Human skeletal remain excavated from Zaisanovka-7 Site

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Introduction

A human skeletal remain was recovered from the Zaisanovka- 7 site located on the southern coast of the maritime region near the North Korean boundary in the Russian Far East. This area, adjacent to Japanese archipelagos, has been host to a continued exchange of people and culture with the Japanese Islands for many years. Accordingly, it would be very meaningful to investigate the ancient human skeletal remains in this area, not only for the study of Far Eastern human history but also for the study of the history of the Japanese population. Here we describe the analysis of human bones unearthed by an excavation team in 2004.

Human skeletal remains and methods

A human skeleton was unearthed from a shell mound situated on the lower sand dune adjacent to Expedicia Bay, about 3 m above sea level. It was buried in crouched posture lying on the right side in the pit, that is, with both arms bent strongly at the elbow and with the hands drawn near to the face, and the hip and knee joints were also bent strongly, with both knees drawn close to the breast. Most bones retain their original position at the time of burial. This human skeleton was unearthed with many prehistoric artifacts in addition to many animal bones and plant remains. Judging from the archaeological analysis concerning the artifact and the stratum of this shell mound, it was concluded that this bone belonged to the Yankovsky culture (8 th ? 3 rd century B.C.) or later (Komoto & Obata, 2005).

Figure 1 shows the recovered parts of bones. The bone preservation is not especially good in general. Although almost all of the bones had become small fragments, it is clear that they belong to just one individual, since there is no portion that overlaps a part of bone.

From the morphology of the pelvic bone containing left pubic bone and the robustness of limb bones such as the femur, this individual can be judged to be a male. The attrition of teeth is heavy (Fig. 3), and about half of the coronal suture and a part of the sagittal suture had begun to fuse. In addition to these clues to age, the morphological features of the pubic bone reveal that this individual was a mature male between 40 and 60 years old.

The methods of measurements basically follow Martin (1957). Facial flatness was measured by the method of Yamaguchi (1973).

Morphological features

1. Skull

Neurocranium

The skull of this mature male, on the whole, shows robust features, as can be seen in Figure 2. The vault is quite thick and the development of the portions to which muscles attach such as the mastoid process, temporal muscle lines, and external occipital process are relatively good. The development of the supraorbital ridge is not so good, and the depression at the nasion is weak.

Measurements relating to the skull found at Zaisanovka- 7 are listed in Table 1. A comparison of the principal measurements among groups is shown in Table 2.

The vault of the Zaisanovka- 7 skull is ovoid in norma verticalis. Seen from the side, norma lateralis, the crania are long and evenly arched. The maximal cranial length is very large (189 mm), which is attained by few populations, as shown in Table 2. It is interesting that ancient people of Siberia (Alekseev & Gochman, 1983) have the same feature. The maximal width of the Zaisanovka- 7 skull (143 mm) is also comparatively large like those of other Siberian peoples. The cranial index (75.7) value is close to the boundary of mesocran and dolichocran because of the influence of the large maximal length, whereas the cranial height is very high and shows a definitive difference in comparison to ancient Siberian peoples.

Facial skeleton

The facial skeleton as a whole is high and somewhat wide. The upper face is higher than almost all other groups' average value excepting the material from the Boisman site (Popov, et.al., 1997). The facial width is relatively large in comparison to the Neolithic southern Chinese such as those from the Weiden site(Nakahashi, et.al., 2002), although it is smaller than that of the Siberian groups. The upper facial index (55.8) is mesenic.

As mentioned above, the development of the supraorbital ridge is weak, and the nasal bone is very flat (simotic index: 16.0, Jomon: 45.5, Yayoi: 27.9, Baikal Neolithic: 39.9; Yamaguchi, 1980; Nakahashi & Nagai, 1989; Ishida & Dodo, 1990) . The direction of the frontal surface of the frontal process of the maxilla is nearer to the frontal plane than to the sagittal plane. The frontal index of flatness (12.1) also indicates a very flat upper face (Jomon: 16.4, Yayoi: 14.7, Baikal Neolithic: 14.8).

The orbits tend to be low relative to the breadth. The orbital index (76.2) is chamaeconche. The nasal aperture is very high and narrow. The nasal index (43.6) is the lowest value among the groups compared in Table 2. The degree of prognathism is weak.

The mandible is large and robust. The body is long, and the ramus tends to be broad. The pterigoid muscle attachment at the gonion is moderately rugged, while the gonial angle shows an eversion. The attrition of teeth is very heavy, as shown in Figure 3. These details indicate that the muscles of the jaw were well developed.

2. Dimensions and shape of the limb bones

The results of measurement of the limb bones are shown in Table 3. As a whole, the limb bones of Zaisanovka- 7 show somewhat robust and relatively short features, although the morphological details were difficult to observe due to the bones' fragmentation.

A. Upper Limb Bones

The proximal half of the humerus and radius were preserved and possible to observe. The remarkable development of deltoid tuberosity of the humerus indicates strong]activity using this muscle. The shaft diameters (maximal diameter: 21 mm, minimum diameter: 17 mm) are, however, not so large in comparison with other populations (for example, Kanenokuma Yayoi: 23.6 mm and 17.1 mm, respectively, Tsugumo Jomon: 23.7 mm and 17.7 mm, Nakahashi et al, 1985; Kiyono & Hirai, 1928).

The left radius was also unearthed from the burial pit in good condition. As shown in Table 3, the maximum length of the radius is shorter than that of the Jomon or Yayoi peoples. The shaft diameter did not show a clear difference from the mean values of the compared groups. The signs of osteoarthritis can be seen in the elbow joint (at the proximal end of the ulna).

B. Leg Bones

Only the right femur was preserved well enough for observation. The maximum length was approximately 430-440 mm, which exceeds the mean value of the Jomon people. The linea aspera is somewhat developed, but the pilaster formation on the dorsal surface of the mid-shaft is relatively weak (the Pilastric index is 107.8). The subtrochanteric portion of the shaft is not platymeric, although the measurement of this part was difficult. Although the exact measurement of the tibia was also impossible, observation allowed one to infer that the tibia shaft is flattened transversely. At the lower end of the tibia, squatting facets, a condition caused by the habitual extreme dorsification of the ankle joints, as occurs in those who squat, was detected.

As mentioned above, the radius was relatively short, while the femur was rather long in comparison with that of the groups in Table 3. In consideration of these results, it is feasible that the forearm and lower part of the leg are relatively short compared with the upper part of the limbs. In general, northern Mongoloids have been characterized by the shortness of their extremities, so it is reasonable to infer that the Zaisanovka- 7 man shared such a feature.

Reconstructed Stature

The estimated stature was calculated by Peason's formula using the maximum length of the femur. As shown in Table 4, the stature of the Zaisanovka- 7 individual (162-164 cm) is somewhat greater than that of the Jomon people but less than that of several Neolithic peoples in China.

3. Comparative analysis

We compared the features of the Zaisanovka- 7 man to those]of the other populations using Penrose's shape distance and principal component analysis using 9 measurements of the skull (Martin's No. 1, 8, 17, 45, 48, 51, 52, 55). Fig.2 shows the morphological relationships among the peoples in northeast Asia according to the first and second principal components, which explain 62.6% of the total variance.

Here, the differences between the Zaisanovka-7, the Neolithic peoples in south China (containing

Weidun), and the Jomon people in Japan are evident. Although the materials from the Boisman site located in same region also show a large difference from Zaisanovka- 7 in the second principal component, it would be premature to draw absolute conclusions, because this result is based on the examination of only a few samples (only one or two skulls). Also, the differences in the second principal component in this figure show mainly the differences in the size of the neurocranium. In their facial morphology, strong similarity was seen between the populations with regard to their features, such as an extremely long face and very flat nasal bone. Three Siberian groups (from Neolithic to early Iron Age) have clear similarity to one another, and the Zaisanovka- 7 falls between these Siberian groups and other northern Asian groups such as those in North Korea (Imamura,1932; Suzuki, 1940), the Yeanri in south Korea(Kim, et.al., 1993), and the northern Kyushu Yayoi people.

To investigate how close the Zaisanovka- 7 man was to the other Asian groups, we compared Penrose's shape distance from the Zaisanvka- 7 man to that of the peoples of the Neolithic Age, the Bronze Age, the early Iron Age, and later ages from various parts of northeast Asia. Figure 4 shows Penrose's shape distance based on nine cranial measurements. As can be seen from the figure, the Jomon people are quite distant from the Zaisanovka- 7 man. In contrast to this, the northern Kyushu Yayoi show morphological resemblance to the Zaisanovka- 7 man, as do the Siberia (Bronze Age) Linzi in Shandong Province (Han & Matsushita, 197; Matsushita, 2000).

Although the efficiency of multivariate analysis is limited in this case due to the low number of samples available, judging from these results, it would be possible to say that the man from the Zaisanovka- 7 site is included in the northern Asian groups(the so-called Northern Mongoloids). To reach definite conclusions regarding the ancient people in this region, it would be needless to say that we will need to examine more skeletal remains from the Far East and neighboring countries.

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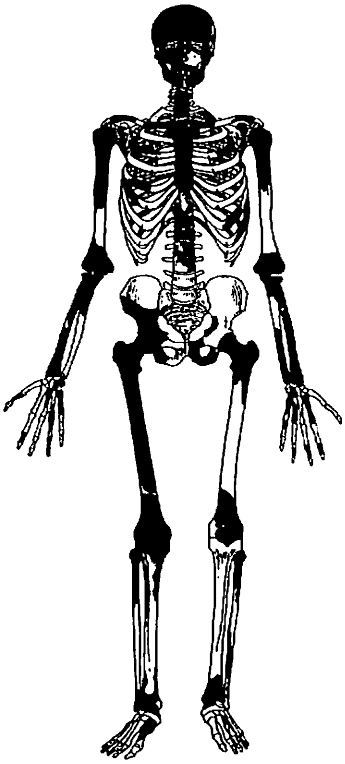

Fig.1. Preserved parts of human skeleton excavated from Zisanovka- 7 site.

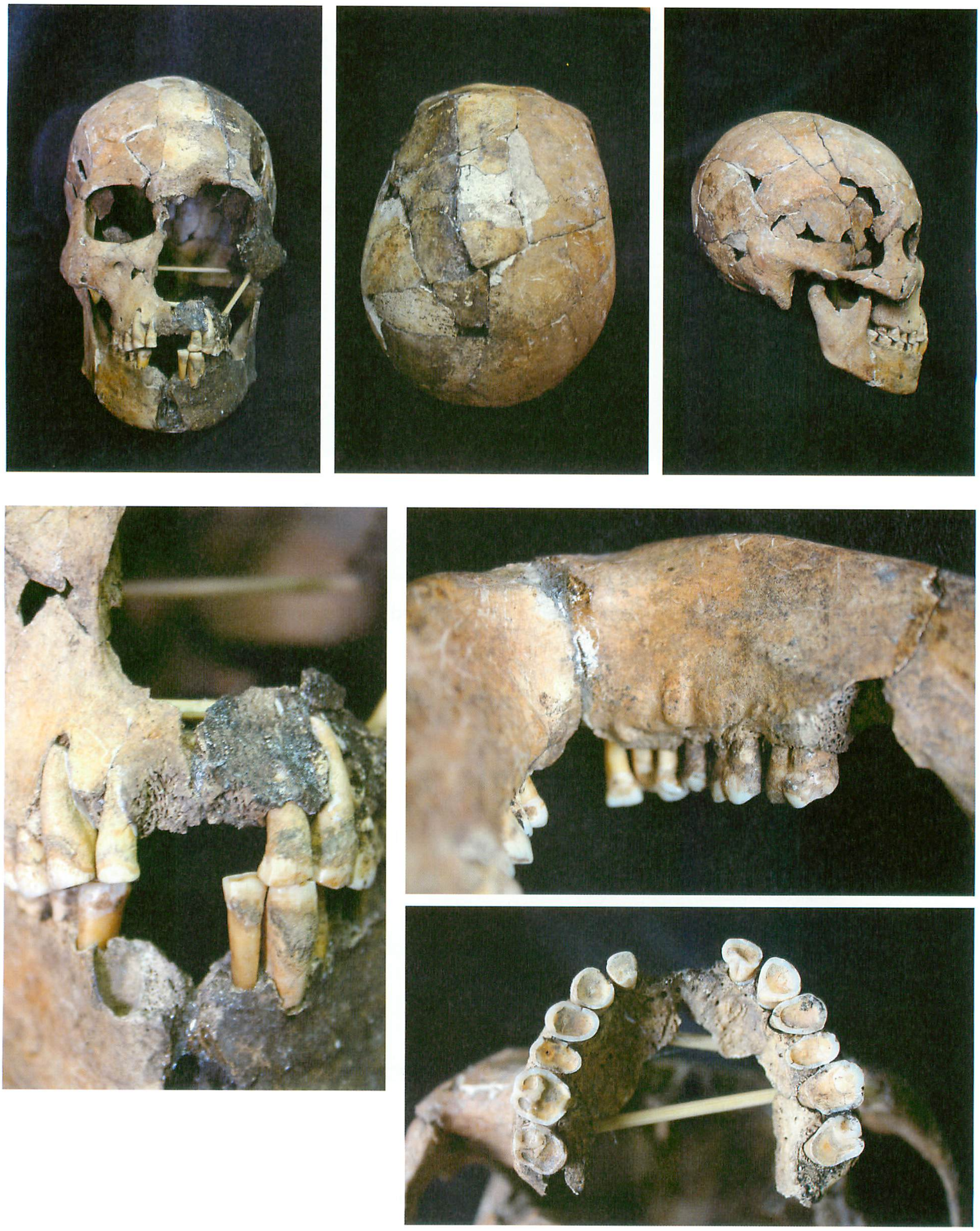

Fig.2. Skull of Zaisanovka- 7 site. (male)

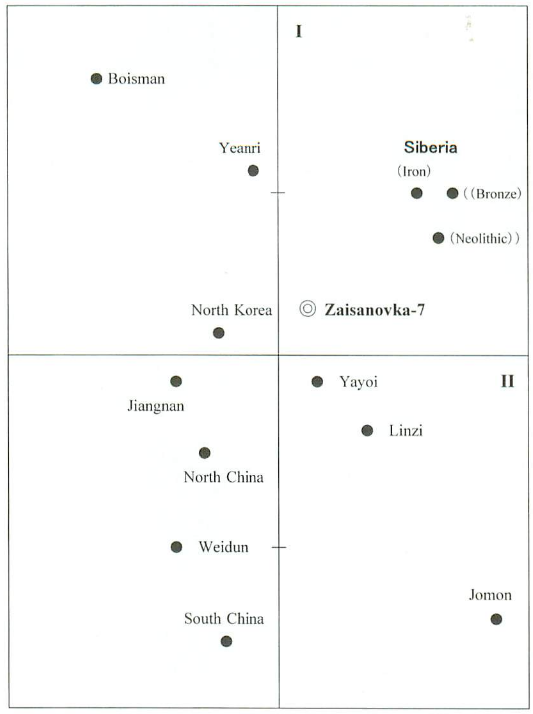

Fig.3. Result of principal component analysis based on 9 cranial measurements.

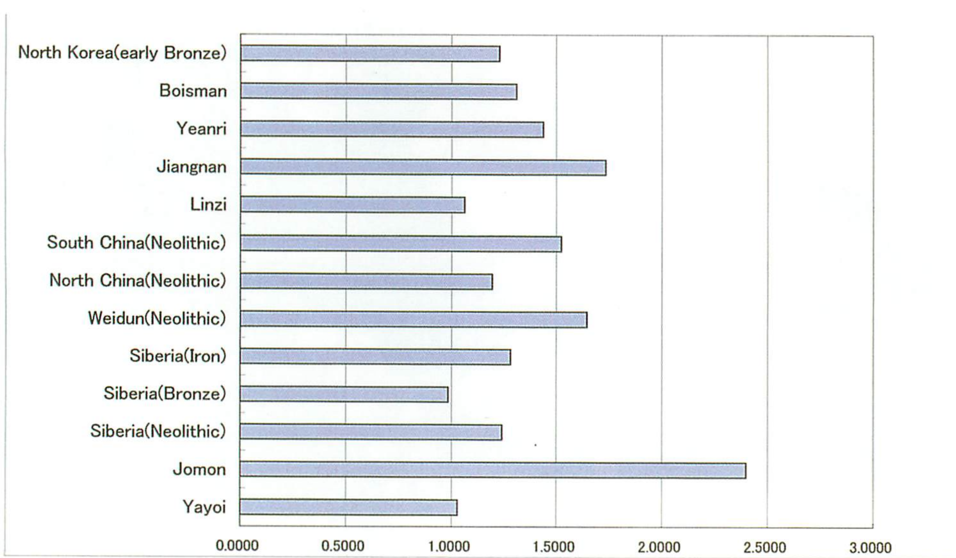

Fig.4. Penrose's Shape Distance from Zaisanovka-7

Table 1. Cranial Measurement

Martin No.	Zaisanovka- 7 (M ale)	
1	Maximum cranial length, g-op	189
8	Maximum cranial breadth, eu-eu	143
9	Minimum frontal breadth, ft-ft	91
17	Basi-bregmatic height, ba-b	140
23	Horizontal circumference (g, op)	533
24	Transverse arc, po-b-po	232
25	Total sagittal arc, n-o	394
43	Upper facial breadth, fmt-fmt	105
44	Bi-orbital breadth, ek-ek	100
45	Bizygomatic breadth, zy-zy	138
46	Bimaxillary breadth, zm-zm	104
47	Total facial height, n-gn	129
48	Upper facial height, n-sd (av)	77
51	Orbital breadth (R)	42
52	Orbital height (R)	32
MH	Malar height, fmo-zm (R)	49
MB'	Malar breadth, zm-rim. Orb (R)	30
54	Nasal breadth	24
55	Nasal height, n-ns	55
57	Minimum nasal breadth	6
FC	Frontal chord, fmo-fmo	96.4
FS	Frontal subtense, n to fmo-fmo	11.7
SC	Simotic chord (Minimum nasal breadth)	6
SS	Simotic subtense to SC	0.96
72	Facial profile angle, n-pr and FH	85
73	Middle facial profile angle, n-ns and FH	90
74	Alveolar profile angle, ns-pr and FH	69
8 : 1	Cranial length-breadth index	75.7
17 : 1	Cranial length-height index	74.1
17 : 8	Cranial breadth-height index	97.9
9 : 8	Transverse frontoparietal index	63.6
47 : 45	Kollmann's total facial index	93.5
48 : 45	Kollmann's upper facial index sd (av)	55.8
47 : 46	Virchow's total facial index	124.0
48 : 46	Virchow's upper facial index sd (av)	74.0
52 : 52	Orbital index (R)	76.2
54 : 55	Nasal index	43.6
48 : 17	Vertical cranio-facial index sd (av)	55
FS : FC	Frontal index of flatness	12.1
SS : SC	Simotic index	16.0
65	Bicondylar breadth	118
66	Bigonial breadth, go-go	105
67	Bimental breadth	50
68	Mandibular body length (Mandibulometer)	72
68- 1	Maximum projective length of mandible	113
69- 1	Mandibular body height (For. Ment.) (L)	34
69- 3	Mandibular body thickness (For. ment.) (L)	13
70	Mandibular ramus height (L)	53
70a	Projective mandibular ramus height (L)	45
71	Mandibular ramus breadth (L)	36
71a	Minimum breadth of mandibular ramus (L)	36
71 : 70	Index of mandibular ramus (L)	67.9

Table 2. Comparison of proncipal measurements

Martin No.		Zaisanovka-7	Boisman1) (Neolithic)	North Korea (Bronze)	Siberia (Neolithic)	Siberia (Bronze)	Siberia (Iron)	Weidun (Neolithic)	South China (Neolithic)	Nouth China (Neolithic)	Linzi	Jiangnan	Yean-ri	Jomon	Yayoi
1	Maximum cranial length	189	179.5	178.4	188.1	191.7	184.8	180.7	188.8	178.6	184.7	177.4	182.9	184.2	183.4
8	Maximum cranial breadth	143	138	142.8	145.1	145.2	147.4	141.1	139	144	142.8	140.7	141.8	144.8	142.3
9	Minimum frontal breadth	91	91	96	91	94.9	93.6	96.7	92.3	93.8	96.4	92.9	93.2	97.3	96.3
17	Basi-bregmatic height	140	138	135.9	131.2	131.8	131.7	141.6	141.6	143.6	138.7	137.4	135.1	135.8	137
8 / 1	Cranial length-breadth index	75.7	77.4	80.2	77.1	75.7	79.8	78.1	73.6	80.6	77.3	79.3	77.1	78.6	77.7
17/ 1	Cranial length-height index	74.1	75.5	76.1	69.8	68.8	71.3	78.4	75	80.4	75.1	77.5	73.2	73.7	75
17/ 8	Cranial breadth-height index	97.9	97.5	94.7	90.4	90.8	89.3	100.4	101.9	99.7	97.1	97.7	96	93.8	96.3
45	Bizygomatic breadth	138	141.5	137.8	143.1	142.4	141.5	134.3	134.7	138	140.3	138.3	143.3	141.3	139.8
48	Upper facial height	77	79.5	72.8	74.2	74.9	76.1	71.7	69.4	74	70.8	75.2	74.2	65.6	74.3
48/45	Kollmann's upper facial index	55.8	56.2	52.8	51.9	52.6	53.8	53.4	51.5	53.6	50.5	54.4	49.8	46.4	53
51	Orbital breadth	42	40.5	41.1	42.4	42.5	42.9	42.8	42.8	52.5	43.5	42.3	41.8	43	43.3
52	Orbital height	32	35.5	34.8	34.4	34.5	35.2	34	33.2	33.7	34.3	35.1	36.2	33.3	34.5
52/51	Orbital index	76.2	87.7	84.1	81.1	81.2	82.1	79.4	77.6	64.2	78.9	83	86.9	77.4	79.7
54	Nasal breadth	24	25.5	26.2	26.2	26.2	26.5	28.4	28	27.4	26.7	28.1	26.6	26.6	27.1
55	Nasal height	55	56.5	52.9	52.6	55.6	55	52.8	52.3	54.1	53.7	53.5	54.9	48.3	52.8
54/55	Nasal index	43.6	45.1	49.5	49.8	47.1	48.2	53.8	63.5	50.6	49.7	52.5	48.6	53.8	51.3
57	Minimum nasal breadth	6	-	-	6.8	7.5	7.7	9	8.7	7.4	7.7	8.4	6.7	9.9	8.5

1) Popov.et.al.. (1997) 2) Imamura, Y. (1932) . Suzuki, M. (1940) . 3) Alekseev & Gochman (1983) . 4) Nakahashi.et.al. (2002) . 5) Zhang (1989)
6) Han & Pan (1985) . 7) Han & Matsushita (1997) . 8) Nakahashi.et.al. (2002) . 9) Kim. et.al. (1993) .10) Kintaka. (1928) ; Kiyono & Miyamato (1926)
11) Nakahashi & Nagai (1989) ;

Table 3 Comparison of measurements of the limb bones (mm)

		Zaisanovka- 7	Weidun 1)		Jomon 2)		NK-Yayoi 3)	
Humerus (male)			N	M	N	M	N	M
1.	Maximum length	-	9	313.8	15	283.3	22	302.6
2.	Total length (capitulum)	-	10	309.4	15	279.0	17	296.8
5.	Max. diam. of the mid-shaft	21	11	21.9	20	23.7	76	23.3
6.	Min. diam. of the mid-shaft	17	11	17.4	20	17.7	76	17.4
7.	Least circumf of the shaft	-	11	60.5	21	64.7	81	63.9
7a.	Circumference of the mid-shaft	-	11	64.9	–	–	75	67.8
6:5	Mid-shaft index	81	11	79.3	20	74.6	76	74.9
7:1	Index of robustness	-	9	19.4	15	23.0	22	21.3
Radius (male)								
1	Maximum length	228	7	244.9	11	233.3	64	236.7
2	Physiological length	218	7	230.4	11	217.5	52	221.1
3	Min. circumf. of the distal shaft	-	8	40.4	17	43.6	129	42.9
4	Max. trans. shaft diameter	16	8	15.9	17	16.9	130	17.3
5	Sagittal shaft diameter	12	8	11.3	17	11.6	130	12.3
3:2	Lenght-circumference index	-	7	17.5	11	-	52	19.6
5:4	Shaft index	75	8	71.1	17	68.8	130	71.4
Femur (male)								
1.	Maximum length	430-440	12	439.5	11	415.2	60	430.9
2.	Oblique length	-	12	436.2	11	411.3	18	427.7
6.	Sagit. diam. of the mid-shaft	28	19	29.9	20	28.9	162	29.7
7.	Trans. diam. of the mid-shaft	26	19	26.8	20	25.5	166	28.0
8.	Circumference of the mid-shaft	-	19	89.5	20	86.6	161	90.8
8:2	Length-circumference index		12	21.2	11	21.1	18	21.4
6:7	Pilastric index	107.8	19	112.3	20	113.2	162	106.4

1) .Wakebe(2002) . 2) Tsukumo Jomon (Kiyono and Hirai, 1928) . 3) Northern Kyusyu Yayoi (Nakahashi and Nagai, 1989)

Table 4. Comparison of stature values calculated from right femora. (Pearson's method, cm)

	Period	Population	Male	
			N	M
Russia		Zaisanovka- 7	1	162-164
China	* Neolithic	Weidun	16	163.3
		Liulin	2	168.7
		Songze	1	163.7
		Fuquanshan	2	165.0
		Huating	2	167.5
	8th - 1st century B.C.	Liangwangcheng	3	164.7
		Loahushan	1	161.8
		Huchang	5	165.8
		Wangtuanzhuang	1	161.2
		Luying	1	167.8
Japan	Jomon	Tsukumo	13	159.9
		Yoshiko	22	158.9
	Yayoi (native)	Northwestern Kyusyu	16	158.8
		Otomo	15	159.1
	Yayoi (colonist)	Doigahama	36	163.7
		Kanenokuma	17	162.7

* : Wakebe (2002)