BELTY	176.2	92.0	146.0	130.9	73.2	139.3	34.1	25.1	52.7	1.5	476.2	73.2	150.0	53.0	7194.7	45
170	SAGZN	177.5	93.6	148.0	133.8	75.0	141.5	34.7	26.3	54.2	1.5	476.2	73.2	150.0	53.0	7194.7	31
171	KATSC	181.0	95.1	147.7	133.4	76.6	141.2	35.4	25.8	55.2	1.5	476.2	73.2	150.0	53.0	7194.7	44
172	TELNG	176.7	94.8	151.5	130.6	74.2	142.1	34.2	27.0	53.9	2.0	260.0	64.0	150.0	51.0	7032.9	49
173	W-BUR	183.6	96.5	147.5	135.4	79.1	143.0	35.7	26.8	56.4	-0.4	410.0	72.0	49.0	52.0	7975.2	35
174	B-TUN	181.7	94.9	150.3	132.6	76.9	142.6	35.3	26.6	55.5	-1.3	396.7	72.0	49.0	52.0	7909.2	36
175	B-T-B	181.9	95.6	154.6	131.9	77.2	143.5	36.2	27.3	56.1	-1.2	373.0	72.7	49.0	53.0	8527.4	44
176	BURYATM	181.1	96.2	154.1	131.5	78.0	142.4	35.8	27.5	56.2	-1.3	318.8	75.5	1.5	51.5	8331.9	71
177	YAKUT	184.6	94.1	147.6	135.8	79.6	143.4	35.2	28.0	57.2	-11.5	315.5	71.0	49.0	66.0	9592.3	40
178	CHUK3	182.9	95.7	142.3	133.8	78.0	140.8	36.3	24.6	55.7	-10.6	253.9	85.5	49.0	68.0	11404.6	28
179	ULCHS	183.3	92.5	142.3	134.4	77.6	139.9	35.7	26.7	55.4	-1.6	508.6	75.0	200.0	52.0	10479.0	30
180	KALMY	185.1	94.4	148.4	130.3	76.7	142.2	34.9	26.8	56.2	10.1	266.3	68.0	49.0	47.0	4704.0	42
181	TUVA	183.1	95.8	150.6	131.3	76.4	142.4	34.8	27.0	55.3	1.0	430.0	73.0	150.0	52.0	7520.1	54
182	KAZKH	180.1	96.0	151.1	131.4	75.8	142.5	34.6	26.9	54.4	2.7	260.7	65.8	3.0	48.0	6006.3	74
183	MONGL	182.2	94.3	149.0	131.4	78.0	141.8	35.8	27.4	56.5	-0.8	318.2	60.4	49.0	47.0	7911.7	79
184	FUSHN	180.8	90.8	139.7	139.2	76.2	134.3	35.5	25.7	55.1	12.9	747.0	63.0	67.0	36.0	8937.2	75
185	LIAON	180.1	91.7	140.4	137.2	76.6	134.7	35.4	25.0	54.1	8.3	706.4	64.0	3.0	42.0	9359.1	106
186	TAIYU	175.5	91.7	137.7	135.2	75.8	132.0	36.0	24.5	54.2	10.0	420.0	59.5	12.0	38.0	8501.4	68
187	S-CHI	177.9	93.6	140.1	137.7	69.4	132.6	33.5	25.9	52.9	20.9	1817.0	77.9	18.0	25.0	8749.9	55
188	ZHUAN	178.3	94.3	140.6	136.6	69.4	135.5	33.9	26.2	51.8	21.5	1501.0	77.1	11.0	24.0	8041.0	67
189	HON-K	179.3	92.4	139.6	140.2	72.9	133.4	33.8	26.2	53.3	23.0	2180.0	75.0	11.0	22.0	8549.9	143
190	KOREAM	175.8	91.9	142.5	139.3	73.9	135.5	35.1	25.8	53.5	11.8	1080.0	70.4	68.3	37.8	9750.5	296
191	TIBE2	179.6	93.5	139.4	132.6	73.0	133.8	35.7	26.2	53.4	7.0	400.0	45.0	77.0	30.0	6364.3	31
192	THAIS	171.7	94.8	144.5	135.3	68.8	133.8	33.4	27.1	53.8	26.0	1200.0	72.9	5.0	19.0	6980.1	66
193	VIETN	174.5	94.3	139.1	136.8	67.4	133.5	33.6	26.0	51.5	25.0	2980.0	79.0	34.0	16.0	7924.2	66
194	KHMER	173.7	94.6	140.4	136.8	67.6	132.5	32.8	27.6	51.5	27.6	1553.0	77.9	34.0	13.0	7604.4	33
195	DAYAK	176.6	93.3	138.2	134.8	69.7	132.9	33.5	27.2	52.9	26.4	3201.0	84.5	69.0	0.0	8350.3	50
196	SAUSTM	188.5	95.6	123.0	129.7	65.7	131.0	33.6	27.4	49.8	18.7	226.7	44.7	26.0	31.7	11362.8	98
197	PAPUA	182.7	94.0	129.1	131.7	66.8	128.3	34.1	25.7	50.8	20.1	2210.0	78.9	4.0	6.0	12055.5	80
198	SOLOM	181.7	92.2	130.3	135.0	64.4	131.0	33.5	25.6	49.9	26.0	2770.0	83.0	4.0	10.0	13829.7	38
199	LAPPS	178.3	97.2	147.0	128.1	67.9	134.5	33.6	24.8	50.6	1.0	470.0	80.0	65.0	68.0	6989.3	157
200	FINNS	182.4	99.1	143.7	133.8	70.7	132.5	33.1	25.5	52.1	3.0	610.0	83.0	34.0	62.0	6343.4	69
201	RUSS2	178.2	98.1	145.6	135.2	69.4	133.7	32.1	25.0	50.2	3.7	748.9	79.0	34.0	59.0	5957.3	86
202	ESTON	181.2	96.1	141.5	135.0	69.2	132.9	31.2	24.9	50.2	5.3	745.0	81.0	300.0	59.0	6030.0	39
203	E-LAT	182.9	97.4	144.6	134.8	70.9	134.4	32.4	24.9	51.2	5.5	560.0	80.7	34.0	57.0	5800.2	45
204	LITHU	180.8	97.6	144.7	131.4	68.1	132.6	33.2	24.3	52.5	6.0	660.0	81.3	200.0	55.0	5614.6	209
205	DUTCH	185.9	97.8	146.1	128.3	70.6	131.8	35.1	23.9	52.2	10.0	810.0	82.5	62.0	52.0	5905.1	202
206	WARSW	178.7	96.0	142.4	131.0	68.3	130.2	33.2	25.0	51.8	8.0	540.0	80.0	300.0	52.0	5357.8	316
207	WUERT	179.5	98.6	147.9	129.9	71.5	133.3	34.1	23.9	50.7	7.0	1100.0	79.0	98.0	49.0	5425.6	93
208	BAVR2	180.6	101.0	150.5	132.8	70.8	135.0	33.7	24.8	50.9	8.0	920.0	79.6	117.0	48.0	5250.7	77
209	CARIN	178.3	97.6	146.9	128.7	69.3	133.6	33.5	24.6	50.6	6.6	836.0	75.0	250.0	48.0	5171.7	244
210	FRENC	181.6	96.2	143.4	129.7	68.4	130.7	33.3	23.1	50.4	11.8	737.1	79.0	130.0	46.0	5567.3	56
211	BASQU	185.8	97.1	143.5	130.8	70.7	128.8	33.6	23.2	51.9	13.2	1565.0	78.0	132.0	43.0	5592.3	36
212	GLASG	188.2	96.6	139.2	132.9	72.2	127.9	33.6	23.3	50.2	9.6	901.7	81.0	150.0	56.0	6631.7	475
213	FARRN	188.8	96.8	142.4	129.7	70.5	131.0	34.3	24.6	51.0	11.4	629.9	77.0	350.0	52.0	6136.4	103
214	WHITE	189.1	98.0	140.7	132.0	70.2	130.1	33.4	24.3	50.3	11.4	629.9	77.0	350.0	52.0	6136.4	95
215	ELBIN	177.4	100.6	150.1	132.3	69.0	136.9	33.4	24.4	51.1	6.6	829.7	71.6	334.0	47.0	5158.2	342
216	TYROL	180.1	101.0	151.2	132.6	74.5	135.7	36.0	25.5	53.0	8.4	1177.0	72.9	116.0	47.0	5158.2	126
217	VORAR	177.0	100.0	148.0	130.0	71.8	131.8	33.4	24.2	50.6	5.6	1908.0	76.9	112.0	47.0	5245.4	306
218	SLOVN	175.5	97.5	146.1	133.6	71.0	134.2	33.0	23.9	49.7	8.0	620.0	81.3	150.0	46.0	4981.8	60
219	CZECH	175.9	97.4	145.6	131.4	67.3	131.3	32.9	23.9	49.8	8.0	470.0	79.2	88.0	50.0	5363.5	107
220	HRADK	174.0	96.7	145.1	131.3	66.4	131.0	32.4	24.8	47.7	9.3	470.0	72.9	250.0	49.0	5163.4	148
221	SE-CR	175.4	98.2	147.5	136.4	70.2	136.5	33.4	24.5	51.7	14.0	800.0	72.0	116.0	44.0	4751.4	80
222	OSS-I	182.2	97.3	142.7	132.7	71.2	134.7	33.3	25.1	52.4	8.6	926.9	78.0	26.0	43.0	4253.3	215
223	OSS-D	183.9	98.7	143.8	133.7	72.1	134.9	33.5	25.0	52.8	8.6	926.9	78.0	26.0	43.0	4253.3	159
224	SOFIA	177.6	95.7	138.7	134.1	68.7	130.4	32.2	23.2	50.9	10.0	570.0	72.5	26.0	43.0	4367.6	406
225	NC-BL	177.6	96.2	140.0	134.2	69.0	131.5	32.1	23.0	51.0	11.0	540.0	74.5	26.0	43.0	4314.6	215
226	NB-BL	177.1	96.5	139.6	134.4	66.7	129.8	32.8	23.2	51.6	11.0	540.0	74.5	26.0	43.0	4314.6	106
227	NW-BL	177.3	96.7	137.9	134.6	69.0	129.8	32.5	23.2	51.2	11.0	540.0	74.5	26.0	43.0	4340.1	112
228	BUL-T	178.3	96.5	138.9	134.7	69.2	130.9	32.7	23.5	49.0	12.0	650.0	72.0	26.0	42.0	4208.7	220
229	BUL-S	178.3	96.1	136.6	134.7	67.1	131.1	32.6	23.4	51.4	12.0	650.0	72.0	26.0	42.0	4208.7	135
230	TASHK	175.1	96.2	145.4	135.8	73.3	135.0	34.6	25.4	54.2	14.8	440.0	56.0	37.0	41.0	5141.0	286
231	ARMEN	172.6	96.8	144.4	134.7	73.2	133.5	34.3	25.3	54.0	11.6	275.4	62.9	73.0	40.0	3950.9	107
232	GREEK	176.4	97.1	143.1	136.1	71.8	132.1	34.3	24.5	51.8	18.5	364.8	60.5	119.0	38.0	3818.5	89
233	MALTA	180.5	96.6	139.0	135.6	68.1	132.3	33.3	24.4	51.3	18.8	570.0	75.8	300.0	36.0	4071.3	437
234	ALGER	182.9	93.9	136.6	134.7	71.0	128.3	34.0	25.0	52.0	17.6	516.7	67.5	150.0	37.0	4988.5	32
235	C-NGU	187.3	98.0	136.0	133.0	65.5	129.9	33.5	27.9	49.2	16.8	681.6	66.9	23.0	32.0	4240.3	123
236	SOTHO	186.1	97.4	133.6	131.7	66.6	128.8	33.6	27.2	49.5	16.2	691.0	60.3	23.0	26.0	3568.7	149
237	SHANG	187.1	97.7	132.6	134.5	66.8	130.6	33.8	27.5	49.5	22.4	529.4	65.4	32.0	24.0	3310.7	54

[1)]Both average and minimum sample sizes across craniofacial measurements in each sample are 25 or more (Class A in Table 1).