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Material report: The human skeletal remains excavated from the Yurakucho 1-chome site of the Muromachi period

Kazuhiro Sakaue

Department of Anthropology, National Museum of Nature and Science,
4–1–1 Amakubo, Tsukuba-city, Ibaraki Prefecture 300–0005, Japan
E-mail: k-sakaue@kahaku.go.jp

Abstract This material report focuses on the morphological descriptions of the human skeletal remains unearthed from the Yurakucho 1-chome site. Six individuals were excavated in situ from the layer of the Muromachi period, and almost all the human skeletal remains belonging to this period had been dug up without any archaeological context in the Tokyo. They have unique characteristics, such as osteochondritis dissecans in a knee joint, disuse atrophy in left arm bones, and hands transfixed into the ground with a wooden pile. The information on the skeletal remains of this site is very valuable and a unique example of the burial system in the Muromachi period.
Key words: Human skeletal remains, the Muromachi period, disuse atrophy

Introduction

This report focuses on the morphological descriptions of the human skeletal remains unearthed from the Yurakucho 1-chome site. The Yurakucho 1-chome site (Chiyoda-ku No. 83 site) is located at 1–2 and 4–1, Yurakucho 1-chome, Chiyoda-ku, Tokyo, near the Imperial Palace. This site was found during building construction and investigated in 2013. The remains of a residence of the "daimyo" (the feudal rulers in the Tokugawa regime of the Edo period) and a medieval cemetery were confirmed in this site, in the latter of which human skeletal remains of six individuals were excavated, along with some pottery and Chinese coins (Eiraku-tsuho) estimated to belong to the late sixteenth century (the Muromachi period). Five out of the six individuals were buried in a line from north to south, and all but an infant were excavated in a right lateral decubitus position (Figure 1). It is thought that this site was the cemetery of the Muromachi period located within the Hibiya inlet which had lain at the base of the hill of Edo Castle and was reclaimed in the early Edo period (Mizumoto, 2015).

Up to the present, some skeletal materials possibly from the Muromachi period have been collcted. For example, the Kajibashi collection and the Marunouchi collection are thought to belong to the Muromachi period (Suzuki, 1960). Unfortunately, these skeletal collections were discovered from construction sites around Edo Castle (the Imperial Palace) without any archaeological records, and only skulls were dug up with postcranial bones left behind. Suzuki (1960) considered that these skulls were of the Muromachi period because of the accompanying tombstones or Chinese coins, and historical records. He inferred that the skulls excavated around the Imperial Palace were of the graves unintentionally left behind during the relocations of cemeteries due to the expansion of Edo Castle in the early Edo period.

Thus, the skeletal remains of the Yurakucho 1-chome site can be valuable evidence for the system of burial during the Muromachi period.

Description

The descriptions for sex assessment and age estimation in this report followed the criteria in

Fig. 1. The multiple burials of the skeletal remains on a ray excavated in the Yurakucho 1-chome site. The burial of No.178 was not included in this picture.

Kajigayama and Sakaue (2014). Tables 1 and 2 show the cranial and postcranial measurements of the skeletal remains from this site. The definitions of all measurements follow Martin's (Baba, 1991) except for three measurements on the mid-shaft of the humerus. In the present study, the position of the mid-shaft was defined as the lowest point of the deltoid tuberosity. This makes it possible to measure even in a partially broken humerus. The reference data were quoted from the report of the skeletal remains excavated in the Yuigahama-minami site (Matsushita, 2002). Stature was estimated using the formulae developed by Fujii (1960) and Hasegawa *et al.* (2009), and the average of such estimated values was used as an estimated stature.

No. 170

This individual was unearthed in a right lateral decubitus position facing west (Figure 2). The preservation state of this individual is shown in Figures 3, 4, and 5.

The sex of this individual was identified as "Female?" which means probably female and its age at death was classified as "Middle adult", The estimated stature was 143.4 cm.

As seen in Figure 4, the skull of this individual has dolichocephalic (cranial index 72.1) and alveolar protrusive (alveolar profile angle 55.8) features which were widely recognized among medieval populations (Nagaoka *et al.*, 2006). The prominent depression on the dorsal surface of the pubic bone (Figure 6) and pre-auricular sulcus were seen, which is suggestive of a past pregnancy for this individual. There was ellipse pit on the proximal articular surface of the left tibia (Figure 7) and this was diagnosed as the healed osteochondritis dissecans that is often seen in the knee joints of individuals who a joint while engaged in heavy physical activities in one's youth (Jones and Miller, 2001).

No. 171

This individual was also unearthed in a right lateral decubitus position facing west (Figure 2). The preservation state of this individual is shown in Figures 3, 8, and 9.

The sex could not be determined because this individual was so young; pelvic bones were unfused and the first permanent molar was not present. Thus, this individual was classified in the age group "Child". This individual was unearthed with hands transfixed into the ground by a wooden pile (Figure 10). In order to clarify whether this penetration had been artificial or not, all hand bones were carefully excavated after identification in situ (Figure 11 and Table 3). This result indicated that a wooden pile

Table 1. Cranial Measurements of the human skeletal remains unearthed from the Yurakucho 1-chome site

Martin's No.	Variables	No.170	No.178	No.184	Yuigahama-minami	
		Female?	Female	Male	Male	Female
1	Maximum length	181.4	162.1	177.8	184.4	179.0
5	Basion-Nasion length	95.1	93.2	105.6	103.8	100.3
7	Foramen magnum length	37.8		35.2	34.8	34.5
8	Maximum breadth	130.8		135.7	138.3	134.8
9	Least frontal breadth	85.3		92.3	94.8	92.5
10	Maximum frontal breadth	105.4		111.0	115.0	112.3
11	Biauricular breadth	112.3		120.0	126.9	121.0
12	Biasterionic breadth	105.7		111.3	110.4	105.9
13	Mastoid width	91.9		102.2	103.5	99.1
14	Minimum cranial breadth	60.5		66.3		
16	Foramen magnum breadth			28.4	28.8	28.4
17	Basion-Bregma height	140.0		144.8	138.1	133.7
23	Horizontal circumference	507.0		504.0	524.8	508.8
24	Transverse arc	325.0		313.0	310.8	303.4
25	Total sagittal arc	367.0		367.0	379.6	369.3
26	Frontal sagittal arc	132.0		121.0	128.3	124.9
27	Parietal sagittal arc	114.0		121.0	129.9	128.0
28	Occipital sagittal arc	121.0		125.0	120.4	116.9
29	Frontal sagittal chord	117.0		106.1	112.6	109.2
30	Parietal sagittal chord	123.4		110.4	115.9	113.1
31	Occipital sagittal chord	103.8		101.9	99.1	97.8
40	Basion-Prosthion length	100.0		100.6	100.9	98.9
43	Outer biorbital breadth	99.5		102.3	105.8	101.8
43a	Bifrontal breadth	92.5		97.1		
	Nasion subtence (calculated)	16.3		14.0		
44	Biorbital breadth			97.4	100.0	96.1
45	Bizygomatic breadth			137.2	137.7	129.4
46	Bimaxillary breadth (zm)	101.3		98.3	104.2	99.6
46b	Bimaxillary breadth (zm:a)	101.2		97.8		
	Subspinale subtence (calculated)	27.1		24.9		
48	Upper facial height	67.3		67.1	67.3	63.0
48H	Upper facial height (Howells)	63.1		64.4		
48d	Malar height	20.3		22.0		
49a	Interorbital breadth	23.5		21.8		
50	Anterior interorbital breadth	23.0		17.9	18.1	18.6
51	Orbital breadth	38.8	35.3	39.3	43.7	41.4
52	Orbital height	36.5	32.3	32.2	33.3	32.5
54	nasal breadth	28.4	23.4	25.2	26.1	25.5
55	nasal height	47.0	42.3	54.5	52.1	48.2
57	Least nasal breadth			9.7	8.1	8.5
	Nasal subtense (calculated)			4.6		
60	External palate length			53.0	55.2	52.5
61	External palate breadth	67.9		65.2	64.6	63.0
62	Internal palate length			44.2	45.9	45.6
63	Internal palate breadth	43.1		43.0	40.3	39.0
65	Bicondylar breadth			*113.0*		
66	Bigonial breadth	92.2	85.6	99.3	104.1	98.0
68	Projective length of mandible	72.8	75.3	78.3	71.1	68.0
65(1)	Bicoronoid breadth		79.2	94.5	97.1	91.4
67	Bimental breadth	46.2	44.2	46.4	48.1	46.7

Table 1. Continued

Martin's No.	Variables	No.170	No.178	No.184	Yuigahama-minami	
		Female?	Female	Male	Male	Female
69	Height of mandibular symphysis	36.9	28.0	29.8	34.7	30.1
69(1)	Mandibular body height	33.8	27.3	27.9	32.1	28.8
69(2)	Mandibular body height at M2	25.9	24.0	25.0	27.7	25.2
69(3)	Mandibular body breadth	9.9	11.8	14.2		
69b	Mandibular body breadth at M2	13.8	16.6	16.9		
70	Height of mandibular ramus	58.9	54.5	67.6	60.5	55.3
71a	Minimum width of ramus	36.2	32.4	38.2	36.2	34.5
71(1)	Condylo-cornoid breadth		32.4	34.7		
	Mandibular condyle breadth (right)		18.3	16.1		
	Mandibular condyle breadth (left)			19.7		
72	Total profile angle	81.6		84.2	83.6	81.9
73	Nasal profile angle	93.6		89.3	86.2	86.4
74	Alveolar profile angle	55.8		68.7	74.6	65.9
79	Mandibular angle	120.0	122.0	115.0	122.3	123.2
8/1	Cranial index	72.1		76.3	75.1	75.5
17/1	Index	77.2		81.4	74.6	74.7
17/8	Index	107.1		106.8	99.8	98.9
(1+8+17)/3	SchadelModulus	150.7		152.8	153.4	149.6
9/10	Index	81.0		83.2		
9/8	Index	65.2		68.1		
8/12	Index	123.8		121.9		
40/5	Index	105.1		95.3		
16/7	Index			80.7	82.6	82.1
27/26	Index	86.4		100.0		
28/26	Index	91.7		103.3		
29/26	Index	88.6		87.7	87.9	87.4
30/27	Index	108.3		91.2	89.3	88.9
31/28	Index	85.8		81.5	82.4	84.0
43/8	Index	76.1		75.4		
46/45	Index			71.6		
48/45	Index			48.9	48.5	49.0
48/46	Index	66.4		68.3	64.1	63.5
9/45	Index			67.3		
45/8	Index			101.2		
50/44	Index			18.4	18.1	18.6
52/51	Index	94.1	91.5	81.9	77.3	77.8
54/55	Index	60.5	55.3	46.3	50.9	53.1
61/60	Index			123.2	118.0	119.6
63/62	Index			97.3	86.3	87.0
68/65	Index	64.4		69.3		
69(3)/69(1)	Index	29.2	43.3	51.0		
69b/69(2)	Index	53.1	69.1	67.6		
71/70	Index	61.5	59.5	56.6	60.6	62.6
	Frontal index of flatness	17.6		14.4		
	Zygomatic index of flatness	26.7		25.4		
	Simotic index			47.2		

Italics mean estimated values.

Table 2. Postcranial Measurements of the human skeletal remains unearthed from the Yurakucho 1-chome site

Martin's No.	Variables	No.170		No.171		No.177		No.178		No.184		No.195	
		right	left	right	left	right	left	right	left	right	left	right	left
CLAVICLE													
1	Maximum length									137.9	141.9		
2a	Height of shaft curvature									26.1	25.7		
2a/1	Index									19.0	18.1		
4	Vertical diameter of mid-shaft	8.5	9.8					10.5	8.6	10.4	13.3		
5	Sagittal diameter of mid-shaht	9.5	8.4					8.9	8.6	10.4	10.1		
4/5	Index	88.8	116.3					117.8	99.7	100.3	132.5		
6	Circumference of mid-shaft	29.0	29.0					32.0	30.0	35.0	38.0		
6/1	Robustisity index									25.4	26.8		
7-01	Vertical diameter of sternal end									29.8	26.5		
7-02	Sagittal diameter of sternal end									21.1	19.7		
7-03	Vertical diameter of acrominal end	9.8								10.5	10.7		
7-04	Sagittal diameter of acrominal end	18.8								19.5	20.9		
SCAPLA													
1	Morphological breadth									164.2			
2	Morphological length							82.6		103.9			
2/1	Index									63.3			
3	Length of axillary border									127.4	129.7		
4	Length of cranial border									77.3			
7	Length of scapular spine												
8	Length of scapular spine base							68.4	67.7	88.3			
12	Vertical diameter of glenoid fossa	32.5						33.0	30.7	41.6	37.1		
13	Transverse diameter of glenoid fossa	23.9						22.2	19.9	29.6	29.2		
13/12	Index	73.6						67.2	64.8	71.2	78.8		
HUMERUS													
1	Maximum length	277.4		(191.0)		(119.8)	(119.0)	266.2				(76.7)	
3	Breadth of proximal epiphysis	35.6						43.1		43.7			
3a	Breadth of caput-Tuberculum	40.6						42.2		48.5			
4	Breadth of distal ephysis	49.5	49.7					52.0					
5	Maximum diameter of mid-shaft	17.4	16.8					16.7	13.7				
6	Minimum diameter of mid-shaft	12.0	11.5					14.9	12.1				
6/5	Index	68.9	68.5					89.0	88.5				
7a	Circumference of mid-shaft	50.0	50.0	(42.0)		(29.0)	(29.0)	55.0	43.0				
7	Least circumference	47.0	46.0					51.5	42.0				
7/1	Robustisity index	16.9						19.3					
9	Transverse head diameter	33.0						35.8					
10	Vertical head diameter	36.8						38.1					
9/10	Index	89.5						94.1					
12a	Width of articular surface	37.4	38.1					37.8					
13	Trochlea depth	20.0	20.4					19.5					
14	Width of fossa olecrani	20.9	21.8					24.1	20.1				
16	Cubital angle	85.3	87.0					82.2					
18	Torsion angle	154.0						157.0					
RADIUS													
1	Maximum length	198.5		(140.0)		(91.0)	(90.0)	205.0					
3	3 Least circumference	30.5	30.0					35.0	28.0				
3/1	Index	15.4						17.1					
4	Maximum transverse shaft diameter	14.9	15.0					13.1	12.3				
5	Minimum sagittal shaft diameter	8.7	8.9					9.7	7.8				
5/4	Index	58.7	59.3					73.8	63.8				
4(1)	Transverse head diameter	19.2						18.6					
5(1)	Sagittal head diameter	19.7						18.5					
5(6)	Distal maximum breadth	28.4	27.4					27.0					

Table 2. Continued

Martin's No.	Variables	No.170		No.171		No.177		No.178		No.184		No.195	
		right	left	right	left	right	left	right	left	right	left	right	left
ULNA													
1	Maximum length	212.0		(152.0)				225.0					
3	Least circumference	29.5						30.5	20.0				
6(1)	Breadth of proximal epiphysis	19.1	20.2					18.9	15.0				
7	Depth of olecranon	20.5	22.0					20.7	20.6				
7(1)	Trochlear notch height	19.9	21.0					19.7					
11	Sagittal shaft diameter	9.8	9.6					10.7	7.9				
12	Transverse shaft diameter	13.6	13.4					12.1	10.0				
11/12	Index	72.2	71.7					88.8	78.9				
11a	Sagittal head diameter	18.0						16.6					
12a	Transverse head diameter	14.0						13.1					
FEMUR													
1	Maximum length	372.0	370.5	(272.0)	(274.0)	(153.3)	(152.0)						
2	Physiological length	371.0	369.1										
6	Sagittal diameter of mid-shaft	20.2	21.3	(15.9)	(15.6)	(10.5)	(10.9)	21.8	19.4				
7	Transverse diameter of mid-shaft	23.9	23.6	(15.8)	(16.1)	(10.4)	(10.5)	21.2	20.1				
6/7	Index	84.7	90.1					102.8	96.5				
8	Circumference of mid-shaft	70.0	70.0	(51.0)	(51.0)	(36.0)	(36.0)	68.5	63.0				
8/1	Robustisity index	18.8	18.9										
8/2	Index	530.0	527.3										
10	Sagittal diameter of upper-shaft	19.0	19.1					19.5	18.3				
9	Transverse diameter of upper-shaft	31.4	30.1					26.9	28.1				
10/9	Index	60.5	63.3					72.4	65.0				
16	Sagittal diameter of neck	23.0	24.2					21.2					
15	Vertical diameter of neck	28.3	27.9					26.6					
16/15	Index	81.3	86.5					79.5					
18	Sagittal diameter of head	39.6	39.4										
19	Vertical diameter of head	39.2	39.4										
21	Bicondylar breadth								65.4				
23	Length of lateral condyle	53.9	54.8						48.6				
24	Length of medial condyle	52.3	52.1						53.1				
28	Torsion angle	11.0	8.8										
29	Collo-diaphyseal angle	127.6	124.0					120.0					
30	Condylo-diaphyseal angle	84.0	80.0						82.5				
TIBIA													
1a	Maximum length	306.5	303.7		(210.0)	(125.0)							
3	Breadth of proximal epiphysis	64.5							62.2				
6	Breadth of distal epiphysis	41.0	39.4										
8	Maximum diameter of mid-shaft	24.0	23.1										
9	Minimum diameter of mid-shaft	14.3	14.4										
9/8	Index	59.6	62.3										
8a	Maximum diameter at nutrient foramen	25.7	24.6		(18.4)	(12.4)			22.7				
9a	Transverse diameter at nutrient foramen	15.2	14.7		(17.8)	(13.2)			18.4				
9a/8a	Index	59.1	59.7						81.2				
10	Circumference of mid-shaft	63.0	60.0										
10a	Circumference at nutirent foramen	68.0	65.0		(57.0)	(33.0)			65.0				
FIBULA													
1	Maximum length	300.9			(215.0)								
2	Maximum diameter of mid-shaft	13.1	12.5		(10.3)								
3	Minimum diameter of mid-shaft	7.3	7.2		(7.0)								
3/2	Index	55.6	57.2										
4	Circumference of mid-shaft	36.0	35.0		(28.0)								
4(1)	Medio-lateral diamenter of head												
4(2)	Distal maximum breadth	23.0	23.1										

Parenthesized numbers designate diaphysial measurements.

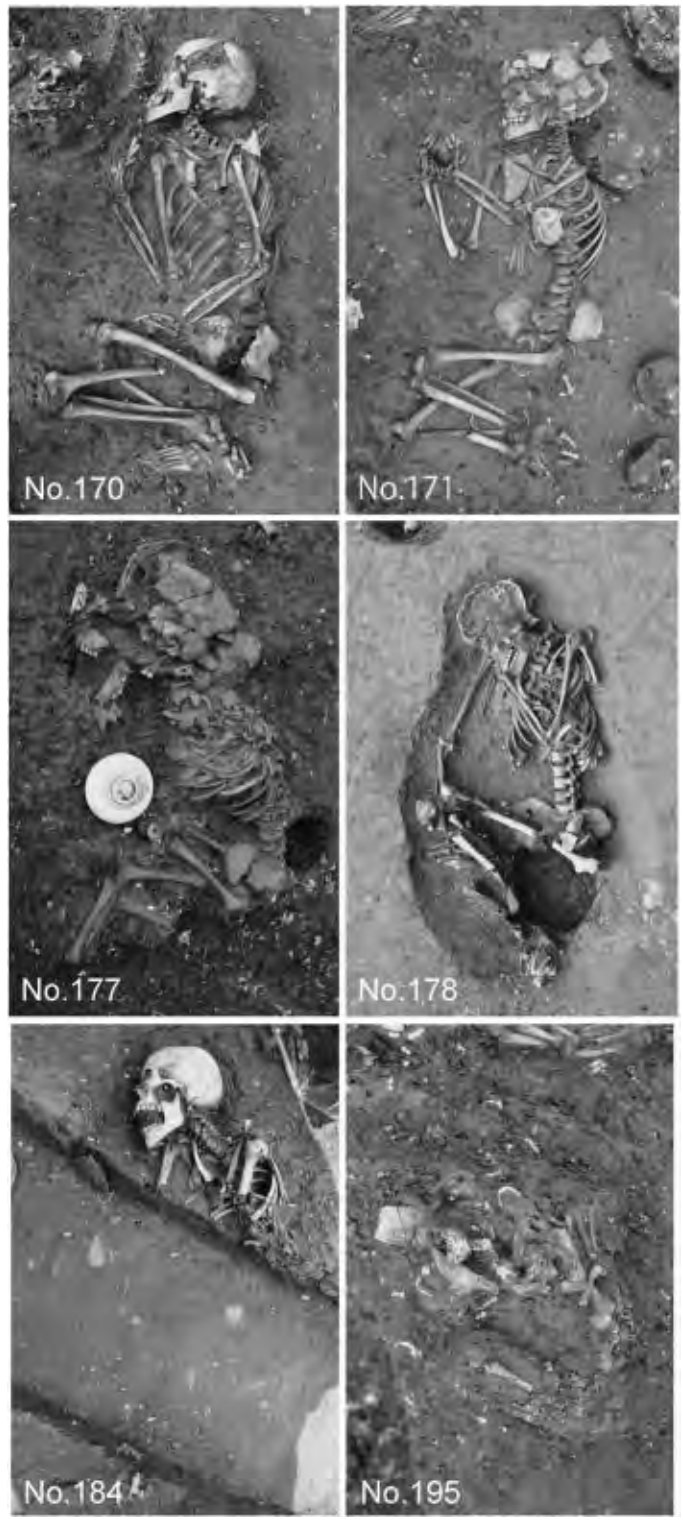

Fig. 2. Burial position of each individual.

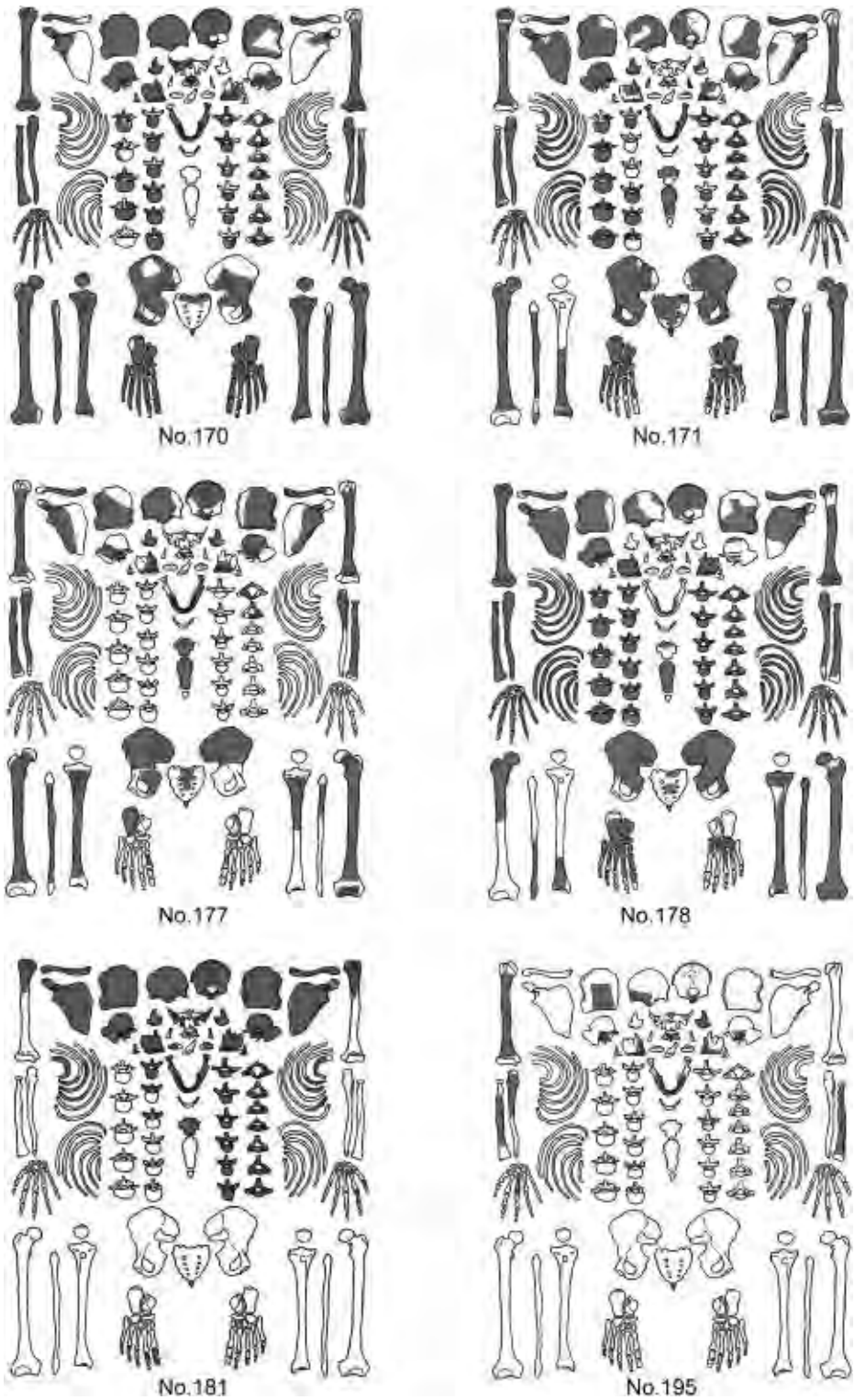

Fig. 3. Preservation of human skeletal remains unearthed at the Yurakucho 1-chome site.

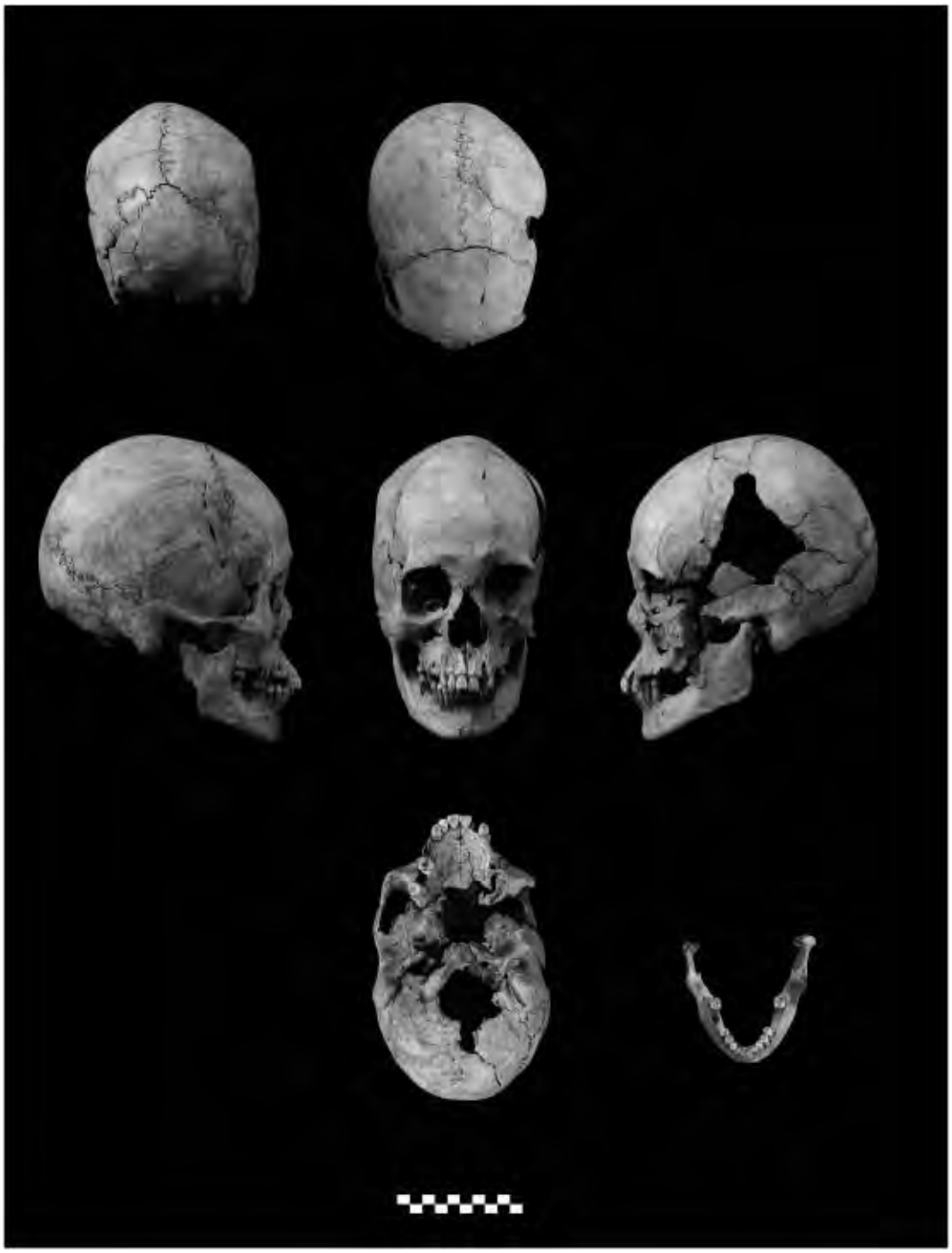

Fig. 4. Photographs of the skull of No. 170.

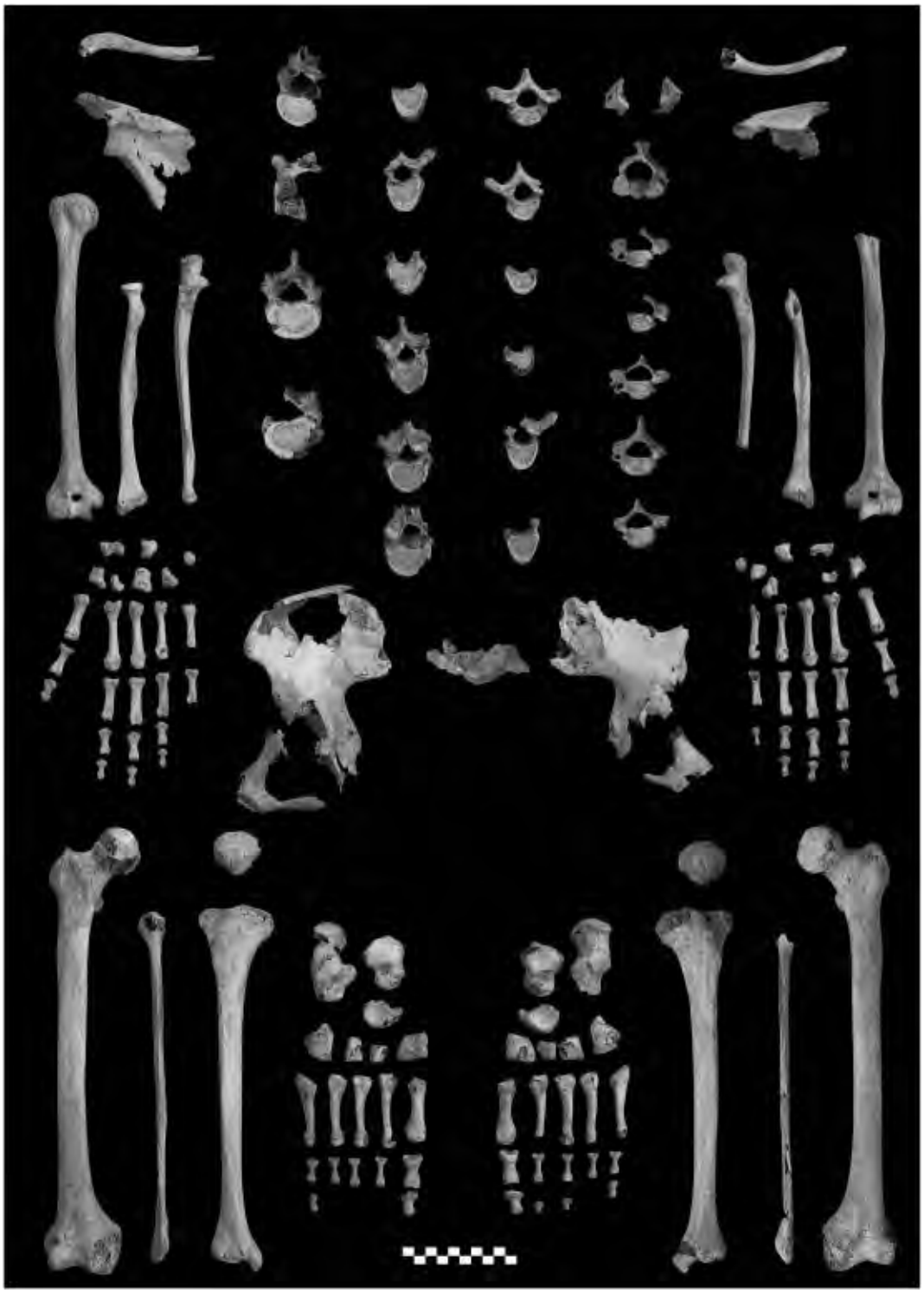

Fig. 5. Photographs of the postcranial bones of No. 170.

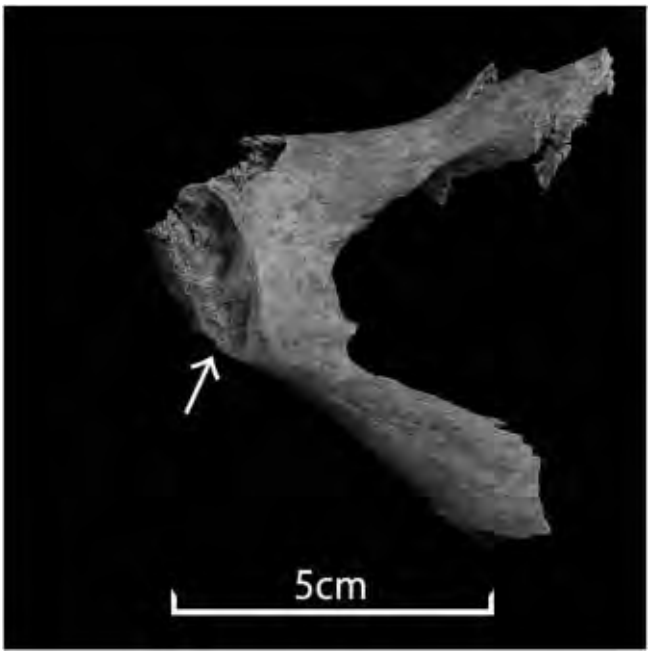

Fig. 6. Depression on the dorsal surface of the pubic bone of No. 170.

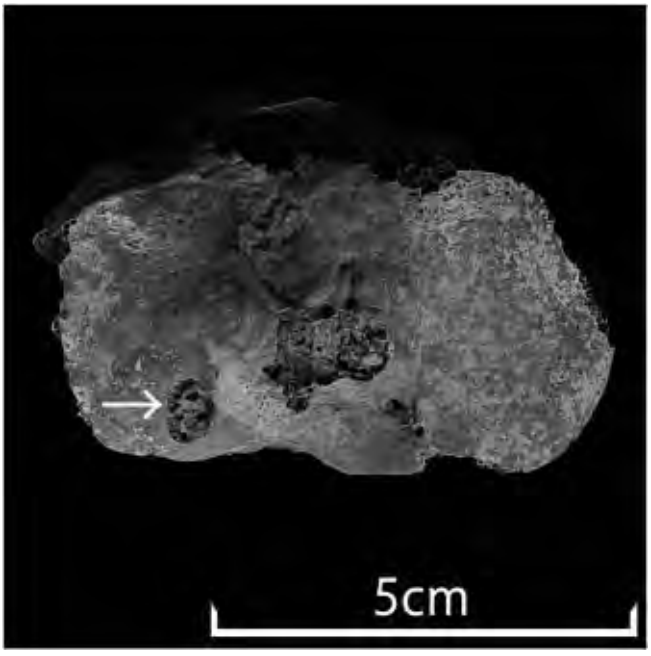

Fig. 7. Healed osteochondritis dissecans on the proximal articular surface of the left tibia of No. 170.

Fig. 8. Photographs of the skull of No. 171.

(170 × 20 × 10 mm maximum, Figure 12) penetrated both hands with the palm side of the left hand placed on the dorsal side of the right hand with little disturbance of the rays of the hand bones. The distance from the top of this pile to the left hand bones was about 50 mm and the length of the pile embedded in the soil was about 80 mm. The right hand of this individual was supinated with the palm of the right hand turned to the ground and the left hand placed on the right. The position of the right radius and ulna also indicated that its right forearm was strongly supinated as seen in Figure 10. This awkward situation was caused not by a pile penetrating the hands by chance after this individual was buried, but by someone who forced the supination of this individual's right forearm, put its left hand on its right, and stabbed both hands around the time of burial. This injury may have been inflicted after death because of the lack of disturbance in the articulation of the hand bones and arm position and no removal of the pile despite its relatively shallow embedment. If this individual had been alive, it would have writhed in agony and pulled

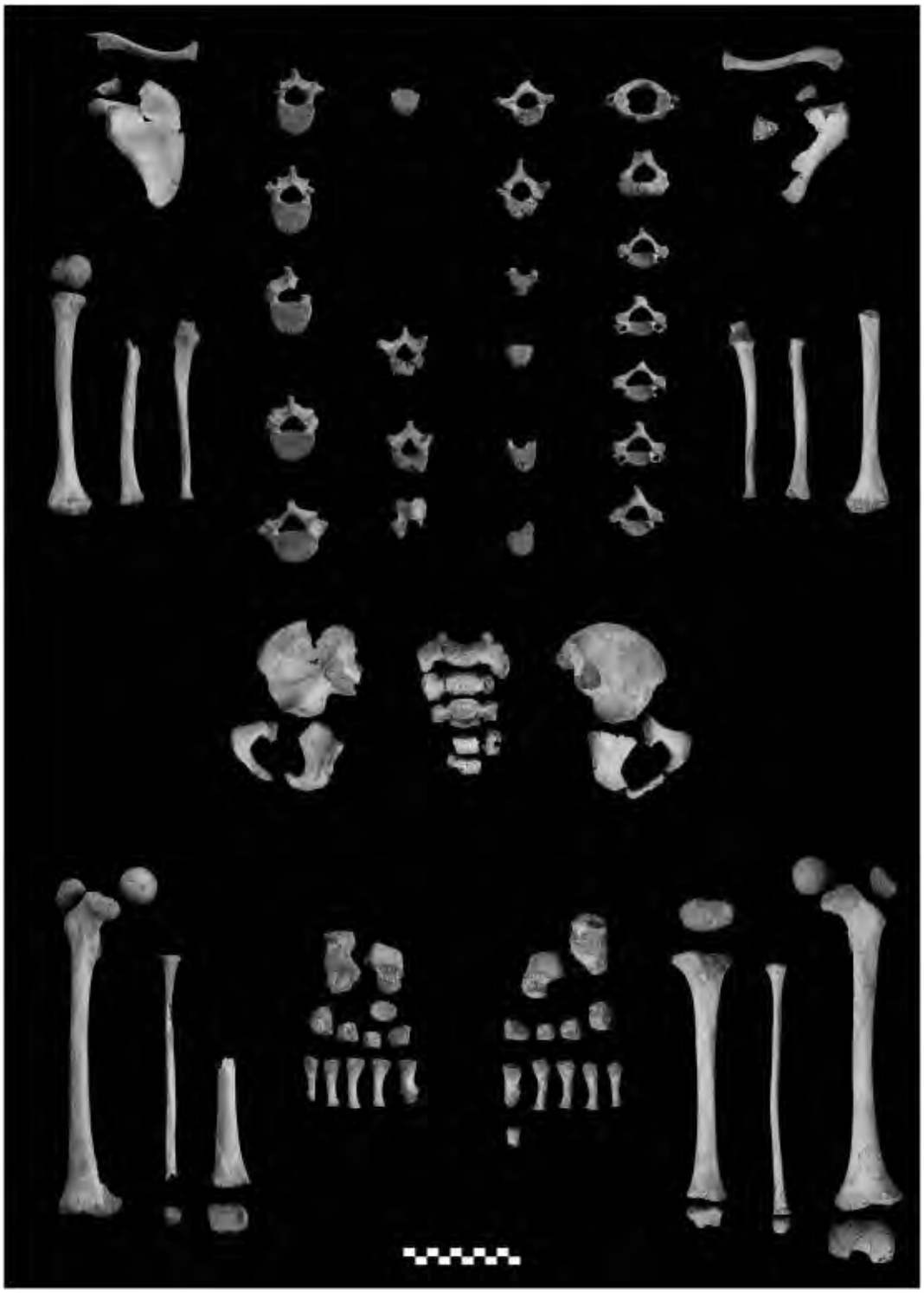

Fig. 9. Photographs of the postcranial bones of No. 171.

Fig. 10. Enlarged image of upper limb of No. 171 during excavation.

out this pile. Noting that this cemetery is located within the Hibiya inlet, almost all the individuals were confirmed as facing west, and the weight of this individual might not have been enough to maintain the burial posture against sea waves, it is inferred that this action might have been carried out in order to keep this individual facing west.

No. 177

This individual was also found in a right lateral decubitus position facing west with some disturbance of its anatomical position (Figure 2). The preservation state of this individual is shown in Figures 3 and 13.

The sex of this individual could not be determined because this individual was so young that only the crowns of permanent teeth had formed. Thus this individual was classified in the age group "Infant".

No artificial harm was found inflicted on this individual, unlike No. 171.

No. 178

This individual was buried about 40 m east, apart from the other individuals. It is thought that this burial was around the same time as the other burials of this site because it has the same burial style as right lateral decubitus position facing west in shallow ellipse shaped grave (Figure 2) and excavated from the same arcaheological layer and attitudes (-0.54 m for this grave and -0.75 m as the average of the other graves) (Hirata, 2015). The preservation state of this individual is shown in Figures 3, 14, and 15.

The sex of this individual was identified as "Female" based on the morphology of the pelvis and skull. Epiphyseal lines can be seen in all the vertebral bodies, proximal humerus, distal radius, and distal ulna. And upper and lower second deciduous molars remained, which indicates this individual was around 15 years old. Thus the age at death of this individual was classified as "Adolescent". The stature was calculated as 137.6 cm in the process of growth.

This individual suffered from considerable atrophy and shortening in the left humerus, radius, ulna, and all hand bones (Figure 16). The difference between sides is considered to have been caused by disuse of the left arm starting from childhood. Suzuki *et al.* (1984) listed the possible diseases that cause disuse atrophy in

Fig. 11. Identification of hand bones of No. 171 by layers.

long bones. Several diseases on their list may have resulted in this individual's disorder, such as infectious diseases (Japanese encephalitis or poliomyelitis anterior acuta), myopathy (myasthenia gravis or polymyositis), spino-cerebellar degeneration (familial amyotrophic lateral sclerosis or spinal muscular atrophy), or cerebral palsy. Considering that this individual had grown to adolescence at death, that only the unilateral upper limb bones were affected, and that there was no evidence of any other disorder (other than spondylolysis of the 5th lumbar seen in Figure 17), poliomyelitis anterior acuta seems the most plausible cause of these diseases.

No. 184

This individual was unearthed in a right lateral decubitus position facing west (Figure 2). A large part of the skeleton of this individual was missing because of disturbance at a later time. The preservation state of this individual is shown in Figures 3, 18, and 19.

The sex of this individual was estimated as "Male" and its age at death was classified as "Middle adult". It was impossible to estimate the stature for lack of intact long bones.

According to morphological traits and cranial measurements, the skull of this individual seems to be less dolichocephalic (cranial index 76.8), chamaeprosopic (48.9 on Kollmann's 48/45 index), and had less alveolar protrusion (alveolar profile angle 68.7), compared with the average data on the medieval population (cranial index under 75, around 50 on Kollmann's index, and alveolar profile angle under 65) in Nagaoka *et al.* (2006). In order to elucidate the characteristics of the skull of this individual, principal component analysis on correlation matrix was performed with 225 male skulls of the Edo period, including 5 of the "daimyo," 40 of the early Edo, 131 of townsmen of the middle-late Edo, 49 of "samurai" of the middle-late Edo (Sakaue 2012, 2013) and 17 male skulls of the Medieval period (12 from the Yuigahama-minami site, 3 from the Marunouchi site, 1 from the Kajibashi site, and this individual). This statistical analysis was carried out with SYSTAT 13 (Systat, Software Inc., 2009).

Table 4 shows the results of the principal component analysis of males. The first principal component may be interpreted as a factor indicating total skull size. For the second principal compo-

Table 3. Identification list of the hand bones of No.171

No.	Side	Identification
First Layer		
1	left	1st metacarpal
2	left	2nd metacarpal
3	left	1st distal phalanx
4		distal epiphysis of 2nd metacarpal
5	left	3rd intermediate phalanx
6	left	2nd intermediate phalanx
7	left	2nd proximal phalanx
8	left	Distal epiphysis of radius
9		unknown
10	left	Capitate
11		Pisiforme
12	left	Triquetrum
13		Pisiforme
14	right	distal epiphysis of radius
15	right	Triquetrum
16		unknown
17	right	Capitate
18		metacarpal
19	left	4th metacarpal
20	left	5th metacarpal
21	right	5th metacarpal
22	right	4th metacarpal
23	right	3rd metacarpal
24	right	1st metacarpal
25	right	2nd metacarpal
26		epiphysis of distal phalanx
27	right	1st proximal phalanx
28	right	3rd proximal phalanx
29	right	2nd proximal phalanx
30		distal phalanx
31		unknown
32		proximal phalanx
33		intermediate phalanx
Second Layer		
34		unknown
35		unknown
36		unknown
37		unknown
38		unknown
39		epiphysis of proximal phalanx
40		distal epiphysis of metacarpal
41		distal phalanx
42		intermediate phalanx
43		distal phalanx
44		distal phalanx
45	left	3rd intermediate phalanx
46		intermediate phalanx
47		distal phalanx
48		distal phalanx
49		intermediate phalanx
50	right	3rd intermediate phalanx
51		distal phalanx
52	right	1st distal phalanx
53		intermediate phalanx
54		distal epiphysis of metacarpal
55		proximal phalanx
Third Layer		
56		unknown
57		unknown
58		unknown
59		unknown
60		unknown
61		epiphysis of distal phalanx
62		unknown
63		unknown
64		unknown
65		unknown
66		unknown
67	right	4th proximal phalanx
68	right	2nd intermediate phalanx

nent, some variables of calvarial breadth and orbital height have positive and relatively high factor loadings, and this principal componet is negatively correlated with the variables of the sagittal diameters of the facial structure. The third principal component is interpreted as indicating that the two subtenses of facial flatness are correlated with the height of the orbit, nose, and mandibular symphysis. The scatter plots of the second and third principal component scores are presented in Figure 20. In this plot, most of the Medieval period people are scattered within the standard deviation ellipse of the early Edo and middle-late townsmen groups, but tend to be

Fig. 12. Photographs of the pile penetrating both hands of No. 171.

located at the upper side of this ellipse. The skull of this individual was located at the left side of this ellipse, which means this skull is relatively closer to the early Edo and middle-late townsmen groups.

There are degenerative changes in the right mandibular fossa and right mandibular head (Figure 21 and 22), which strongly suggest this individual was affected by severe temporomandibular disorder. There is also eburnation of the right articulation between the 3rd and 4th cervical vertebrae (Figure 23) and bone spurs between the left side of the articulation of the 5th and 6th cervical vertebra, which the cervical spondylotic radiculopathy (Figure 24). There was a belt-like osteophyte at the superior angle of the left scapula and a beak-like osteophyte at the dorsal side of the acromion of the left scapula (Figure 25), which indicated a healed fissured fracture in the left scapula. These bone changes suggest that this individual engaged in heavy physical activities.

No. 195

This individual was unearthed beside No. 170

Fig. 13. Photographs of all skeletal remains of No. 177.

Fig. 14. Photographs of the skull of No. 178.

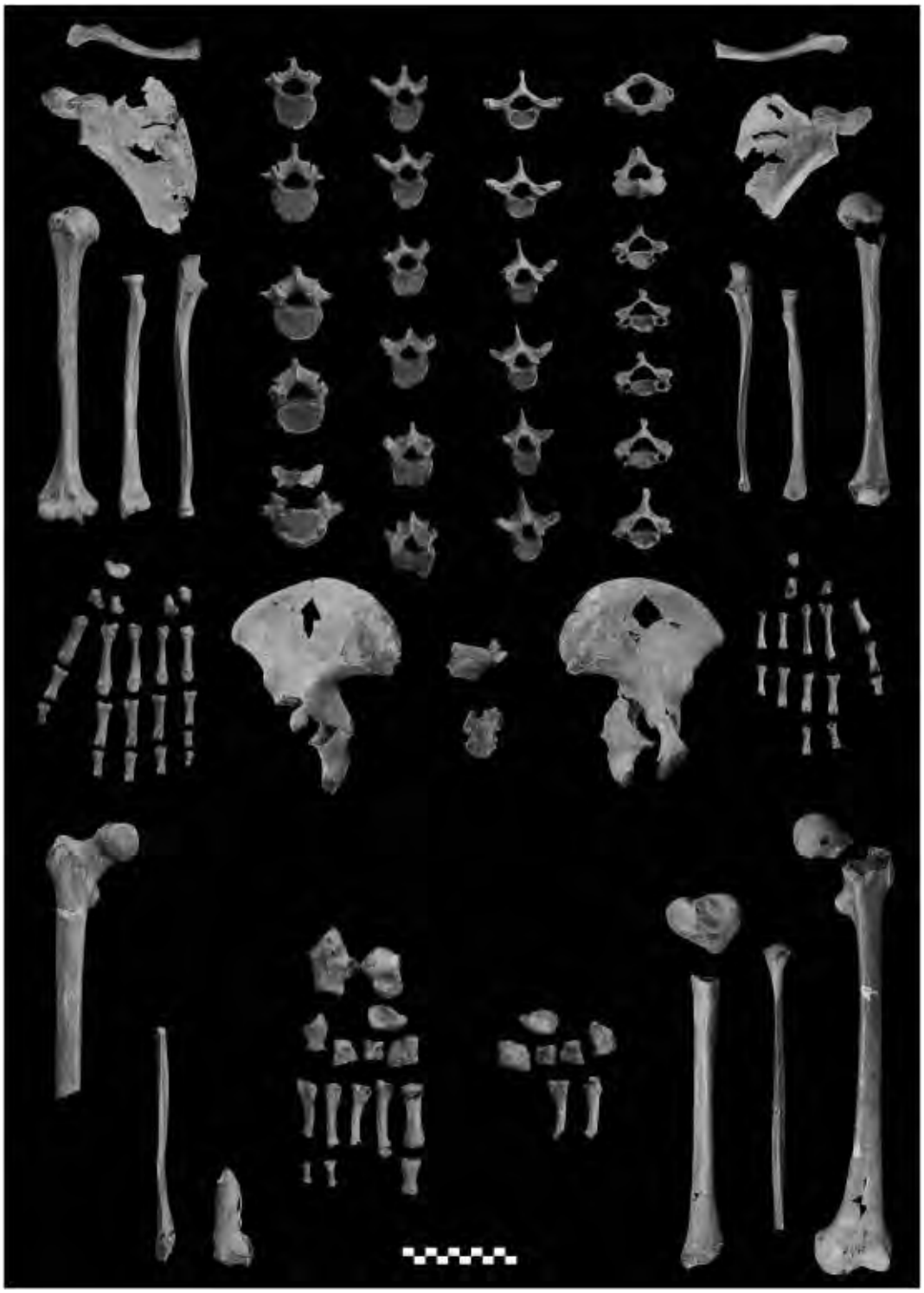

Fig. 15. Photographs of the postcranial bones of No. 178.

Fig. 16. Bilateral asymmetries in the upper limb of No. 178.

Fig. 17. Spondylolysis of 5th lumbar vertebra of No. 178.

and, at first glance, the remains seemed to be piled in disorder (Figure 2). However, it was clear after carefully excavation and identification in situ that the articulation of the maxilla and mandible were kept in the soil and the direction of the face turned to the west. Thus the original burial posture of this individual was possibly the same as the others of this site. The preservation state of this individual is shown in Figures 3 and 26.

The sex could not be determined because this individual was so young that only deciduous teeth had formed. This individual was classified in the age group "Infant".

Discussion

As described above, the skeletal remains excavated from the Yurakucho 1-chome site were composed of one middle adult male (No. 184), one middle adult female (No. 170), one adolescent female (No. 178), one child (No. 171), and two infants (No. 177 and No. 195). It can be said that this composition is consistent with that of a family. Further analysis of DNA will be required for investigation of kindred links between them.

The skeletal remains of this site were only accompanied by some pottery and Chinese coin without tombstone, and were buried within the Hibiya inlet. On the other hand, the Marunouchi, Kajibashi, and Ootemachi sites, in which the skulls of the Muromachi period were dug up, were on land in the Muromachi period and not within inlet. Suzuki (1960) noted that the skeletal remains of the Marunouchi and Ootemachi sites were accompanied by tombstones and wooden coffins. Thus it is possible that these differences may be due to those in social status or Buddhist sectarian differences.

In the 2014 academic year, these skeletal remains were added to the Human Osteological Collection of the Department of Anthropology, NMNST, Tokyo.

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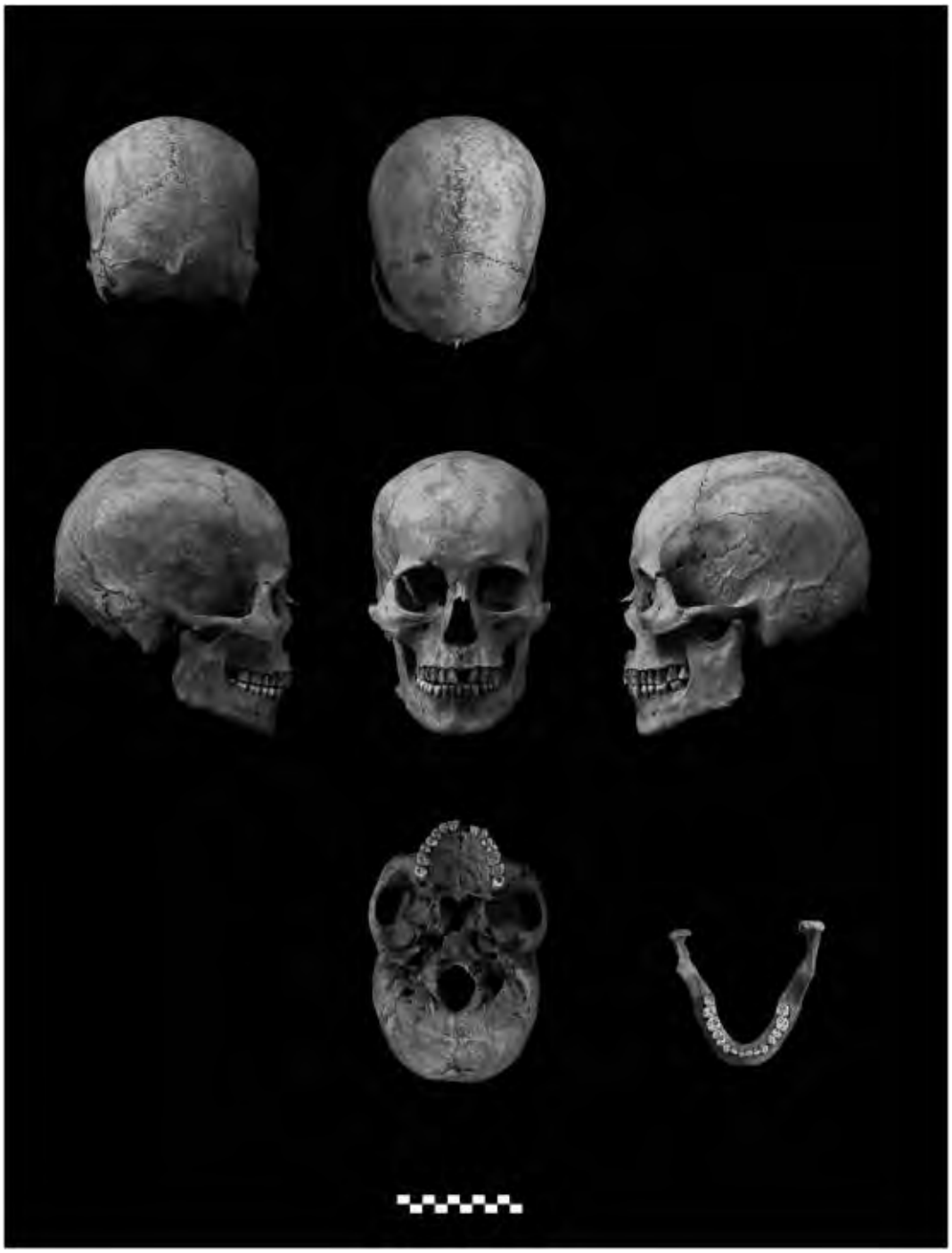

Fig. 18. Photographs of the skull of No. 184.

Fig. 19. Photographs of the postcranial bones of No. 184.

Table 4. Result of principal component analysis.

Martin No.	Variables	1	2	3	4	5	6
1	Maximum length	**0.642**	−0.159	0.187	0.112	**−0.377**	**−0.364**
8	Maximum breadth	**0.313**	**0.595**	0.154	**0.298**	−0.097	**0.376**
17	Basion-Bregma height	**0.564**	0.063	−0.219	**0.328**	−0.210	0.141
9	Least frontal breadth	**0.544**	**0.381**	0.110	**−0.337**	−0.178	−0.144
10	Maximum frontal breadth	**0.357**	**0.635**	0.179	0.061	−0.144	0.028
5	Basion-Nasion length	**0.564**	**−0.325**	−0.044	0.000	0.019	−0.083
11	Biauricular breadth	**0.604**	0.215	0.237	0.089	0.281	**0.346**
12	Biasterionic breadth	**0.435**	0.136	0.100	0.272	−0.168	0.140
40	Basion-Prosthion length	**0.497**	**−0.616**	−0.018	0.041	−0.161	0.005
14	Minimum cranial breadth	**0.493**	**0.399**	−0.125	0.003	**0.309**	−0.017
7	Foramen magnum length	0.266	0.111	0.139	0.151	0.032	**−0.459**
16	Foramen magnum breadth	0.146	0.154	−0.013	0.227	0.143	−0.291
23	Horizontal circumference	**0.725**	0.153	0.200	0.223	**−0.342**	−0.216
24	Transverse arc	**0.461**	**0.488**	−0.103	0.286	**−0.393**	0.271
29	Frontal sagittal chord	**0.461**	0.077	−0.055	0.298	**−0.367**	0.067
30	Parietal sagittal chord	**0.394**	0.016	0.075	0.112	**−0.387**	**−0.333**
31	Occipital sagittal chord	**0.383**	0.100	−0.055	0.196	**−0.321**	0.017
43	Outer biorbital breadth	**0.783**	0.108	0.122	−0.300	−0.011	−0.169
	Nasion subtence (calculated)	0.063	0.049	−0.210	**−0.539**	−0.135	−0.190
44	Biorbital breadth	**0.787**	0.073	0.134	−0.268	0.060	−0.220
45	Bizygomatic breadth	**0.755**	0.041	0.240	−0.025	**0.383**	0.112
46	Bimaxillary breadth (zm)	**0.692**	−0.213	0.048	−0.079	**0.315**	0.095
	Subspinale subtence (calculated)	0.046	0.088	**−0.564**	−0.175	0.021	−0.037
48	Upper facial height	**0.471**	0.057	**−0.702**	−0.080	0.074	−0.027
48d	Malar height	**0.486**	−0.253	−0.300	−0.043	0.071	0.229
49a	Interorbital breadth	**0.538**	0.029	**0.316**	**−0.468**	−0.229	0.066
50	Anterior interorbital breadth	**0.488**	0.027	0.262	**−0.528**	−0.208	0.081
51	Orbital breadth	**0.545**	0.189	−0.123	−0.065	0.181	**−0.432**
52	Orbital height	0.250	**0.465**	**−0.327**	0.056	0.123	−0.149
54	nasal breadth	**0.504**	−0.134	0.264	−0.103	0.046	0.023
55	nasal height	**0.417**	0.115	**−0.588**	−0.089	0.209	−0.055
57	Least nasal breadth	0.236	0.013	0.026	**−0.595**	−0.238	0.279
	Nasal subtense (calculated)	0.050	0.045	**−0.334**	**−0.405**	−0.172	0.246
60	External palate length	**0.400**	**−0.542**	−0.276	0.047	−0.196	−0.030
61	External palate breadth	**0.572**	−0.036	−0.245	0.069	0.136	0.166
66	Bigonial breadth	**0.472**	−0.022	0.236	0.048	0.247	0.085
68	Projective length of mandible	**0.452**	**−0.420**	−0.120	0.074	0.008	0.109
65	Bicondylar breadth	**0.580**	0.027	0.243	0.067	**0.444**	0.017
65(1)	Bicoronoid breadth	**0.591**	**0.307**	0.087	−0.089	**0.342**	0.027
67	Bimental breadth	**0.510**	−0.112	0.000	0.050	0.022	**0.320**
69	Height of mandibular symphysis	**0.345**	−0.079	**−0.575**	0.060	−0.154	0.082
69(1)	Mandibular body height	**0.453**	−0.085	**−0.514**	0.063	−0.095	0.005
69(3)	Mandibular body breadth	**0.310**	**−0.428**	0.267	0.054	−0.169	0.238
70	Height of mandibular ramus	**0.361**	−0.130	−0.218	0.157	0.202	−0.117
71a	Minimum width of ramus	**0.426**	**−0.642**	0.176	0.038	0.038	0.118
71(1)	Condylo-cornoid breadth	**0.318**	**−0.550**	0.135	0.137	0.035	−0.210
	Mandibular condyle breadth	**0.456**	−0.211	0.019	0.188	0.228	−0.067
	Eigenvalues	10.98	3.94	3.21	2.42	2.30	1.83
	Percent of explained (%)	23.4	8.4	6.8	5.1	4.9	3.9

A bold number means a factor loading whose absolute value is greater than 0.3.

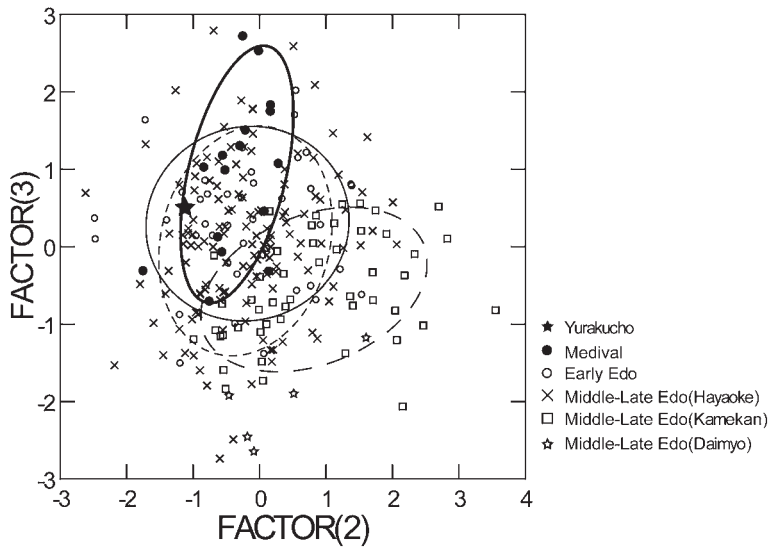

Fig. 20. Plot of the second and third principal component scores.
The ellipses represent the 68.27% confidence interval for the Medieval period (thick line), early Edo period (thin line), the middle–late "Hayaoke" Edo period (dotted line), and the middle–late "Kamekan" Edo period (dashed line). A star symbol in this plot means the skull of No. 184.

Fig. 21. Degenerative change of right mandibular fossa of No. 184.

Fig. 22. Degenerative change of right mandibular head of No. 184.

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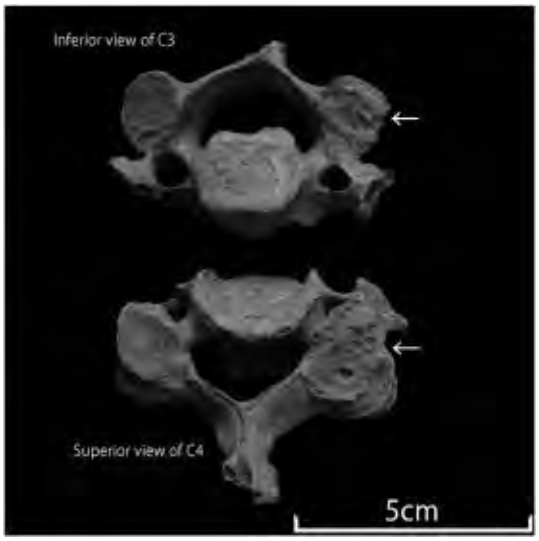

Fig. 23. Degenerative change of 3rd and 4th cervical vertebrae of No. 184.

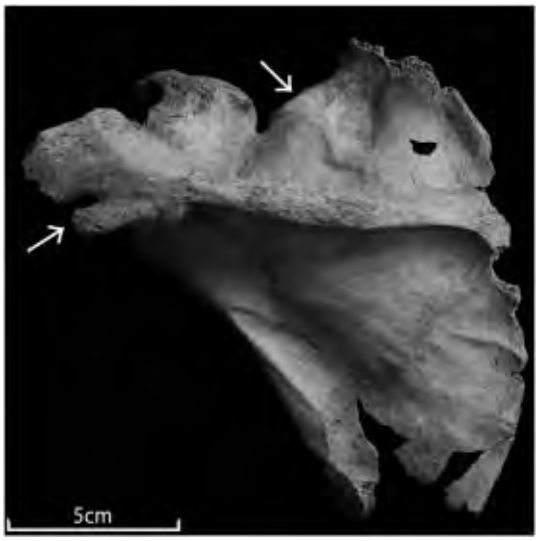

Fig. 25. Healed fracture and osteophyte in left scapula of No. 184.

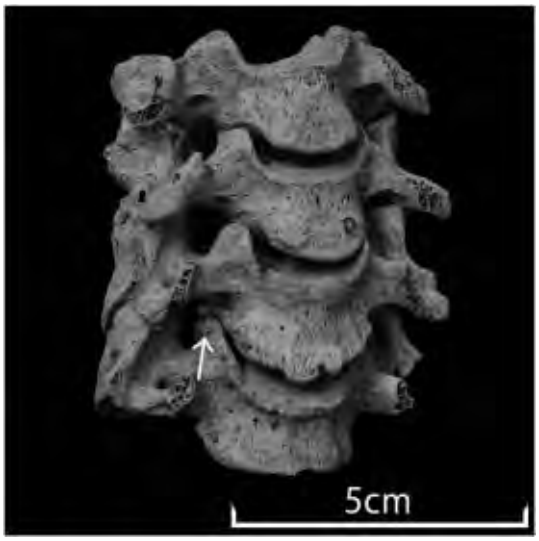

Fig. 24. Bone spur between 5th and 6th cervical vertebrae of No. 184.

Fig. 26. Photographs of all skeletal remains of No. 195.

References

Baba H. (1991) Anthropology. Additional volume 1, II: Osteometry. Yuzankaku, Tokyo (in Japanese).

Fujii A. (1960) Sisikotutyou no nagasa to sintyou tono kankei nituite (Relationship between long bones and stature). Juntendou daigaku taiikugakubu kiyou (Bulletin of the School of Physical Education, Juntendo) 3: 49–61.

Hasegawa I., Uenishi K., Fukunaga T., Kimura R., and Osawa M. (2009) Stature estimation formulae from radiographically determined limb bone length in a modern Japanese Population. Legal Medicine 11: 260–

266.

Jones R.B. and Miller R.H. III (2001) Bony overuse injuries about the elbow. Operative Techniques in Orthopaedics 11: 55–62

Hirata H. (2015) Ikou (Archeological remains). Mitsuifudosan Co. Ltd. and Musashibunkazaikennkyuusho Co. Ltd. edited, Yurakucho 1-chome iseki (Archeological report of the Yutakucho 1-chome site), Mitsuifudosan Co. Ltd. and Musashibunkazaikennkyuusho Co. Ltd., Tokyo, pp. 17–135 (in Japanese).

Kajigayama M. and Sakaue K. (2014) Material Report: Human skeletal remains newly added in the 2013 academic year to the Human Osteological Collection at the Department of Anthropology, National Museum of Nature and Science, Tokyo. Bulletin of the National Science Museum Series D, 40: 25–42.

Matsushita T. (2002) Kanagawa-ken kamakura-si Yuigahama-minami iseki syutudo no chyusei jinkotu (the skeletal remains of the Yuigahama-minami site in Kamakura city, Kanagawa prefecture). Yuigahama-minami iseki cyosadan edited Yuigahama-minami site (Archaeological report of the Yuigahama-minami site), Yuigahama-minami chosadan, Kamakura-si kyouikuiinnkai, Kamakura, pp. 101–134.

Mizumoto Y. (2015) Chyusei no Hibiya (Hibiya area in the Medieval era). Mitsuifudosan Co. Ltd. and Musashibunkazaikennkyuusho Co. Ltd. edited Yurakucho 1-chome iseki (Archeological report of the Yutakucho 1-chome site), Mitsuifudosan Co. Ltd. and Musashibunkazaikennkyuusho Co. Ltd., Tokyo, pp. 430–437 (in Japanese).

Nagaoka T., Shizushima A., Sawada J., and Hirata K. (2006) Morphological variation of crania of the Medieval period Japanese. Anthropological Science (Japanese series) 114(2): 139–150 (in Japanese with English summary).

Sakaue K. (2012) Craniofacial variation among the common people of the Edo period. Bulletin of the National Science Museum Series D, 38: 39–49.

Sakaue K. (2013) Secular changes in craniofacial morphology during the Edo period of Japan. Bulletin of the National Science Museum Series D, 39: 9–18.

Suzuki H. (1960) Hone (Bones), Gakuseisha, Tokyo, pp. 175–193 (in Japanese).

Suzuki T., Mineyama I., and Mitsuhashi K. (1984) Paleopathological study on an adult skeleton of Jomon period from Irie shell mound, Hokkaido. Journal of Anthropological Society of Nippon 92: 87–104 (in Japanese with English summary).

Systat Software Incorporated (2009) SYSTAT 13: Chicago, Illinois, USA.