

# Material report: Human skeletal remains of Kofun period excavated from the Nakawada tumulus cluster at Tama City, Tokyo

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**Abstract** This is a material report of human skeletal remains excavated from the Nakawada tumulus cluster at Tama city, Tokyo in 1976. Although some of the remains were accompanied by many burial accessories, such as swords and arrowheads, and they were in a relatively good condition, the remains have not been used for anthropological studies because the archaeological report was not published until 2017. The purpose of this report was to present an inventory of human skeletal remains in English. There were at least 20 individuals in total, and almost all of them were middle-aged adults (9 males and 3 females, 7 of unknown sex).

**Key Words:** skeletal remains, Kofun, Hitachinaka seaside tumulus cluster

## Introduction

This material report focuses on morphological descriptions of human skeletal remains excavated from the Nakawada tumulus cluster of the Kofun period. The Nakawada tumulus cluster was located at 1523 Wada, Tama city, Tokyo, and was discovered during the construction of a Buddhist cemetery. The site was excavated by the Rissho University Archaeological Laboratory of Rissho University between August and December, 1976.

The site includes a group of horizontal tunnel tombs on a plateau on the southern slope of the Ohkuri River, a tributary of the Tama River. The tomb chambers could be approached via tunnel pathways 10–20 m from the entrance on the slope, and a rectangular chamber about 2 m long was built at the back of the tunnels, with the ground surfaces covered with gravels (Fig. 1). In contrast to the general type of the tunnel tombs with few burial accessories, there were many burial accessories found at this site, including several straight swords and numerous iron arrowheads. Human skeletal remains were excavated from eight tunnel tomb sites (No. 2, 3, 6, 7, 8, 9,

10, and 11) and were brought to the department of Anthropology, the National Museum of Nature and Science, Tokyo in November 1976 for appraisal and conservation treatment.

The Rissho University Museum (2017) published an archaeological report about the burial site. However, to date, no other reports on human skeletal remains have been published. This is the reason why these remains have not been used for anthropological studies in spite of their relatively good preservation. Therefore, this report aims to present a basic morphological analysis of the human skeletal remains excavated from the Nakawada tumulus cluster.

## Material and Methods

All human skeletal remains were cleaned, repaired, and stored at the Department of Anthropology at the National Museum of Nature and Science, Tokyo. The estimation of age at death was based on the pubic symphysis, auricular surface of the pelvis, epiphyseal union, cranial sutures, and tooth wear. An individual's age at death is classified into the following eight age categories: "Infant," "Child," "Adolescent," "Young adult," "Middle adult," "Old adult," "Child?" and "Adult?" (Kajigayama and Sakaue,

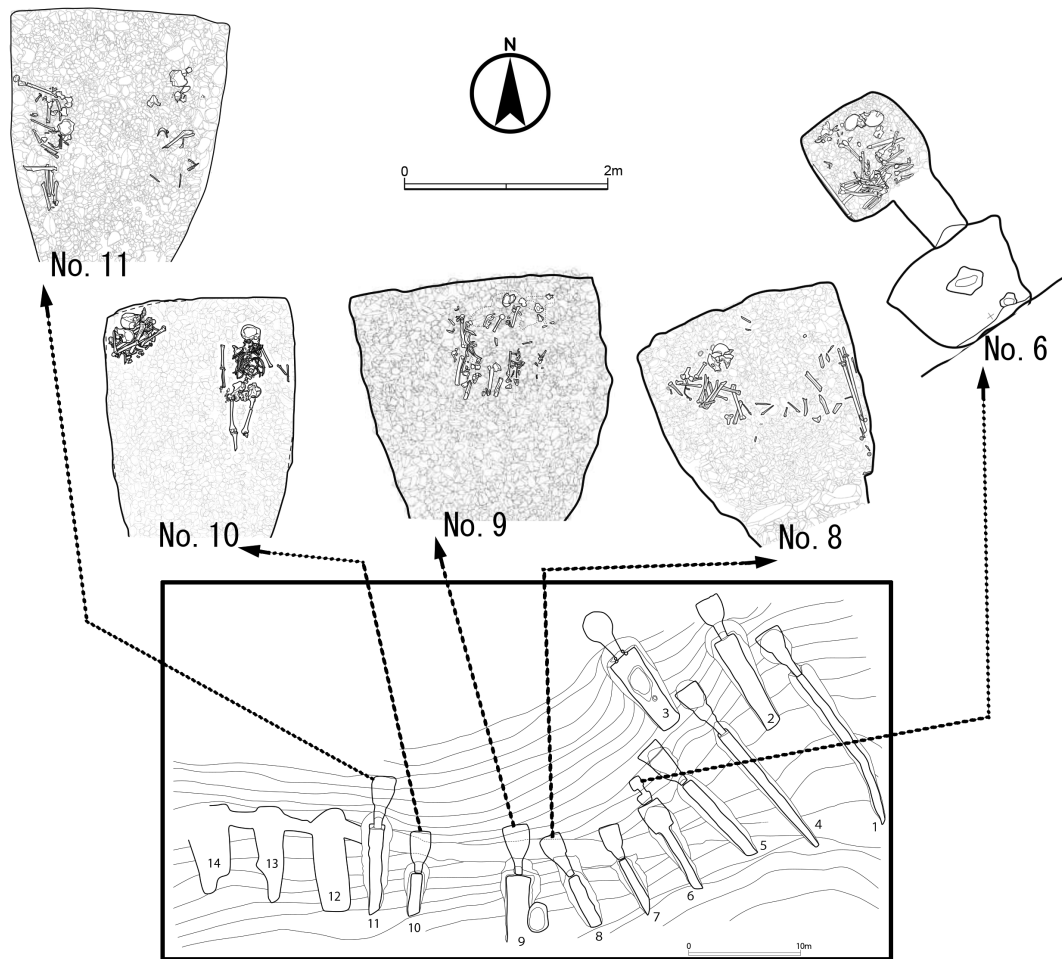


Fig. 1. Plan of the Nakawada tumulus cluster and enlarged figures of tomb chambers and excavated state of the human skeletal remains.

2014). The sex of an individual could be identified based on morphological characteristics, including the greater sciatic notch and ventral arc of the pelvis, the supraorbital ridge, and the mastoid process of the skull (Buikstra and Ubelaker, 1994; Sakaue and Adachi, 2009). The following five classifications pertain to this criterion: “Male,” “Male?” “Female,” “Female?” and “Unknown” (Kajigayama and Sakaue, 2014).

Tables 1 shows the list of identifiable skeletal remains, and Table 2 and 3 show cranial and postcranial measurements of skeletal remains that were preserved enough to be measured. The bones were measured primarily on the left side, and those on the right side were measured when

the left side was unavailable. The definitions of all measurements follow Martin (Baba, 1991). Reference data were obtained from the mean values for eastern Japanese during the Kofun period (Yamaguchi, 1987). The stature was estimated using the formula developed by Fujii (1960). The human skeletal remains identifiable for each tomb were numbered consecutively.

## Results and Discussion

### No. 2 tunnel tomb

A small number of long bone fragments were found in the center of the tomb chamber, all of which were too small to be identified and recon-

Table 1. List of identified human skeletal remains excavated at the Nakawada tumulus cluster

Number	side	Identification	Sex	Age at death	note
No. 3 tunnel tomb					
1		femur			fragments
No. 6 tunnel tomb					
1		cranium	Middle adult	Male	
2		cranium	Middle adult	Female?	
3	right	humerus		Male?	same individual of No. 5
4	right	humerus			
5	left	humerus		Male?	same individual of No. 3
6	right	ulna			same individual of No. 7
7	right	ulna			
8	left	ulna			same individual of No. 6
9	right	radius			
10	right	femur		Male	Same individual of No. 15
11	right	femur		Male	Same individual of No. 18
12	right	femur		Female?	Same individual of No. 16
13	right	femur			
14	right	femur			
15	left	femur		Male	Same individual of No. 10
16	left	femur		Female?	Same individual of No. 12
17	left	femur			
18	left	femur		Male	Same individual of No. 11
19	left	femur			
20	right	tibia			
21	right	tibia			
22	right	tibia			
23	right	tibia			
24	left	tibia		Female?	
25	left	fibula			
26	left	hipbone	Middle adult	Female	preaulicular sulcus
27	right	hipbone	Middle adult	Female	preaulicular sulcus
28	right	hipbone		Female	preaulicular sulcus
No. 8 tunnel tomb					
1		cranium	Middle adult	Male	
2	right	temporal		Male?	
3	right	parietal			
4	right	clavicle		Male?	
5	right	humerus		Male?	Same individual of No. 6
6	left	humerus		Male?	Same individual of No. 5
7	left	humerus		Male?	
8	right	ulna			
9	left	ulna			
10	right	radius			
11	left	radius			
12	right	femur			Same individual of No. 13
13	left	femur		Male	Same individual of No. 12
14	right	femur		Male	
15	right	femur		Male?	Same individual of No. 16
16	left	femur		Male?	Same individual of No. 15
17	right	tibia		Male	Same individual of No. 18
18	left	tibia		Male	Same individual of No. 17
19	left	tibia			
20	left	tibia			
21	right	talus		Male?	Same individual of No. 17
No. 9 tunnel tomb					
1		frontal and parietal			
2		parietal			
3	left	temporal			
4	right	temporal			
5		mandible			
6	right	clavicle			
7	right	humerus		Male	
8	right	humerus		Male	
9	right	humerus			
10	left	femur			

Table 1. Continued

Number	side	Identification	Sex	Age at death	note
11	left	ulna			
12	right	radius		Male?	Same individual of No. 12
13	left	radius		Male?	Same individual of No. 11
14	left	hipbone		Male	
15	right	femur		Male?	Same individual of No. 16
16	right	femur		Male?	
17	left	femur		Male?	Same individual of No. 14
18	right	fibula			Same individual of No. 20
19	left	fibula			
20	right	fibula			Same individual of No. 18
21	right	talus		Male?	Same individual of No. 22
22	left	talus		Male?	Same individual of No. 21
No. 10 tunnel tomb					
1		skull	Middle adult	Male	
2	right	clavicle			
3	left	clavicle			
4	right	scapula			
5	left	scapula			
6	right	humerus		Male	
7	left	humerus		Male	
8	right	ulna		Male	
9	left	ulna		Male	
10	right	radius			
11	left	radius			
12	right	hipbone	Middle adult	Male	
13	left	hipbone	Middle adult	Male	
14	right	femur		Male	
15	left	femur		Male	
16	right	tibia		Male	
17	left	tibia		Male	
18	right	fibula		Male	
19	left	fibula			
20		skull	Middle adult	Female	
21	right	clavicle			
22	left	clavicle			
23	right	scapula			
24	left	scapula			
25	right	humerus		Female?	
26	left	humerus		Female?	
27	right	ulna		Female?	
28	left	ulna		Female?	
29	right	radius		Female?	
30	left	radius			
31		sacrum			
32	right	hipbone	Middle adult	Female	preaicular sulcus
33	left	hipbone	Middle adult	Female	preaicular sulcus
34	right	femur		Female?	
35	left	femur		Female?	
36	right	tibia		Female?	
37	right	temporal	infant		
No. 11 tunnel tomb					
1		cranium	Middle adult	Male	Same individual of No. 2
2		mandible	Middle adult	Male	Same individual of No. 1
3		cranium	Middle adult		
4		mandible	Middle adult	Male	
5	left	ulna			
6	right	radius			
7	right	hipbone			
8	left	hipbone	Middle adult	Male	
9	right	femur		Male	Same individual of No. 11
10	right	femur		Male?	Same individual of No. 12
11	left	femur		Male	Same individual of No. 9
12	left	femur		Male?	Same individual of No. 10
13	left	femur			
14	right	tibia			

Table 2. Cranial measurements of male individuals excavated at the the Nakawada tumulus cluster

Marin's No.	Variables	Nakawada tumulus cluster				Kofun	
		No. 8 Male	No. 10 Male	No. 10 Female	No. 11 Male	Male (means)	Female (means)
1	Maximum length	184.0		181.0	172.0	182.6	174.9
5	Basion-Nasion length	105.0		95.0		101.6	97.2
8	Maximum breadth		135.0		145.5	143.1	138.3
9	Minimum frontal breadth	100.0		98.0		94.5	91.5
17	Basion-Bregma height	144.0		132.0		136.6	137.7
40	Basion-Prosthion length	99.0	97.0	98.0		100.1	94.9
45	Bizygomatic breadth			122.0		141.6	131.8
46	Bimaxillary breadth	96.5		96.0		102.4	97.3
48	Malar height	64.0	63.5	64.0		71.0	66.7
51	Orbital breadth	41.0	42.5	40.5		42.9	41.2
52	Orbital height	32.5	35.0	33.5		34.3	33.6
54	Nasal breadth	27.0	28.0	26.0		27.1	26.6
55	Nasal height	52.5	52.0	48.0		51.4	48.3
57	Least nasal breadth	5.5	7.0	7.0		7.4	8.1
8/1	Cranial index	79.4			84.0	78.7	78.8
17/1	Cranial length-height index	78.3		72.9		75.3	74.9
48/45	Upper facial Index of Kollman			52.9		50.7	52.3
48/46	Upper facial Index of Kollman Virchow			65.3		69.2	69.4
52/51	Orbital index	79.3	82.3	85.0		80.3	81.7
54/55	Nasal index	51.4	53.8	53.2		53.2	55.1
	Frontal index of flatness	11.4		13.9		15.2	13.2
	Simotic index of flatness	27.9		14.3		31.2	22.0
	Zygomatic index of flatness	21.4		14.7		20.1	20.8

structed. The minimum number of individuals was one. The age at death was classified as "Adult?" and sex was identified as "Unknown."

### No. 3 tunnel tomb

Two fragments of human skeletal remains were found in the tomb chamber. One included fragments of the femur, and the other was not identified or reconstructed. The minimum number of individuals was one. The age at death was classified as "Adult?" and sex was identified as "Unknown."

### No. 6 tunnel tomb (Fig. 2)

Due to the collapse of the ceiling of the original chamber in the past, an additional small chamber was built on the back wall of the chamber, and the human skeletal remains of several individuals seemed to be reburied in this small chamber. The anatomical positions of these individuals were not maintained; their skulls were placed at the back of the small chamber, and their limb bones were placed at the front.

The minimum number of individuals in this

tomb was estimated to be five based on five right femurs and five left femurs. The sex and age at death group estimated from these crania were one "Middle adult," "Male" and one "Middle adult," "Female"; those estimated from the hipbone were two "Adult?" "Females," and those estimated from the femurs were two "Adult?" "Males?"; one "Adult?" "Females?"; and two "Adult?" "Unknown." Eleven teeth (four of them only roots) remained in the No. 1 skull, and one tooth (only root) remained in the No. 2 skull. Nine isolated teeth were also identified. The right lateral incisor of the mandible of No. 1 skull was removed, and the alveolus was closed before death. Given that this male individual was so old that his tooth was removed naturally, and only one side of the tooth was missing, it is unlikely that the tooth was extracted according to custom. The preauricular sulci were distinct in all hipbones. One femur of No. 10 showed weak pilastric features (pilastric index of the central diaphysis, 101.9).

### No. 7 tunnel tomb

Small pieces of skull fragments and 12











remaining teeth were excavated from the rear wall of the tomb. The sex of this individual was identified as “Unknown,” and the age at death was classified as “Adult?” The minimum number of individuals was one.

No. 8 tunnel tomb (Fig. 3)

Human skeletal remains were found in the two areas. The accumulated human skeletal remains were located on the west side of the tomb and were widely scattered along the east wall. The anatomical positions of individuals were not maintained. Accompanying human skeletal remains on the eastern side, two straight swords, fourteen iron arrowheads, and six knives were found. This is the largest number of weapons excavated at this site.

The bone accumulation on the west side

includes relatively well-preserved human skeletal remains, which are thought to have originated from the same individual based on their common characteristic of having thick and flat limb bones. Another right femur with half the damage was excavated from this assembly. The scattered remains on the east side were identified as skull fragments, including one left femur, one right femur, and two left tibiae. The left femur seemed to come from the same individual as the right one, with half damaged in west accumulation. There was also a right femur with a narrower diaphysis than the others. Therefore, the minimum number of individuals in the tomb was estimated to three. The sex and age at death group estimated from the skull were one “Middle adult,” “Male”; and those estimated from the femurs were one “Adult?” “Male?” and one

Table 3. Continued

		No. 11				
Sample Number	Estimated sex	9	10	11	13	14
Side		Male right	Male? right	Male left	left	right
<b>HUMERUS</b>						
1	Maximum length					
5	Maximum diameter of mid-shaft					
6	Minimum diameter of mid-shaft					
6/5	Index					
7a	Circumference of mid-shaft					
<b>ULNA</b>						
1	Maximum length					
11	Sagittal shaft diameter					
12	Transverse shaft diameter					
11/12	Index					
3a	Circumference of mid-shaft					
<b>RADIUS</b>						
1	Maximum length					
4	Maximum transverse shaft diameter					
5	Minimum sagittal shaft diameter					
5/4	Index					
5(5)	Circumference of mid-shaft					
<b>FEMUR</b>						
1	Maximum length	33.0	28.0	32.0	26.0	
6	Sagittal diameter of mid-shaft	30.0	25.5	29.0	26.0	
7	Transverse diameter of mid-shaft	110.0	109.9	110.3	100.0	
6/7	Index	100.0	84.0	100.0	84.0	
8	Circumference of mid-shaft					
9	Transverse diameter of proximal shaft					
10	Anteroposterior diameter of proximal shaft					
10/9	Index					
<b>TIBIA</b>						
1a	Maximum length					30.0
8	Maximum diameter of mid-shaft					18.0
9	Minimum diameter of mid-shaft					60.0
9/8	Index					75.0
10	Circumference of mid-shaft					
10a	Circumference at nutrient foramen					
<b>FIBULA</b>						
1	Maximum length					
2	Maximum diameter of mid-shaft					
3	Minimum diameter of mid-shaft					
3/2	Index					
4	Circumference of mid-shaft					

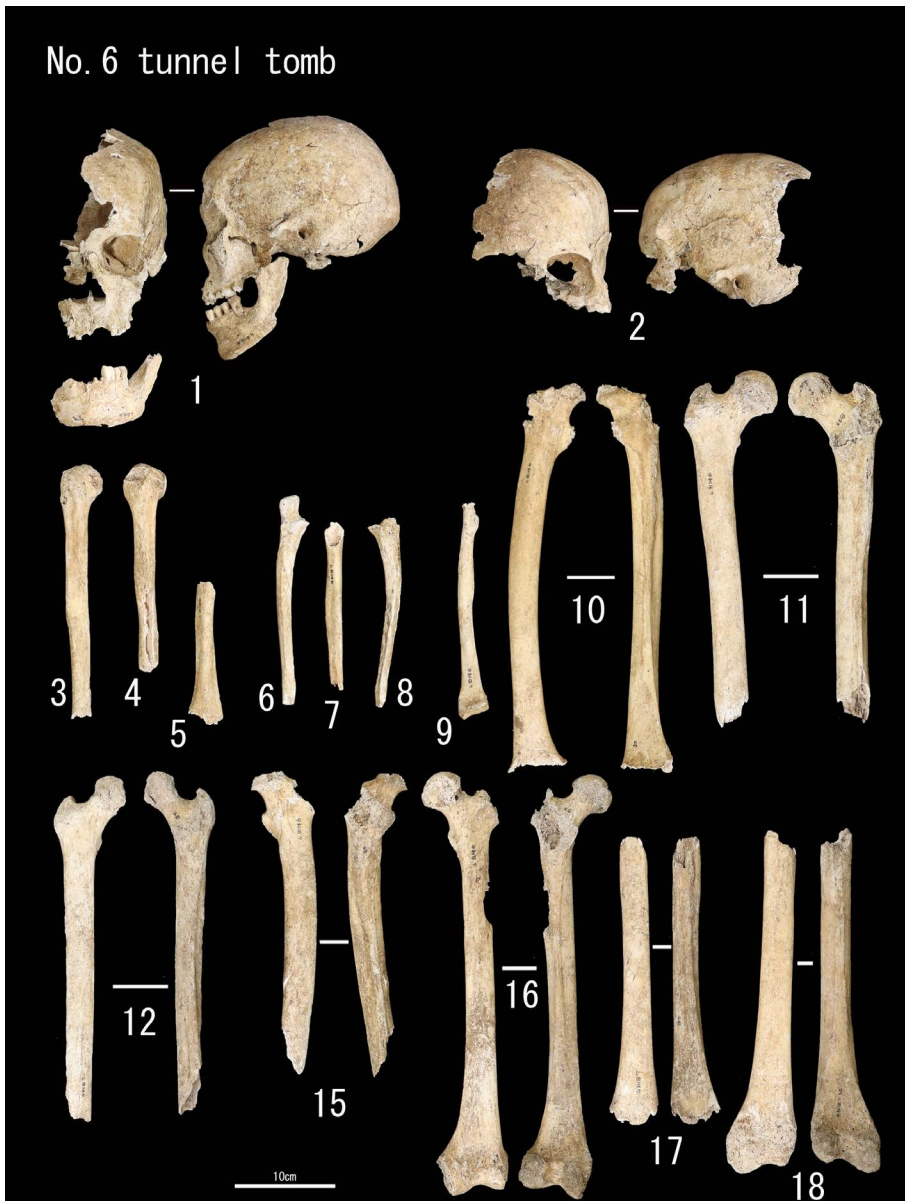


Fig. 2. Photographs of the human skeletal remains excavated from No. 6 tunnel tomb. The numbers correspond to those in Table 1.

“Adult?” “Unknown.” The cranium on the west side was mesocephalic (cranial index: 79.4), and the brow arch and mastoid processes developed were relatively strong. The nasal root was relatively flat (simotic index: 27.9). The shape of the facial region was low and broad (Virchow’s upper facial index, 66.3). Thirteen teeth with weak wear remained in the cranium.

#### No. 9 tunnel tomb (Fig. 4)

In this tomb, human skeletal remains with four isolated teeth were found scattered around the central area of the tomb chamber, most of which did not maintain their anatomical position. The minimum number of individuals was three based on the three right humeri. It was not possible to estimate the age at death, and it can be said that

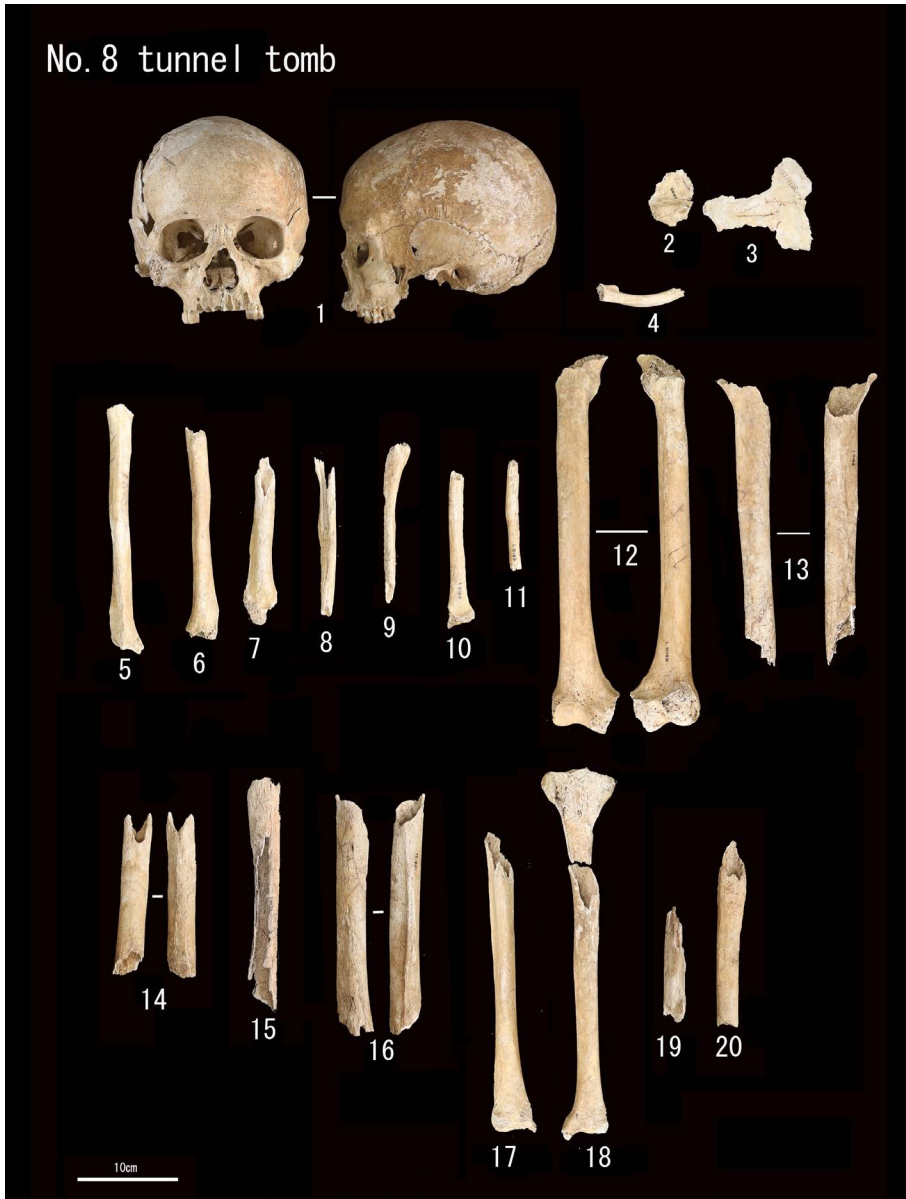


Fig. 3. Photographs of the human skeletal remains excavated from No. 8 tunnel tomb. The numbers correspond to those in Table 1.

almost all remains were of “Adults?” Two right humeri of stout diaphyses and left hipbone with narrow greater sciatic notch indicated that at least two “Males” were buried in this tomb.

#### No. 10 tunnel tomb (Fig. 5)

There were two areas where the human skeletal remains were accumulated at the northwest

corner of this tomb chamber, and where one set of skeletal remains maintained its anatomical position with an extended burial at the east side of this chamber. Therefore, the human skeletal remains buried in this tomb could be clearly individualized from where the bones were found and were best preserved among those buried in the tombs at this site.

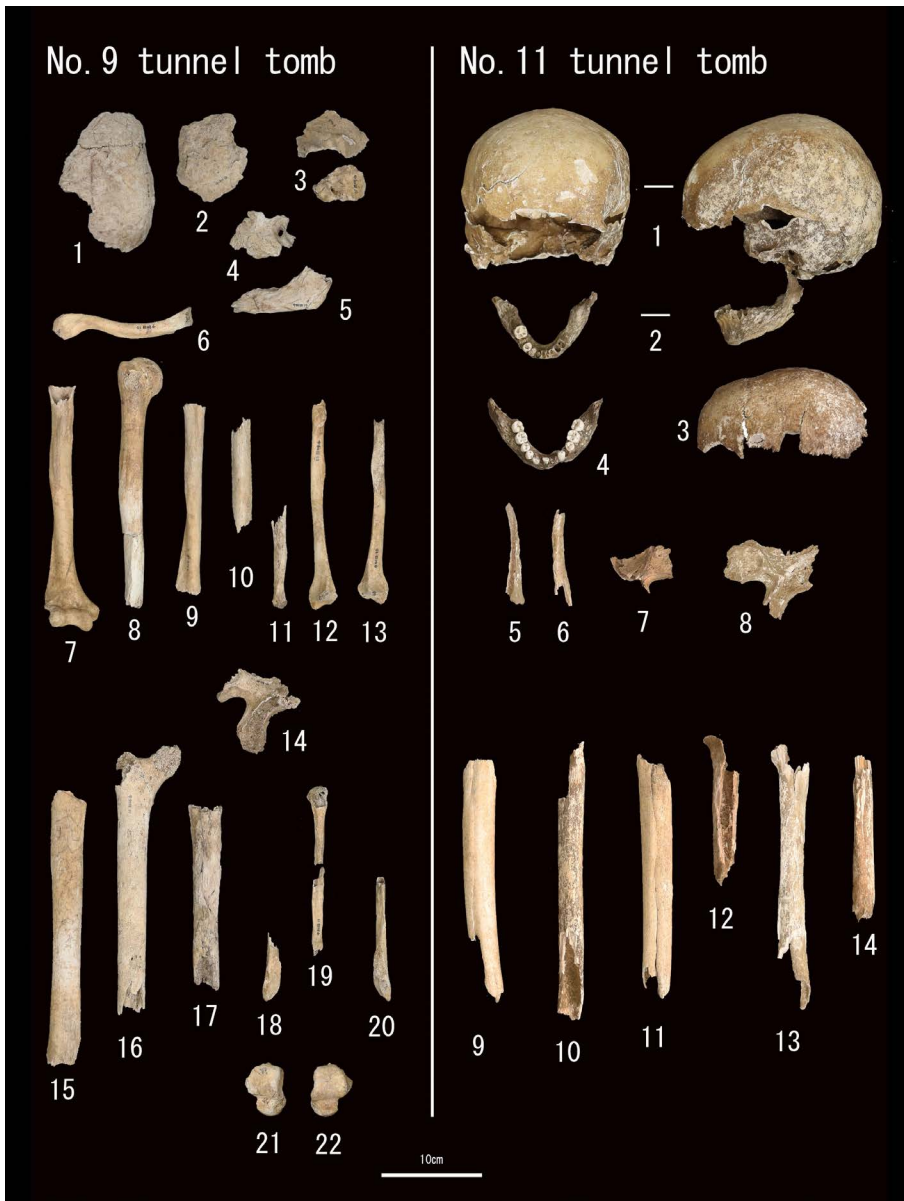


Fig. 4. Photographs of the human skeletal remains excavated from No. 9 and No. 11 tunnel tombs. The numbers correspond to those in Table 1.

The bone assemblage in the west corner includes the human skeletal remains of one adult individual and the right temporal bone of an infant. All skeletal remains, except for the infant bone found in the northwest corner, may be of the same individual. All human skeletal remains found in the east apparently belong to one individual. The sex and age at death of adult individ-

ual of the northwest was estimated to be "Middle adult," "Male," based on the shape of the skull and pelvis. The estimated stature with the maximum length of the femur (420mm) was 1586mm. The skull appeared dolichocephalic, and the brow arch and mastoid processes were relatively strongly developed. The nasal root was flat (simotic index, 0.0). The lateral overhang at

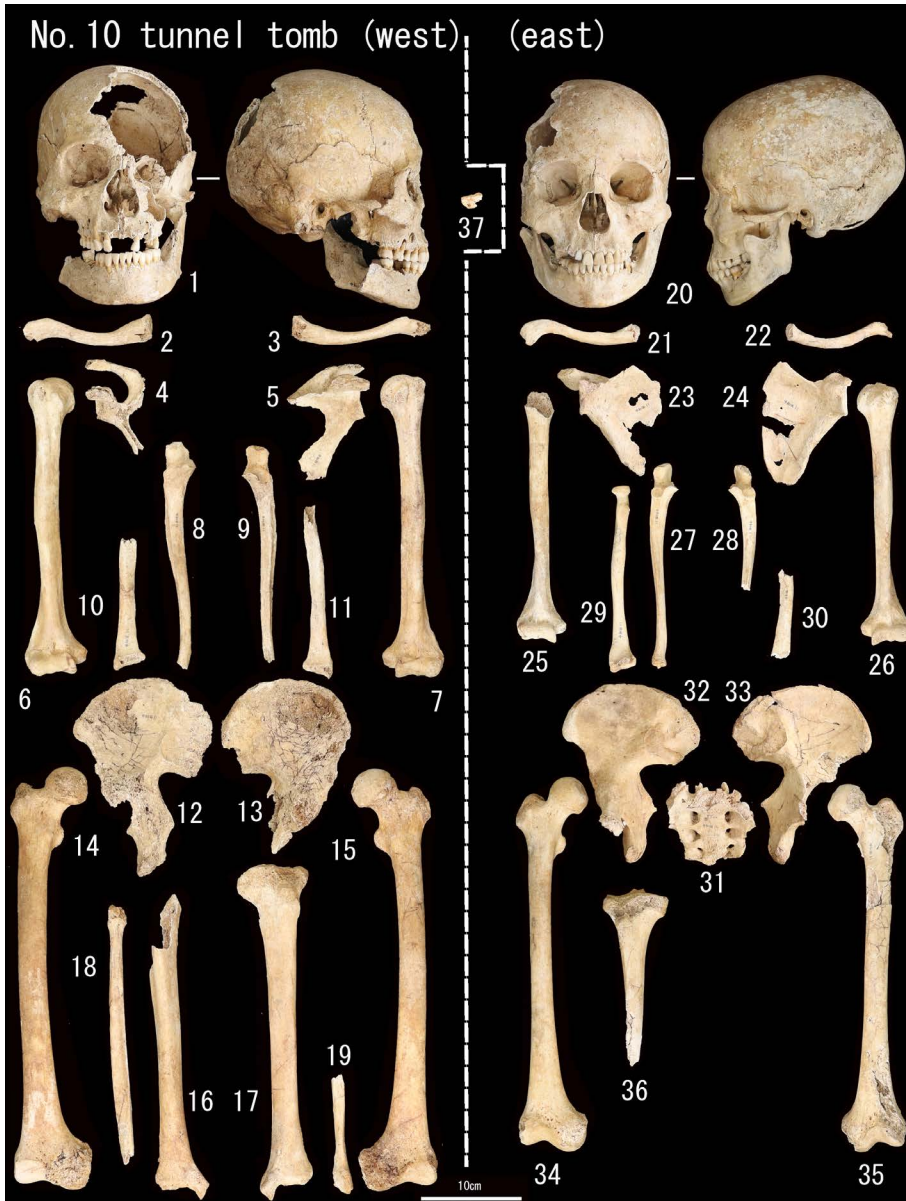


Fig. 5. Photographs of the human skeletal remains excavated from No. 10 tunnel tomb. The numbers correspond to those in Table 1.

the mandibular angle was relatively weak. Twenty-three severely worn teeth remained in this skull. The muscle attachment areas of the long bones were developed, and the femur diaphysis showed a pilaster (the pilastic index at the center of the femoral shaft was 106.9).

Human skeletal remains in the east were also relatively well preserved. The estimated stature,

with the maximum length of the femur (372 mm), was 1443 mm. The sex and age at death of this adult individual were estimated to be "Middle adult," "Female," based on the shape of the skull and pelvis. The skull appeared mesocephalic, and the brow arch and mastoid processes were relatively weak. The nasal root was relatively flat (simotic index, 14.3). The shape of the facial

Table 4. Summary of the human skeletal remains excavated from the Nakawada tumulus cluster

Tomb number	Period*	N	Age group	Sex	Stature
No. 2	latter half of 7c	1	Adult?	Unknown	
No. 3	latter half of 7c	1	Adult?	Unknown	
No. 6	first half of 7c	5	Middle adult Middle adult Adult? Adult? Adult?	Male Female Male? Female Unknown	
No. 7	latter half of 7c	1	Adult?	Unknown	
No. 8	middle of 7c	3	Middle adult Adult? Adult?	Male Male? Unknown	
No. 9	end of 7c	3	Adult? Adult? Adult?	Male Male Unknown	
No. 10	end of 7c	3	Middle adult Young adult infant	Male Female Unknown	1586 1443
No. 11	middle of 7c	3	Middle adult Middle adult Adult?	Male Male? Unknown	

\*: the description of each period are cited from Rissho University Museum (2017).

region was broad and low (upper facial index of Virchow, 65.3). Twenty-eight teeth with weak wear remained in the skull. A persistent metopic suture measuring approximately 2 cm was observed in the frontal bone. Cribra orbitalia on the roofs of the orbits could be identified. The muscle attachment areas of long bones were very weak. The preauricular sulcus of the right and left hipbones were distinct.

#### No. 11 tunnel tomb (Fig. 4)

In the tomb chamber, there were two areas on the west and east sides where the human skeletal remains were found. Because these remains were poorly preserved, and the right and left femurs of the same individual were found on the west side (No. 10 in Table 1 and Fig. 4) and east side (No. 12), respectively, the positions of the skeletal remains could not be reflected in their original burial area, as seen in the No. 10 tunnel tomb. There were many artifacts, including two swords, 16 iron arrowheads, iron tools such as tweezers, and two iron needles, which were among the few samples found in Japan (Rissho University

Museum, 2017).

The minimum number of individuals was three based on the three left femurs. It was difficult to identify the human skeletal remains belonging to each individual because of their poor preservation and disturbance of the tomb chamber. The cranium and mandible with remaining four severely worn teeth indicated that the sex and age at death of this individual was “Middle adult,” “Male.” Another mandible with 11 worn teeth indicated that this individual also was “Middle adult,” “Male?” Furthermore, the greater sciatic notches of right and left hipbones also indicated male individuals. The cranium on the west side was mesocephalic (cranial index, 79.4). The femur diaphyses (Nos. 9 and 11) of an individual clearly showed pilasters (pilastric indices were 110 on the right side and 109.9 on the left).

As shown in Table 4, at least 20 individual human skeletal remains were excavated from the Nakawada tumulus cluster. Almost all individuals except for an infant with the right temporal bone. The estimated sex of the adult individuals was nine males, three females, and seven

unknown, with males tending to be more numerous than females. The estimated age of death for the adult individuals was higher as six individuals were classified as “Middle adults.” Although the preservation of human remains was poor, and only a few individuals could be evaluated, the estimated statures of both male and female were lower than the average for the Kofun period (male as 1630mm, female as 1515mm, Hiramorto, 1972). However, many male femur bodies appeared thicker and had more developed muscle attachments. The femoral linea asperas of two femurs of the No. 11 tunnel tomb were so developed that the pilastric indices were approximately 120, similar to those of the Jomon people. The five hipbones on both sides, which could be presumed to be female, had a preauricular sulcus, which was thought to indicate pregnancy. The cranium excavated from this site had a lower upper facial height in both sexes. In general, people buried in tunnel tombs in the Kanto region tended to be tall and long-faced, but the human skeletal remains excavated from this site showed the opposite trend. This may be related to the fact that this burial site belonged to the earlier phase of the Kofun period because the influence of an earlier group, the Jomon people might remain in the Kanto region, and that the burials were accompanied by a large number of accessories, which meant that people buried at this site might have come from a higher social class. Therefore, it is necessary to investigate the morphological

characteristics of the increasing number of human skeletal remains during the Kofun period in the Kanto region. In addition, we plan to investigate population dynamics and kinship during the Kofun period in more detail using scientific analyses such as carbon 14 dating and DNA analysis.

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