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Protohistoric Human Skeletal Remains from the Goshōzan Cave Site in Ishinomaki

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Abstract Metric and morphological characters of the adult skeletal remains from the Goshōzan cave site, a secondary burial site of the late Kofun period, in Ishinomaki, Miyagi Prefecture, were recorded, and comparisons were made with those of other protohistoric series and also with those of the Jōmon, recent Japanese and Ainu series. The Goshōzan remains as a whole were generally close to the contemporaneous protohistoric series from the Kantō and other western districts. However, two of the six adult skulls were divergent from the rest showing more or less resemblance to the Ainu skulls from Hokkaidō, particularly in transverse facial flatness indices, and among the limb bones there were some pilastric femora and platycnemic tibiae that are commoner in the Jōmon remains and the Ainu than in the protohistoric remains.

The Goshōzan cave site in Ishinomaki, Miyagi Prefecture, is a secondary burial site of the late Kofun period (around A. D. 600) in a small calcareous clay stone cave on the left bank of the mouth of the Kitakami River. Archaeological investigation was made in 1982 by the Ishinomaki Municipal Board of Education under the leadership of Messrs. T. KIMURA and S. MIYAKE. Human remains, including partial skeletons of not fewer than 19 individuals, were found in disarticulated and mixed condition. Associated artefacts included a Sue ware of the late 6th to the early 7th centuries, iron weapons such as swords, daggers, and arrowheads, bone and antler implements such as needles, points, and plates, and some ornaments such as gilt bronze earrings and a shell bracelet (MIYAKE, 1986).

The northern part of Miyagi Prefecture was the frontier of the Yamato regime in the late Kofun period. The territory north of the lower Kitakami River and the Eai River, one of the former's branches, were inhabited by "Emishi" who were not always submissive to the central political power of the Yamato Court. Practically no skeletal evidence has so far been disclosed of this little known population. The critical location of the Goshōzan site just in the Emishi frontier is the reason why the Goshōzan remains have attracted special scientific attention. The primary purpose of this article is to examine the presence of extraneous components or traces of northern influence in the Goshōzan skeletal remains. Detailed morphological description and measurements will be published elsewhere, together with the full archaeological records of the site (MIYAKE (ed.), in press).

Brief Description of Skeletal Remains

The minimum number of buried individuals was estimated to be 19. It comprises 2 infants, 1 juvenile, 2 subadults, and 14 adults. None of them were articulated, and many skeletons were represented only by small parts.

Skulls

There are 6 adult or mature skulls preserved in relatively good condition.

Skull 1 (adult female, without mandible): Mesocranic with cranial index of 76.8, stenometopic, leptene, hypsikonch, and leptorrhine, with a flat nasal root and alveolar prognathism.

Skull 2 (mature male): Dolichocranic with index of 74.0, eurymetopic, euryprosopic, mesokonch, and chamaerrhine, with the glabella of grade III (BROCA) in prominence, a shallow nasofrontal suture, and pinched nasal bones.

Skull 3 (mature female): Mesocranic with index of 79.1, stenometopic, probably euryene, mesokonch, and chamaerrhine, with a flat nasal root and alveolar prognathism.

Skull 4 (mature male, without mandible): Lacks the left temporal bone and most of the skull base. Probably dolichocranic, chamaeprosopic, mesokonch, and chamaerrhine, with the glabella of grade III, a strongly developed external occipital protuberance, a flat nasal root, and alveolar prognathism.

Skull 5 (adult male, without mandible): Mesocranic with index of 75.8, metriometopic, mesene, chamaekonch, and mesorrhine, with the glabella of grade III/IV, a horizontally curved nasal root, exceptionally high transverse facial indices, and moderate alveolar prognathism.

Skull 6 (adult female): Mesocranic with index of 77.4, stenometopic, mes-/leptene, hypsikonch, and chamaerrhine, with a flat nasal root and alveolar prognathism.

Standard measurements on these six skulls are given in Tables 1 and 2.

Long Limb Bones

Maximum lengths and average cross-sectional shaft indices of adult long bones are given in Tables 3 and 4. The attribution of sex for the long bones in Table 3 is provisional because of dissociation from the skull and the hip bones.

Platycubitonia of the ulna, where the maximum diameter of the mid-shaft is between the interosseous and the posterior borders and the minimum diameter is between the anterior border and the posterior surface, is observed in 11 out of 17 adult cases. In subtrochanteric shaft index, 10 out of 16 femora are platymeric and all the rest are hyperplatymeric. Only 3 out of 17 tibiae are platycnemic in mid-shaft index, while 6 and 8 tibiae are meso- and eurycnemic, respectively. Of the 7 right tibiae and 6 left tibiae that possess the lower end, all but one left bone have the squatting facet on the anterior margin of the distal articular surface.

Table 1. Cranial measurements and indices compared with the averages of four series (male).

		Goshōzan				Recent Japanese[1]	Proto-historic[2]	Jōmon[3]	Ainu[4]	S.D.[1]
		2	4	5	mean					
1.	Maximum length	196	191	182	189.7	181.21	182.1	184.2	185.9	6.03
5.	Basal length	107		104		101.48	101.5	103.2	105.4	4.81
8.	Maximum breadth	145		138		139.53	143.5	144.8	141.3	5.06
9.	Min. frontal br.	102	89	93	94.7	94.14	94.5	97.3	96.2	4.30
17.	Ba.-b. height	143		138		136.30	136.3	135.8	138.1	4.54
40.	Facial length	(109)		(99)		97.51	100.2	102.6	105.0	5.07
45.	Bizygomatic br.	141		136		133.40	141.6	141.3	137.3	5.84
46.	Bimaxillary br.	104	101	101	102.0	98.56	102.5	104.0	102.1	5.28
48.	Upper facial ht.	(69)	(71)	69	69.7	68.97	71.2	65.6	69.7	4.17
51.	Orbital breadth	46	41	45	44.0	40.22	42.8	43.0	43.6	2.04
52.	Orbital height	35	34	34	34.3	35.13	34.3	33.3	34.3	1.77
54.	Nasal breadth	30	29	25	28.0	25.66	27.0	26.6	25.7	2.46
55.	Nasal height	48	51	52	50.3	52.02	51.5	48.3	50.5	3.07
FC.	Frontal chord	98.8	96.9	98.9	98.2	97.8	98.9	99.6	99.5	4.29
FS.	Frontal subtense	16.9	15.3	18.4	16.9	16.3	15.0	16.4	16.9	2.08
SC.	Simotic chord	6.6	6.8	7.2	6.9	7.2	7.5	10.2	8.7	1.91
SS.	Simotic subtense	1.9	1.0	3.7	2.2	2.7	2.3	4.6	3.7	0.97
ZMC.	Zygomaxillary ch.	104.2	99.8	100.6	101.5	97.9	100.7	102.8	101.4	5.19
ZMS.	Zygomaxill. subt.	23.6	20.1	27.0	23.6	23.6	19.4	22.9	22.7	2.89
8:1.	Length-br. index	74.0		75.8		77.00	79.1	78.8	76.0	2.59
17:1.	Length-ht. index	73.0		75.8		75.46	75.3	73.3	74.1	2.42
17:8.	Breadth-ht. index	98.6		100.0		98.01	95.4	93.9	97.7	3.68
9:8.	Tr. frontopar. ind.	70.3		67.4		67.43	65.8	67.3	68.2	2.73
48:45.	Up. facial ind. (K)	(48.9)		50.7		51.89	50.8	47.0	50.9	2.77
48:46.	Up. facial ind. (V)	(66.3)	(70.3)	68.3	68.3	70.25	69.6	63.1	68.1	4.65
52:51.	Orbital index	76.1	82.9	75.6	78.2	87.39	80.5	77.3	78.8	4.45
54:55.	Nasal index	62.5	56.9	48.1	55.8	49.05	52.7	54.8	50.8	4.39
FS:FC.	Tr. frontal index	17.1	15.8	18.6	17.2	16.7	15.1	16.5	17.0	1.88
SS:SC.	Simotic index	28.5	15.0	50.9	31.5	38.7	31.4	45.5	43.3	12.78
ZMS:ZMC.	Zygomaxill. ind.	22.7	20.1	26.9	23.2	24.1	19.2	22.2	22.5	2.99

Sources of the comparative data for the standard measurements and indices: 1) YAMASAKI, *et al.* (1967). 2) Revised from YAMAGUCHI (1987). 3) KIYONO & MIYAMOTO (1926) and KINTAKA (1928) combined. 4) KOGANEI (1893), supplemented by the present author.
Sources of the comparative data for the transverse facial flatness measurements and indices: 1), 4) YAMAGUCHI (1973). 3) YAMAGUCHI (1980).

Table 2. Cranial measurements and indices compared with the averages of four series (female).

		Goshōzan				Recent Japanese	Proto-historic	Jōmon	Ainu	S.D.
		1	3	6	mean					
1.	Maximum length	177	182	177	78.7	173.14	174.4	176.3	177.2	7.14
5.	Basal length	100	100	97	99.0	95.78	96.9	96.9	99.9	4.77
8.	Maximum breadth	136	144	137	139.0	134.33	138.2	141.8	136.9	5.33
9.	Min. frontal br.	89	94	88	90.3	89.86	91.7	95.6	92.4	4.27
17.	Ba.-b. height	139.	128	131	132.7	130.33	131.2	129.8	133.3	4.16
40.	Facial length	98	(100)	97	98.3	94.50	94.2	95.6	100.2	5.19
45.	Bizygomatic br.	(130)		(127)		125.50	(132.6)	132.9	130.1	5.63
46.	Bimaxillary br.	105		97		94.09	96.1	99.8	96.5	5.63
48.	Upper facial ht.	74	(69)	70	71.0	65.36	66.0	62.2	65.6	4.08
51.	Orbital breadth	40	42	40	40.7	39.26	41.3	41.7	41.8	1.96
52.	Orbital height	34	32	35	33.7	34.70	33.6	32.7	33.5	1.40
54.	Nasal breadth	24	28	28	26.7	24.87	26.6	25.5	24.8	1.66
55.	Nasal height	52	52	48	50.7	49.48	47.8	45.0	47.4	3.20
FC.	Frontal chord	96.5		91.7		92.6	93.5	97.6	94.7	3.51
FS.	Frontal subtense	12.3		13.2		14.3	13.3	14.4	15.5	2.23
SC.	Simotic chord	7.7	6.7	7.0	7.1	7.4	8.2	9.3	8.4	1.40
SS.	Simotic subtense	1.3	1.3	1.7	1.4	2.2	1.8	3.2	3.0	0.77
ZMC.	Zygomaxillary ch.	104.6		95.0		93.6	93.1	101.0	95.6	5.01
ZMS.	Zygomaxill. subt.	20.0		21.3		22.3	19.6	21.8	22.2	2.28
8:1.	Length-br. index	76.8	79.1	77.4	77.8	77.69	79.0	80.4	77.3	3.96
17:1.	Length-ht. index	78.5	70.3	74.0	74.3	75.39	75.0	73.4	75.1	3.73
17:8.	Breadth-ht. index	102.2	88.9	95.6	95.6	97.13	95.5	91.7	97.2	4.01
9:8.	Tr. frontopar. ind.	65.4	65.3	64.2	65.0	66.96	67.0	67.0	67.6	3.62
48:45.	Up. facial ind. (K)	(56.9)		(55.1)		52.04	(51.6)	48.0	50.9	3.36
48:46.	Up. facial ind. (V)	70.5		72.2		69.31	69.2	62.3	67.9	4.67
52:51.	Orbital index	85.0	76.2	87.5	82.9	88.50	81.5	78.1	80.3	4.14
54:55.	Nasal index	46.2	53.8	58.3	52.8	50.42	55.7	56.1	52.1	4.21
FS:FC.	Tr. frontal index	12.8		14.4		15.4	14.2	14.8	16.4	2.16
SS:SC.	Simotic index	16.3	19.6	24.5	20.1	30.6	22.2	33.6	37.1	10.14
ZMS:ZMC.	Zygomaxill. ind.	19.1		22.4		23.8	21.1	21.6	23.2	2.41

See the footnotes of Table 1 for the sources of the comparative data.

Table 3. Maximum length of long limb bones (in mm).

Humerus	male right: 291, male left: 305
Ulna	male right: 252, 243; male left: 252
Radius	male right: 235; male left: 231, 235, 239 female right: 225, 218; female left: 226, 215
Femur	male right: 436; male(?) right: 402; male left: 453, 415 female right: 389
Tibia*	male right: 320, 333, 352, 308; male left: 337, 340 female right: 307
Fibula	male left: 334, 335 female right: 330

* Total length minus spine (MARTIN's no. 1).

Table 4. Average cross-sectional shaft indices for pooled-sex long bones.

	Right		Left	
	(n)	M	(n)	M
Humerus, mid-shaft (min./max.)	(9)	72.1	(4)	75.4
Femur, subtrochanteric (min./max.)	(8)	77.4	(8)	74.6
Femur, mid-shaft (sag./transv.)	(9)	106.5	(7)	101.6
Tibia, mid-shaft (transv./max.)*	(9)	70.3	(8)	71.5
Fibula, mid-shaft (min./max.)	(5)	65.9	(9)	65.1

* Measured after the method of VALLOIS (1938).

Comparison of the Cranial Measurements and Morphology

The standard measurements and indices of the adult skulls from Goshōzan are compared, in Tables 1 and 2, with the averages of the recent Japanese crania from the Tōhoku district (YAMASAKI, *et al.*, 1967), of the protohistoric Japanese crania (mostly of the late Kofun period) from the Kantō district (revised from YAMAGUCHI, 1987), of the prehistoric Jōmon crania from the Tsukumo site (KIYONO & MIYAMOTO, 1926) and the Yoshiko site (KINTAKA, 1928) combined, and of the Ainu crania from Hokkaidō (KOGANEI, 1983, partly supplemented by the present author). The sources of the comparative data of facial flatness measurements for the recent Japanese, Ainu, and Jōmon crania are YAMAGUCHI (1973, 1980).

When compared with the averages of the protohistoric series from the Kantō district, the Goshōzan skulls are relatively long-vaulted, especially in the skulls 2 and 4. The male skulls are broad-faced, with upper facial indices similar to the Kantō average. The female skulls are relatively narrow-faced, with upper facial indices slightly higher than the female Kantō average. Orbital and nasal indices are widely varied among the skulls, but the mean of the former is somewhat lower in the male and slightly higher in the female than the Kantō averages, whereas the mean of the latter is larger in the male and smaller in the female. With respect to transverse facial flatness, the skull 2 diverges from others with frontal and zygomaxillary indices higher

than the Kantō averages, and the skull 5 is quite distinct with considerably high values of all the transverse facial indices.

In cranioscopic characters, the swelling of the glabella is moderate to slight, with the exception of the skull 5, whose glabella is developed almost up to grade IV. The glabello-nasal profile is generally smooth and the nasofrontal suture is shallow, again except for the skull 5. A pronounced horizontal curvature of the nasal root also distinguishes the skull 5 from others. The nasal bones of the skull 2 are of 'pinched' type, but all other skulls are characterized by a flattened nasal root. The alveolar prognathism, that is one of the common features of the Japanese crania in the Kofun and subsequent historical periods, is less marked in the skulls 2 and 5 than in others.

Collectively considered, the Goshōzan skulls are not appreciably different from the protohistoric series from the Kantō district. But the skulls 2 and 5 are more or less distinct from others in the morphology of the vault and facial skeleton.

In order to investigate the affinities of these two skulls, shape distances were calculated between each of the Goshōzan skulls and the four comparative series. Differences in measurements were standardized by using the standard deviations of the recent Japanese series, and the shape distance was obtained as the unbiased variance of the standardized differences (d_i), by

$$\left\{\sum^{n} d_i^2 - \frac{(\sum^{n} d_i)^2}{n}\right\} \Big/ (n-1)$$

where n is the number of the metric characters. The results are shown in Table 5. As the set of the metric characters used for obtaining the distance varies between skulls, the figures in Table 5 can be compared only vertically.

The skull 2 is closest to the Ainu, and second to the protohistoric Kantō series. The skull 4 is close only to the protohistoric Kantō series, and distant from all others. The skull 5 is again closest to the Ainu, and then to the recent Japanese. However, the closest to the male Goshōzan series as a whole is the protohistoric Kantō series, and in the next place is the Ainu. The Jōmon series is the most distant.

As for females, the skull 1 is closest to the recent Japanese, and second to the

Table 5. Shape distances of the Goshōzan skulls from the four comparative cranial series.

Goshōzan skulls	Male				Female			
	2	4	5	Mean	1	3	6	Mean
Number of metric characters	(19)	(14)	(19)	(14)	(19)	(13)	(19)	(13)
Recent Japanese	1.278	0.914	0.456	0.517	1.138	1.393	0.392	0.496
Protohistoric, Kantō	0.902	0.554	0.893	0.360	1.151	0.798	0.391	0.351
Jōmon	1.350	1.941	0.818	0.994	1.962	1.784	1.398	1.652
Ainu	0.853	1.093	0.386	0.370	1.336	1.493	0.768	0.854

Table 6. Pooled covariance matrices (male in roman and female in italic) based on 82 male and 47 female Japanese and 45 male and 21 female Ainu crania.

	(1)	(2)	(3)	(4)	(5)	(6)
(1) Frontal chord	17.6670	4.4531	2.6629	0.4437	9.9912	0.5573
	12.6587	*3.3868*	*2.7481*	*0.3892*	*9.6495*	*−1.1265*
(2) Frontal subtense		4.2018	1.0701	0.1411	1.1642	0.9121
		6.0043	*1.7536*	*0.2689*	*1.5699*	*1.3102*
(3) Simotic chord			3.2469	0.8024	2.6386	−0.0429
			3.1187	*0.4330*	*3.1688*	*0.3109*
(4) Simotic subtense				0.8916	−0.1852	0.4263
				0.6360	*0.9576*	*0.4304*
(5) Zygomaxillary chord					28.4625	3.4536
					26.5828	*4.4114*
(6) Zygomaxillary subtense						6.9940
						5.8192

Table 7. Discriminant function values based on the six transverse facial flatness measurements.

	Means of Protohist., Kantō	Means of the Ainu	Sectioning points	Scores of Goshōzan skulls
Male	5.152	9.060	7.106	G2= 7.008, G4= 3.908, G5=11.304
Female	16.916	20.545	18.729	G1=16.088, G6=17.540

protohistoric series, whereas the skulls 3 and 6 are both closest to the protohistoric and then to the recent Japanese series. The closest to the female Goshōzan series as a whole is again the protohistoric Kantō series and in the second place is the recent Japanese.

To confirm the divergence of the two male skulls from others, discriminat function analyses were undertaken on the basis of the six facial flatness measurements. Using the pooled covariance matrices obtained from recent Japanese and Ainu crania (Table 6), the following two discriminant functions were constructed for the protohistoric Kantō series and the Ainu series:

D.F. (male)= −0.1492 FC+0.4992 FS−0.0617 SC+1.4790 SS+0.0341 ZMC
+0.3117 ZMS

D.F. (female)= +0.1021 FC+0.2991 FS−0.4559 SC+1.8365 SS−0.0232 ZMC
+0.3053 ZMS

As shown in Table 7, the result of the analyses corroborates the divergence of the two skulls because the skull 2 is very close to the sectioning point in the discriminant score and the skull 5 is on the side of the Ainu, whereas the three other skulls are definitely assigned to the protohistoric population.

Comparison of the Limb Bone Measurements and Morphology

The averages of the statures estimated by the formulae of FUJII (1960) from the 21 male and 7 female long bone lengths that are given in Table 3 are 158.8 cm and 151.1 cm, respectively. These values do not differ significantly from the average statures estimated for larger protohistoric series from the Kantō and other districts (HIRAMOTO, 1972; YAMAGUCHI, 1986; KOUCHI, 1987).

The average cross-sectional indices of the mid-shaft of the humerus are slightly larger than those of the Jōmon series but not so large as those of the recent series. The incidence of the platycubitonic condition of the ulnar shaft, 64.7%, is lower than in the Jōmon remains and close to the incidence of 60% in the protohistoric series from western Japan (Jō, 1938).

The average subtrochanteric shaft indices of the femur are lower than those of the Jōmon and the recent Japanese series and similar to those of other protohistoric series (Jō, 1938; YAMAGUCHI, 1986). The average mid-shaft indices of the femur are also definitely lower than in the Jōmon series, resembling other protohistoric series. However, 4 out of the 9 right femora and 1 out of the 7 left femora are pilastric with mid-shaft indices over 110. In the average mid-shaft indices of the lower leg bones, the Gōshozan series is intermediate, like other protohistoric series, between the Jōmon and the recent series, but the index values are somewhat lower, due to some platycnemic and platyperonic bones, than in other protohistoric series and approach those of Jōmon remains. The incidence of the squatting facet in the distal end of the tibia, 92.3%, is much higher than in recent Japanese series (BABA, 1970; MORIMOTO, 1981), being comparable with that in the Jōmon tibiae. In about a half of the fibulae, the lateral surface is fluted as commonly seen in the Jōmon and Ainu fibulae.

To summarize, the long limb bones from the Goshōzan site are generally intermediate in morphology between the Jōmon and the recent series like other protohistoric series, but there are some bones that show resemblance to those of the Jōmon people or the Ainu, such as pilastric femora, flattened tibiae, and fluted fibulae.

Notes on Auditory Exostosis and Dental Caries

Small auditory exostosis with smooth surface, barely exceeding the minimum criterion of DODO (1972), was found in a pair of isolated right and left temporal bones that are, most likely, of one and the same individual (probably an adult female). The frequency in adult skulls (1/14 on the right side and 1/14 on the left side) does not differ significantly from those in other protohistoric series (Jō, 1938; YAMAGUCHI, 1985). In view of the geographical location of the site, the finding agrees with the hypothesis of KENNEDY (1986) and others that auditory exostoses are caused by chronic exposure of the external auditory meatus to cold water while diving or swimming in the middle latitudes.

Caries was observed in 14 (7.2%) out of 194 functional permanent teeth. The

approximate estimate of caries frequency per person, as defined by SAKURA (1964), is 2.33. The caries rate is somewhat higher than in the Jōmon crania, comparable to those in other protohistoric series (INOUE, *et al.*, 1981), and far lower than in the recent Japanese population.

Conclusion

The human skeletal remains of the late Kofun period from the Goshōazn cave site in Ishinomaki are generally similar in cranial and postcranial morphology to the protohistoric skeletal series of the same period from the Kantō district. However, two of the six adult skulls are more or less akin to the Ainu skulls in metrical characters, particularly in transverse facial indices, and a few lower limb bones also resemble the Ainu or the Jōmon remains with pilaster formation and platycnemia.

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