

Human skeletal remains of the Kofun period excavated from the Hitachinaka seaside tumulus cluster, Ibaraki Prefecture

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Abstract This is a material report of human skeletal remains excavated from the Hitachinaka tumulus cluster in the Ibaraki Prefecture. In this area, numerous human skeletal remains from the Kofun period were found in stone coffins constructed on the slopes of seaside cliffs without any artifacts. The purpose of this report was to present an inventory of human skeletal remains in English. There were 19 individuals in total, including seven males and nine females, showing a unique bias in terms of sex and age.

Key Words: Skeletal remains, Kofun, Hitachinaka seaside tumulus cluster

Introduction

This report focuses on the morphological descriptions of human skeletal remains excavated from the Hitachinaka seaside tumulus cluster from the Kofun period. This cluster was formed over approximately 3 km off the coast from north to south and comprised five tumulus groups, including the Isozaki East tumulus group, Isozaki tumulus group, Irido tumulus group, Mitsuzuka tumulus group, and Nyudo tumulus group, with over 100 grave sites excavated (Fig. 1). Almost all of these tumuli have stone coffin tombs formed on the slopes of seaside cliffs, without any artifacts. These stone coffins were made of stones from the near coast without stone material on the floor. There are almost no excavated artifacts other than human skeletal remains from these coffins. These burial systems have been found in coastal tumulus around Japan, such as the No. 13 tumulus of Shirakata site groups in the Ibaraki Prefecture, No. 5 tumulus of Kawarako tumulus group in Ibaraki Prefecture, Hasekouji-syuhon site in Kanagawa Prefecture, Kaccha sand dunes site in Kanagawa

Prefecture, Wakinotani tumulus in Wakayama Prefecture, and Inado tumulus group in Fukuoka Prefecture (Inaba, 2019).

A report of human skeletal remains excavated from the Hitachinaka seaside tumulus cluster has not yet been published. The purpose of this report is to present an inventory of human skeletal remains in English.

Materials and Methods

All materials were excavated by Hitachinaka City's education board from 1990 to 2020, which belonged to the Isozaki East tumulus group and Nyudo tumulus group. They were cleaned, repaired, and stored in the Department of Anthropology of the National Museum of Nature and Science, Tokyo (NMNS).

The estimation of age at death is based on teeth, pubic symphysis, auricular surface of the pelvis, epiphyseal union, and cranial sutures. 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, 2014). The sex of an individual can be diagnosed based on morphological character-



Fig. 1. Map of the the Hitachinaka seaside tumulus cluster and each coffin described in this study.

istics, including the greater sciatic notch and ventral arc of the pelvis, supraorbital ridge, and mastoid process of the skull (Buikstra and Ubelaker, 1994; Sakaue and Adachi, 2009). The following four classifications pertain to this criterion: “Male,” “Male?,” “Female,” and “Female?” (Kajigayama and Sakaue, 2014).

Tables 1, 2, and 3 show cranial and postcranial measurements of skeletal remains from this site. Bones on the left and right sides were measured primarily on the left side, and the right side was measured when the left side was unavailable. The definitions of all measurements follow Martin (Baba, 1991). The reference data were quoted

from the mean values of eastern Japanese during the Kohun period (Yamaguchi, 1987). Stature was estimated using the formula developed by Fujii (1960).

The Isozaki East tumulus group Coffin [1990–29]

This coffin was unearthed in 1990, with a few individuals commingled and partially articulated, as shown in Fig. 2. Two individuals with the anatomical position of the lower limb bones, one limb bone of another individual between them, and one child bone have been identified. However, because of the storage conditions after

Table 1. Cranial measurements of male individuals excavated at the Hitachinaka seaside tumulus cluster

Marin's No.	Variables	Hitachinaka seaside Tumulus Clusters						Kofun	Recent
		1990-29-2	2015-2-1	2015-2-2	2020-4-1	Means	S.D.	Means	Means
1	Maximum length	189.0	188.0	185.0	178.0	185.0	4.3	182.7	181.1
5	Basion–Nasion length		106.0	102.0	94.8	100.9	4.6	101.7	101.5
8	Maximum breadth	134.0	140.0	145.0	132.0	137.8	5.1	142.4	139.5
9	Least frontal breadth	93.0	96.5	97.0	92.0	94.6	2.2	94.4	91.1
17	Basion–Bregma height		140.0	140.0	144.0	141.3	1.9	137.7	136.3
40	Basion–Prosthion length		96.5	103.0	87.0	95.5	6.6	99.7	97.5
45	Bizygomatic breadth		137.0	136.0	131.0	134.7	2.6	141.4	133.4
46	Bimaxillary breadth		107.0	96.0	105.0	102.7	4.8	102.5	98.6
48	Malar height		70.0	66.0	70.0	68.7	1.9	70.8	69.0
51	Orbital breadth	47.5	40.0	39.0	40.0	41.6	3.4	43.0	40.2
52	Orbital height	37.0	35.0	36.0	33.5	35.4	1.3	34.4	35.1
54	Nasal breadth	32.0	28.0	24.5	25.5	27.5	2.9	27.2	25.7
55	Nasal height		52.0	45.0	50.0	49.0	2.9	51.2	52.0
57	Least nasal breadth	9.5	7.0	6.0	3.0	6.4	2.3	7.3	7.2
8/1	Cranial index	70.1	74.5	78.4	74.2	74.3	2.9	78.4	77.0
17/1	Cranial length–height index		74.2	75.5	85.7	78.5	5.1	75.4	75.5
48/45	Upper facial Index of Kollman		51.1	48.5	53.2	50.9	1.9	50.8	51.9
48/46	Upper facial Index of Kollman Virchow		65.4	68.8	66.7	67.0	1.4	69.3	70.3
52/51	Orbital index	77.9	87.5	92.3	83.8	85.4	5.3	80.1	87.4
54/55	Nasal index		53.8	54.4	51.0	53.1	1.5	53.4	49.1
	Frontal index of flatness	12.8	13.6	12.4	12.0	12.7	0.6	15.1	16.7
	Zygomatic index of flatness	16.4	40.0	20.8	0.0	19.3	14.2	30.9	38.7
	Simotic index		23.6	22.6	22.7	22.9	0.5	20.1	24.1

Table 2. Cranial measurements of female individuals excavated at the Hitachinaka seaside tumulus cluster

Marin's No.	Variables	Hitachinaka seaside Tumulus Clusters								Kofun	Recent		
		2011-1-1	2016-1-1	2016-3-1	2016-6-1	2020-2-1	2020-3-2	2020-5-1	2020-7-1	Means	S.D.	Means	Means
1	Maximum length		170.0	170.0		171.0	168.0	175.0		170.8	2.6	174.4	173.1
5	Basion–Nasion length	92.0		90.0	107.0	96.0	91.0	96.0		95.3	6.3	97.5	95.8
8	Maximum breadth		131.0	133.0		132.0	127.0	139.0		132.4	4.3	137.2	134.3
9	Least frontal breadth	96.0		82.5	91.5	94.0	88.0			90.4	5.3	90.8	89.9
17	Basion–Bregma height	124.0	127.0	118.0		128.0	124.0			124.2	3.9	132.0	130.3
40	Basion–Prosthion length	91.8		86.0		89.0	87.0	105.0		91.8	7.7	94.9	94.5
45	Bizygomatic breadth	127.0			122.0	122.0	121.5			123.1	2.6	131.8	125.5
46	Bimaxillary breadth	101.0			104.0	107.0	94.0		89.9	99.2	7.1	98.1	94.1
48	Malar height	65.0		57.0	70.0	67.5	66.0	72.8	61.0	65.6	5.3	66.6	65.4
51	Orbital breadth	41.0		37.0	40.0	41.0	38.0	39.0	36.0	38.9	2.0	41.1	39.3
52	Orbital height	34.0		33.0	35.0	37.0	34.0	36.5	32.0	34.5	1.8	33.5	34.7
54	Nasal breadth	29.0		28.0	29.5	29.0	25.0	25.0	22.5	26.9	2.7	26.7	24.9
55	Nasal height	46.0		48.0	51.0	53.5	48.0	53.5	47.5	49.6	3.0	48.5	49.5
57	Least nasal breadth	7.0		6.8	9.0	4.0	6.1		8.5	6.9	1.8	8.0	7.4
8/1	Cranial index		77.1	78.2		77.2	75.6	79.4		77.5	1.4	78.2	77.7
17/1	Cranial length–height index		74.7	69.4		74.9	73.8			73.2	2.6	75.1	75.4
48/45	Upper facial Index of Kollman	51.2			57.4	55.3	54.3			54.6	2.6	52.3	52.0
48/46	Upper facial Index of Kollman Virchow	64.4			67.3	63.1	77.4			68.0	6.5	68.5	69.3
52/51	Orbital index	82.9		89.2	87.5	90.2	89.5	93.5	88.9	88.8	3.2	81.8	88.1
54/55	Nasal index	63.0		58.3	57.8	54.2	52.1	46.7	47.4	54.2	6.0	55.0	50.4
	Frontal index of flatness	17.5		18.7	14.7	5.0	14.8		15.2	14.3	4.9	14.0	15.4
	Zygomatic index of flatness	18.8		12.1	20.5	23.6	29.9		13.3	19.7	6.6	22.2	30.6
	Simotic index	20.5			17.6	19.6	20.6			19.6	1.4	19.6	23.8

Table 3. Postcranial measurements of the human skeletal remains excavated at the Hitachinaka seaside tumulus cluster

		Male					Female								Means S.D.	
		2015- 2-1	2015- 2-2	2020- 3-1	2020- 4-1	2020- 4-2	1990- 29-1	2016- 3-1	2016- 6-1	2020- 2-1	2020- 3-2	2020- 5-1	2020- 7-1			
HUMERUS																
1	Maximum length	288.0		305.0	300.0	299.5	8.7		285.0							
5	Maximum diameter of mid-shaft	22.0	20.0	22.0	22.0	22.0	1.0		19.0			19.0			19.0	0.0
6	Minimum diameter of mid-shaft	17.0	17.0	17.0	17.0	17.0	0.0		15.0			16.5			16.5	1.1
6/5	Index	77.3	85.0	77.3	77.3	77.3	3.9		78.9			86.8			86.8	5.6
7a	Circumference of mid-shaft	68.0	63.0	66.0	66.0	66.5	2.1		55.0			55.0			55.0	0.0
RADIUS																
1	Maximum length	220.0		240.0		233.3	14.1		210.0	210.0	215.0				212.5	2.9
4	Maximum transverse shaft diameter	16.0	14.0	17.0		16.7	1.5		15.0	13.5	14.5	14.0			14.0	0.6
5	Minimum sagittal shaft diameter	14.0	11.0	12.0		12.7	1.5		10.0	11.0	9.0	11.0			10.3	1.0
5/4	Index	87.5	78.6	70.6		76.2	8.5		66.7	81.5	62.1	78.6			74.0	9.3
5(5)	Circumference of mid-shaft	45.0	40.0	49.0		47.7	4.5		40.0	42.0	35.0	39.0			38.7	2.9
ULNA																
1	Maximum length	250.0		250.0		250.0	0.0				230.0				230.0	
11	Sagittal shaft diameter	13.5		12.0		12.8	1.1				11.0	9.0			10.0	1.4
12	Transverse shaft diameter	17.0		17.0		17.0	0.0				14.0	11.0			12.5	2.1
11/12	Index	79.4		70.6		75.0	6.2				78.6	81.8			80.2	2.3
3a	Circumference of mid-shaft	50.0		48.0		49.0	1.4				41.0	40.0			40.5	0.7
FEMUR																
1	Maximum length	420.0	430.0			433.3	15.3		400.0	390.0	388.0	418.0			402.0	13.7
6	Sagittal diameter of mid-shaft	25.0	24.0	27.5	27.0	30.0	2.3		24.5	23.0	26.0	21.0		27.5	24.8	2.5
7	Transverse diameter of mid-shaft	27.0	26.0	26.0	27.0	25.5	0.7		24.0	27.0	25.0	22.5		26.0	24.4	1.7
6/7	Index	92.6	92.3	105.8	100.0	117.6	10.5		102.1	85.2	104.0	93.3		105.8	101.3	8.6
8	Circumference of mid-shaft	85.0	80.0	85.0	98.0	98.0	8.3		75.0	80.0	82.0	73.0		84.0	78.5	4.7
TIBIA																
1	Total length															
1a	Maximum length	328.0				328.0		340.0	315.0						327.5	17.7
8	Maximum diameter of mid-shaft	31.0	28.0	29.0		29.3	1.5		24.5		25.0			29.0	26.2	2.5
9	Minimum diameter of mid-shaft	22.0	20.0	22.5		21.5	1.3		19.0		24.0			19.5	20.8	2.8
9/8	Index	71.0	71.4	77.6		73.3	3.7		77.6		96.0			67.2	80.3	14.6
10	Circumference of mid-shaft	84.0	71.0	81.0		78.7	6.8		68.0					78.0	73.0	7.1
10a	Circumference at nutrient foramen	93.0	87.0			90.0	4.2		86.0					90.0	88.0	2.8
FIBULA																
1	Maximum length															
2	Maximum diameter of mid-shaft	15.0	10.0	14.0		13.0	2.6									
3	Minimum diameter of mid-shaft	11.0	8.5	10.0		9.8	1.3									
3/2	Index	73.3	85.0	71.4		76.6	7.3									
4	Circumference of mid-shaft estimated stature	43.0	42.0	41.0		42.0	1.0									
	with humerus			1583.4	1583.4	1583.7	0.0									
	with femur	1586.4	1611.1			1598.8			1506.4	1484.0	1479.5	1546.7			1504.2	30.7
	with tibia							1526.7							1526.7	

excavation, the individuality of the excavation conditions is lost; at least the four individuals were identified. Figures 4 and 6 show the skull and postcranial bones in this coffin.

1990-29-1

The sex of this individual was identified as “Female,” and the age at death was classified as “Middle adult.” The estimated stature is 152.7 cm.



Fig. 2. Photographs of coffins excavated at the Hitachinaka seaside tumulus cluster.

The bones determined to belong to this individual were fragments of the skull, hip bones, femurs, tibiae, fibulae, and tarsal bones. The skull seemed dolichocephalic, and the brow arch and mastoid processes were relatively weakly developed. The nasal root was flat. The preauricular sulcus was distinct and osteophyte formation was observed on the margins of the auricular surface. The development of muscle attachment on limb bones was also weak.

1990-29-2

The sex of this individual was identified as “Male?” and its age at death was classified as “Adult?” The bones belonging to this individual

are thought to be the cranium, right ulna, femurs, tibiae, and left calcaneus, which show a massive impression. The cranium of this individual was mesocephalic (cranial index, 70.1). Although the brow arch was weak, the mastoid process was relatively well-developed. The nasal root was flat (simotic index 16.4). There was a bulging bony deformity on the distal part of the diaphysis of the right femur—probably, an old fracture.

1990-29-3

The sex of this individual was identified as “Male?” and its age at death was classified as “Adult?” The bones belonging to this individual include the right femur and left calcaneus. These

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

Tumulus group	Coffin	Individual	Sex	Age-at-death	Stature (cm)	Characteristics
Isozaki East tumulus	【1990-29】	1990-29-1	Female	Middle adult	152.7	preauricular sulcus old fracture in femur
		1990-29-2	Male?	Adult?		
		1990-29-3	Male?	Adult?		
		1990-29-4		Child?		
	【2011-1】	2011-1-1	Female	Middle adult		maxillary sinusitis
	【2015-2】	2015-2-1	Male	Young adult	158.6	Rouge-stained, apical abscess, ossification of trochlear, flatness of articular process of sacrum
		2015-2-2	Male	Adolescent	161.1	Rouge-stained, ossification of trochlear, flatness of articular process of sacrum
	【2016-1】	2016-1-1	Female?	Adult?		
	【2016-3】	2016-3-1	Female	Young adult	150.6	alveolar pyorrhea, preauricular sulcus
		2016-3-2		Infant		
【2016-6】	2016-6-1	Female	Middle adult	148.1	Rouge-stained, dental caries, ossification of the anterior ligament, preauricular sulcus	
Nyudo tumulus	【2020-2】	2020-2-1	Female?	Young adult	148.0	dental caries, alveolar pyorrhea
	【2020-3】	2020-3-1	Male	Middle adult	158.3	pilastric femur
		2020-3-2	Female	Young adult	154.7	
		2020-3-3		Infant		
	【2020-4】	2020-4-1	Male	Middle adult	158.3	nasal bone defect, craniosynostosis suspected, dental caries
		2020-4-2	Male	Young adult		pilastric femur
	【2020-5】	2020-5-1	Female	Young adult		sacroiliac arthrosis suspected
【2020-7】	2020-7-1	Female	Young adult		pilastric femur	

bones seem more slender than those of individual 1990-29-2.

1990-29-4

The age at death of this individual was classified as “Child?” Owing to the poor state of preservation, no remark was found.

Coffin 【2011-1】

This coffin was unearthed in 2011 and contained one individual with an extended burial. The preservation states of these individuals are illustrated in Fig. 3. Figure 4 shows the preservation of this individual and the skull in this coffin.

2011-1-1

The sex of this individual was identified as “Female,” and its age at death was classified as “Middle adult.” The shape of the facial part was low and broad (upper facial index of Virchow

64.4 as hypereuryene). It has a weak brow arch and massive mastoid process. The nasal root was flat (simotic index 18.8). The canine fossa was deeper on the left with a marked left–right difference, the posterior wall of the left maxillary sinus has a porous area, and the left maxillary alveolar portion of the canine and first premolar also has a porous deformation (Fig. 7). Large bone resorption was observed in the alveolar region of the mandibular right first to second premolars (Fig. 7). These findings suggested maxillary sinusitis due to alveolar pyorrhea or dental caries. Muscle attachments on limb bones were weak. Osteophyte formation in the vertebrae was severe.

Coffin 【2015-2】

Figure 2 shows the unearthed coffin [2015-2].

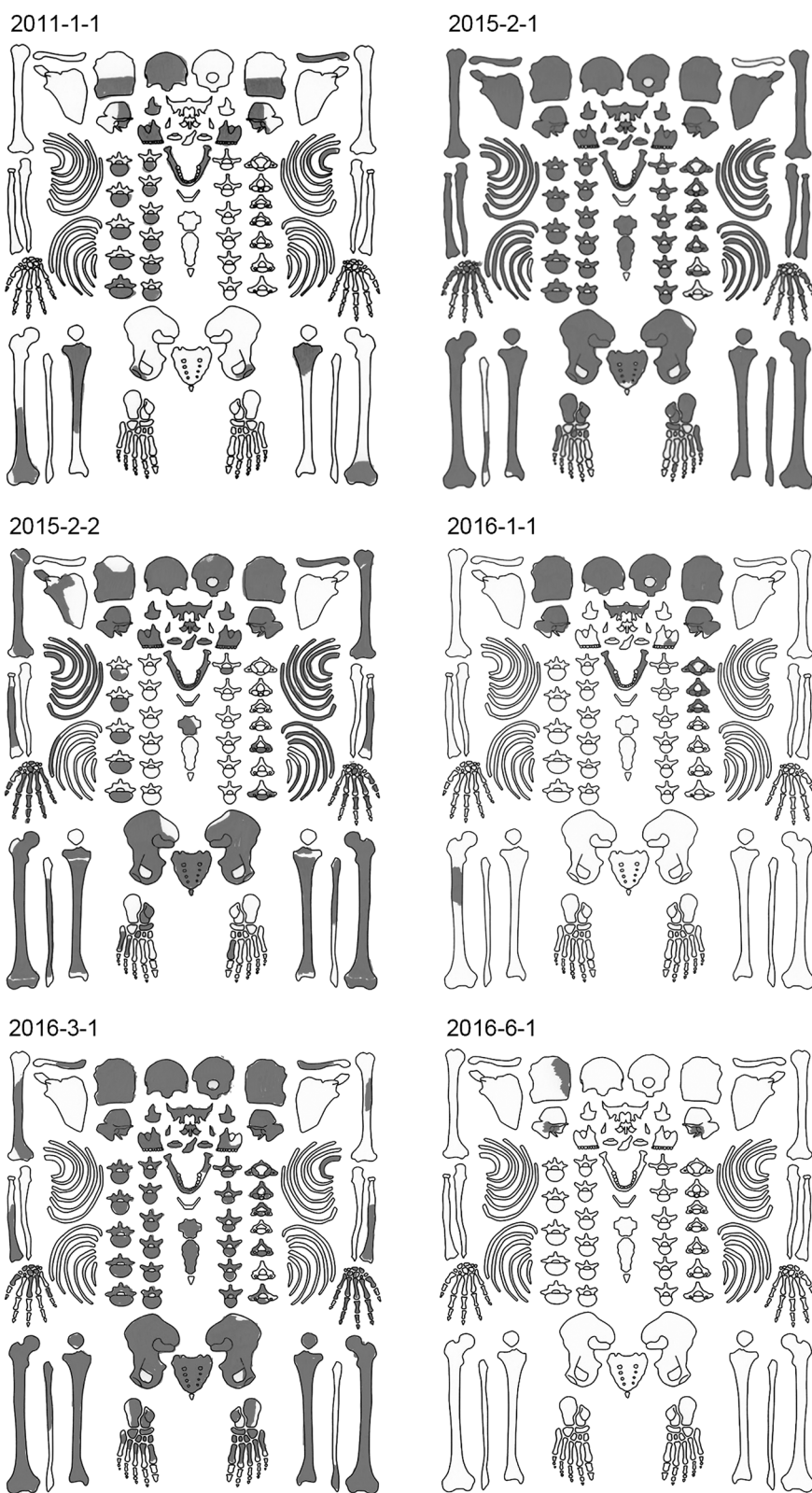


Fig. 3. Preservation states of the human skeletal remains excavated at the Hitachinaka seaside tumulus cluster.

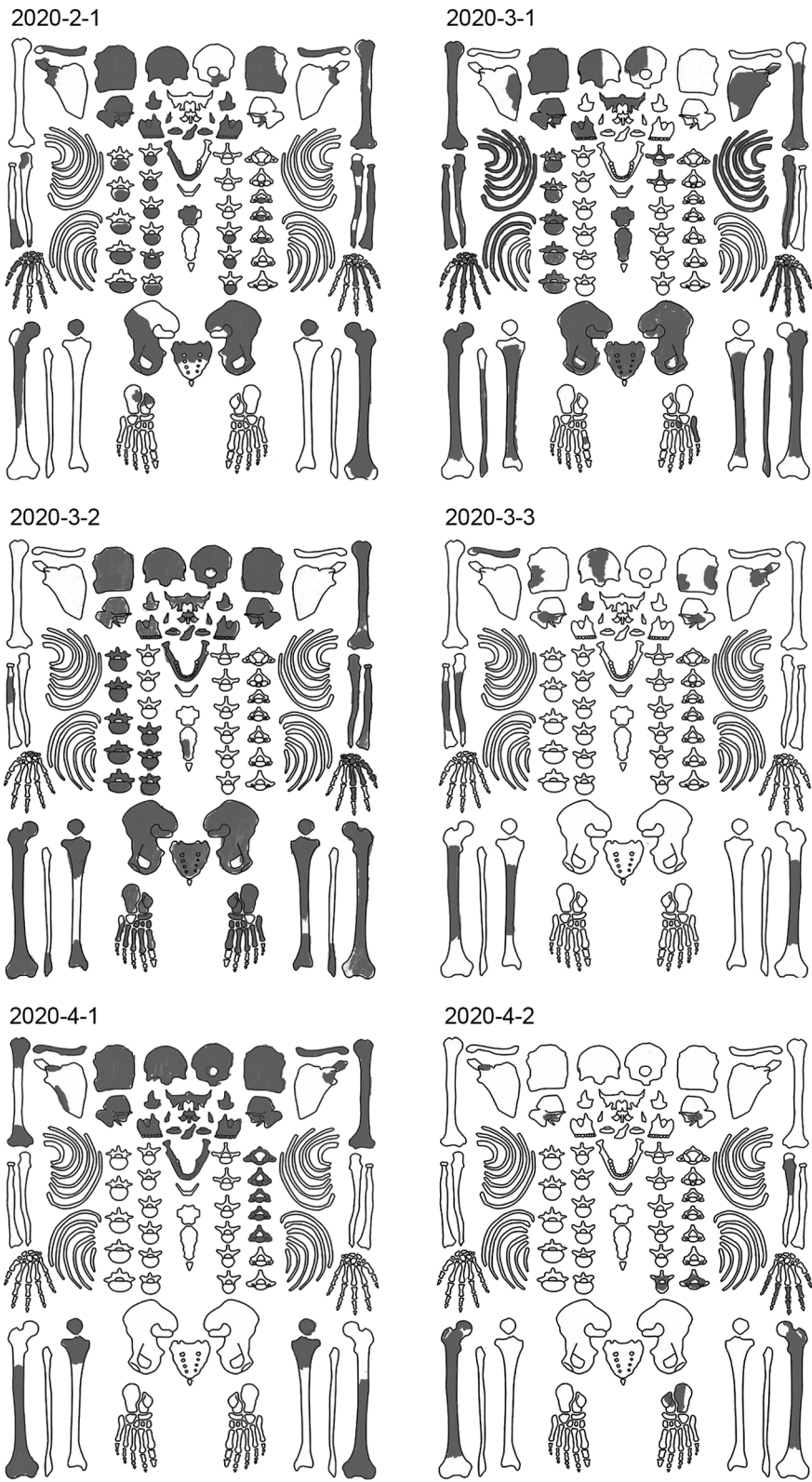


Fig. 3. Continued.

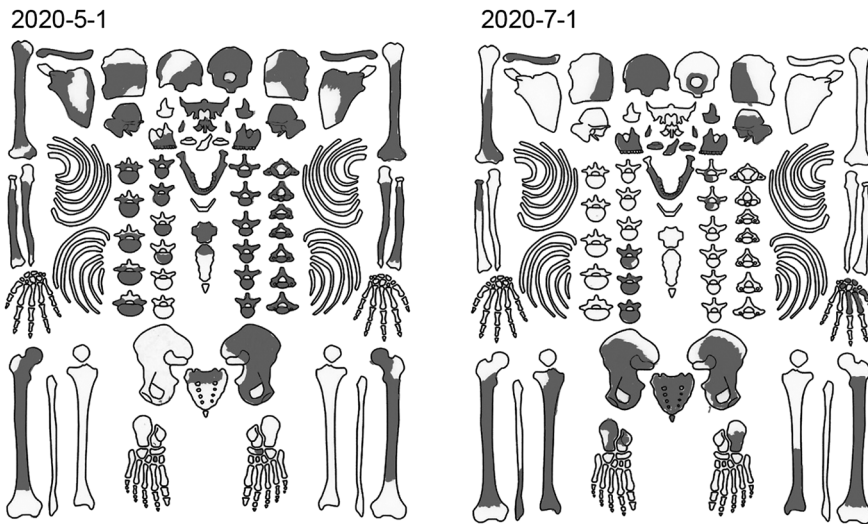


Fig. 3. Continued.

Two individuals with articulated bones were included in the study. They were buried in an extended position with their heads placed toward the north side of the coffin. Rouge-stained areas can be seen in the upper-half of the body, centered on the heads of these individuals. Interestingly, a manubrium with a stained rouge was excavated and placed on the wall of a stone coffin. Figures 3, 4, and 8 show the preservation, skulls, and postcranial bones in this coffin, respectively.

2015-2-1

This individual was placed in the upper layer, and the bones were well-preserved and nearly complete. The sex was identified as “Male,” the age at death was classified as “Young adult,” and the estimated height was 158.6 cm. The cranium was dolichocephalic (cranial index, 74.5). The brow arch and mastoid processes were moderately developed. The shape of the facial part was low and broad (upper facial index of Virchow 65.4 as euryene). The nasal root was highly elevated (simotic index 40.0). The right zygomatic bone shows os Japonicum. All the teeth remained, and there was little or no dental wear. Roots of deciduous teeth also remained between the second premolars and first molars in both the right and left maxillae (Fig. 9). On the left side,

there was circular bone resorption in the alveolar portion around the remaining root, exposing its apex, which was presumed to be an apical abscess. Trochlear apparatuses of the eyes were calcified on the medial walls of the right and left orbits (Fig. 9). Muscle attachment marks on limb bones were indistinct, presumably because of their young age. The left clavicle with the proximal epiphysis during fusion was extremely short and thick, and a continuous ridge was formed from proximal to distal on the lower face of the clavicle. Additionally, the articular surfaces of the inferior articular process of the fourth lumbar vertebra to the superior articular process of the first sacral vertebra were oriented in an anterior–posterior direction, which implies they were flat in the coronal plane on both sides (Fig. 9). Normally, the lower articular processes of the lumbar vertebrae face anterolaterally and the upper articular processes of the sacral vertebrae face posteromedially. This suggests that the motion of the individual around the lower lumbar spine may have been abnormal.

2015-2-2

The individual was placed at a lower level and in a somewhat poor preservation condition. Sex was identified as “Male,” and the age at death was classified as “Adolescent.” The estimated



Fig. 4. Anterior and lateral views of the skulls excavated from the Isozaki East tumulus group.

height was 161.6 cm. The shape of the cranium was unknown because of the growth and damage to the occipital region. The mastoid process was rather large and the brow arch was weakly developed. The shape of the facial part was low and broad (upper facial index of Virchow 68.8 as euryene). The nasal root was relatively elevated

(simotic index: 20.8). Calcified trochlear apparatuses of the eyes were also observed in this individual. The morphology of the facial part, such as the shape of the orbit and nasal aperture, appeared similar in these individuals contained in the same stone coffin. The superior articular surface of the sacrum was oriented posteriorly, giv-

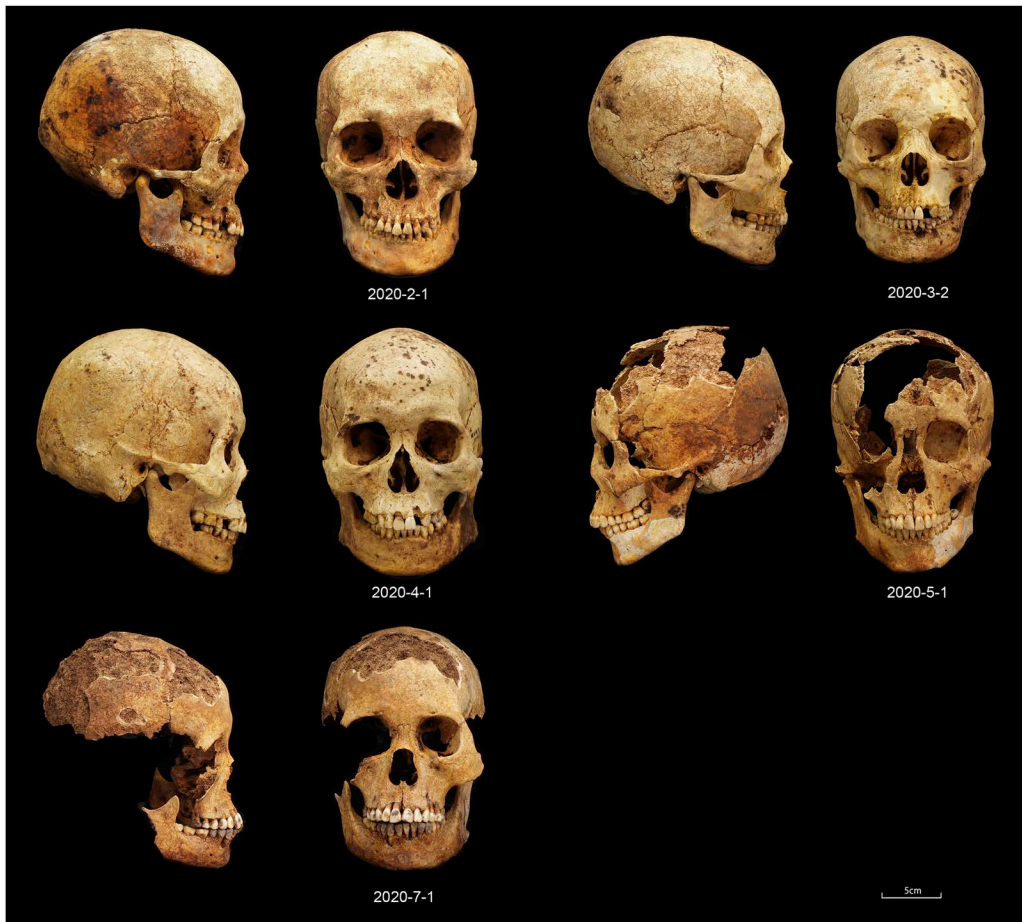


Fig. 5. Anterior and lateral views of the skulls excavated from the Nyudo tumulus group.

ing the impression of flatness. The similarity in these morphologies suggests that these two individuals had kinship.

Coffin [2016-1]

This coffin contained one individual in an extended burial with the head toward the north side of the coffin (Fig. 2). Figures 3 and 4 show the preservation and skulls in this coffin.

2016-1-1

The preservation status of the individual was poor. The sex was identified as “Female?” and the age at death was classified as “Adult?” The cranium was mesocephalic (cranial index, 77.1).

Coffin [2016-3]

This coffin contained two individuals: an adult

and a child, in an extended burial with their heads placed toward the north side of the coffin (Fig. 2). Figures 3, 4, and 10 show the preservation, skull, and postcranial bones in this coffin, respectively.

2016-3-1

The preservation of this was poor. The sex was identified as “Female,” and the age at death was classified as “Young adult.” The estimated height was 150.6 cm. The cranium was mesocephalic (cranial index, 78.2). The brow arch and mastoid processes were both weak. The nasal root was flat (simotic index 12.1). The alveolar region of the right first molar in the mandible indicated alveolar pyorrhea. Muscular attachment areas were indistinct. A preauricular sulcus was observed.

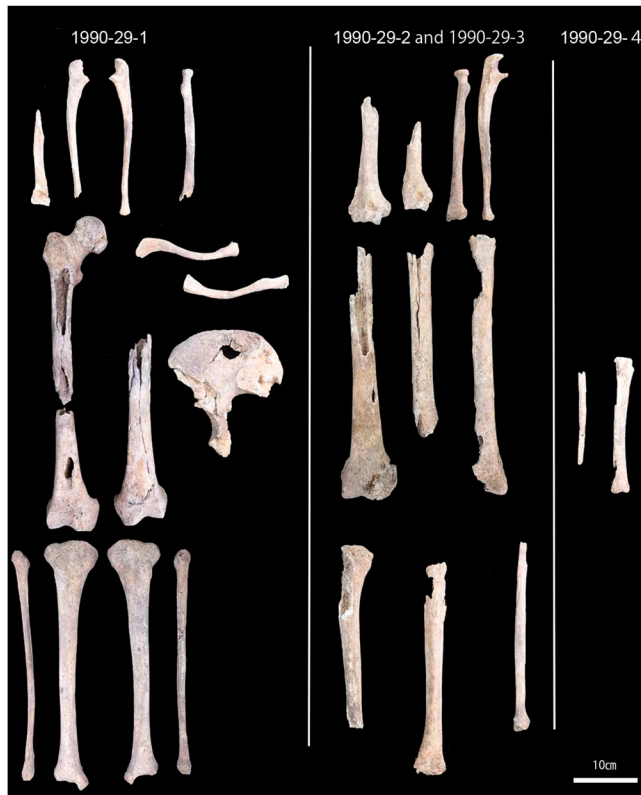


Fig. 6. Photographs of the postcranial bones excavated from coffin [1990-29].

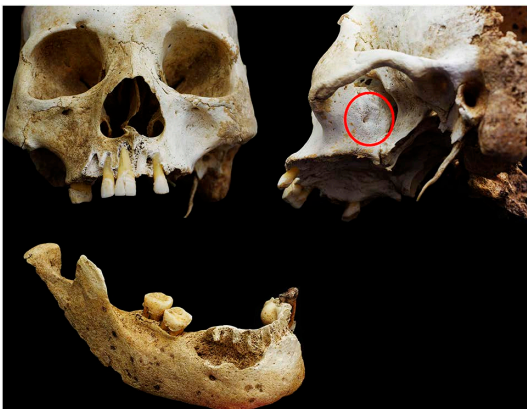


Fig. 7. Morphological traits discovered in the skull of 2011-1-1.

The upper-left figure shows the asymmetrical difference in the canine fossa, the upper-right figure shows the bone deformation on the posterior wall of the left maxillary sinus, and the lower one shows the resorption area in the body of the mandible.

2016-3-2

A few parts of the parietal bones, temporal bones, deciduous teeth, diaphysis of the femur, and vertebral bodies remained. The age at death was classified as “Infant.” Although there was no evidence, it could be inferred from the burial situation that they were related.

Coffin [2016-6]

This coffin contained one individual in an extended burial with the head placed toward the north side of the coffin (Fig. 2). Rouge-stained areas were observed in the upper maxillae and teeth. Figures 3, 4, and 10 show the preservation, skull, and postcranial bones in this coffin, respectively.

2016-6-1

The sex was identified as “Female,” the age at death was classified as “Middle adult,” and the estimated height was 148.1 cm. The brow arch



Fig. 8. Photographs of the postcranial bones excavated from coffin [2015-2].

was moderately developed. The shape of the facial part was low and broad (upper facial index of Virchow 67.3 as euryene). The nasal root was relatively elevated (simotic index: 20.5). All remaining teeth had severe abrasions, as almost all the enamel had worn out. Dental caries was identified in the distal part of the right first molar of the mandible. Plate-like ossification of the ligament was observed on the anterior surface of the fifth lumbar vertebra, suggesting ossification of the anterior longitudinal ligament. An island-shaped bony nodule was formed on the inferior surface of the lumbar vertebra, and a similar nodule was observed on the superior surface of the sacral vertebral body. These changes indicated that the individual had difficulties in the lumbar region. A preauricular sulcus was observed.

The Nyudo tumulus group Coffin [2020-2]

Figure 2 shows an unearthened coffin [2020-2]. One individual with articulated bones was buried in an extended position with the head placed toward the north side of the coffin. Figures 3, 5, and 11 show the preservation, skull, and postcranial bones in this coffin, respectively.

2020-2-1

The preservation state of the individual was relatively good. Sex was identified as “Female?” and the age at death was classified as “Young adult.” The estimated height was 148.0 cm. The cranium was mesocephalic (cranial index, 77.2). The brow arches were weak, but the mastoid processes were massive. The shape of the facial part was low and broad (upper facial index of Virchow 63.1 as hypereuryene). The nasal root was

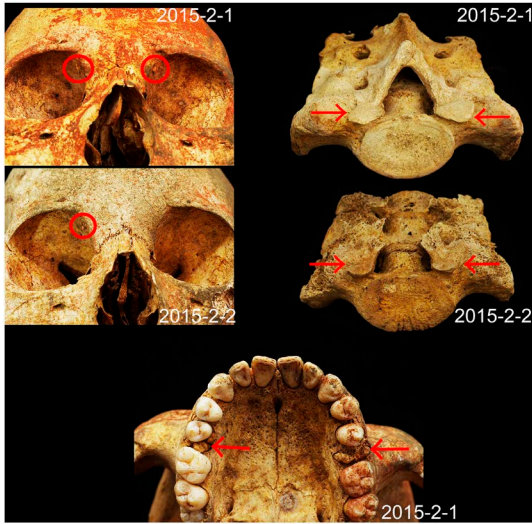


Fig. 9. Morphological traits discovered in the skulls of 2015-2-1 and 2015-2-2.

The upper-left figures show the calcified trochlear apparatuses of the eyes with red circles in both individuals (the upper-part of 2015-2-1; the lower-part of 2015-2-2). The upper-right figures indicate the flat articular facets of the superior articular process of the sacrum in both individuals (the upper-part of 2015-2-1; the lower-part of 2015-2-2). The lower-part shows the remaining roots of deciduous teeth.

somewhat elevated (simotic index: 23.6). Dental caries was identified at the cervical area of the left first molar of the maxilla, and two cases of alveolar pyorrhea were at the right first premolar of the maxilla and left first molar of the maxilla. The muscle attachment areas on the long bones were weak.

Coffin [2020-3]

Figure 2 shows the unearthed coffin [2020-3]. Three individuals were included in the study. One each was buried on the east and west sides of the coffin in an extended position, with their heads placed toward the north side of the coffin. A child was placed around the left thigh of the individual on the east side. Figures 3, 5, and 11 show the preservation, skull, and postcranial bones in this coffin, respectively.

2020-3-1

The preservation state of this individual was relatively good, except for the cranium. The sex

was identified as "Male," the age at death was classified as "Middle adult," and the estimated height was 158.3 cm. The brow arches were extensively developed. Although the muscle attachment areas of the arm bones were weak, those of the lower limbs were developed, as the femur diaphysis shows a pilaster (pilastric index of central femur 105.8).

2020-3-2

The preservation state of the individual was relatively good. The sex was identified as "Female," the age at death was classified as "Young adult," and the estimated height was 154.7 cm. The cranium was mesocephalic (cranial index, 75.6). The brow arch was moderately developed. The shape of the facial part was high and narrow (upper facial index of Virchow 77.4 as leptene). The nasal root was elevated (simotic index: 29.9). The muscle attachment areas on the long bones were weak.

2020-3-3

The frontal bone, left temporal bone, deciduous teeth, right clavicle, diaphysis of the femur, and vertebral bodies remained. The age at death was classified as "Infant."

Coffin [2020-4]

Figure 2 shows this unearthed coffin [2020-4], which contained two individuals: one buried in extended position with head placed toward the north side of the coffin; the other buried in extended position with head placed toward the south side of the coffin. Figures 3, 5, and 12 show the preservation, skull, and postcranial bones in this coffin.

2020-4-1

This individual was buried with the head toward the north, and the preservation state was poor. The sex was identified as "Male," the age at death was classified as "Middle adult," and the estimated height was 157.9 cm. The cranium was mesocephalic (cranial index, 74.2). The brow arches were extensively developed. The shape of the facial part was high and narrow (upper facial index of Virchow 66.7, leptene). The cranium had unique characteristic, such as a high value



Fig. 10. Photographs of the postcranial bones excavated from coffins [2016-3] and [2016-6].

(144.0mm) in basion-bregma height, diminished sutures on the major part of the coronal and sagittal sutures relative to the estimated age, and nasal bones were congenitally absent (Fig. 13). The nasal bone defects and abnormal closure of suture observed in this individual may be related to chromosomal abnormalities (Rivollat *et al.*, 2014). A large mark of caries was observed in the proximal cervical part of the left mandibular first molar (Fig. 13). The observed muscle attachment areas were generally poorly developed.

2020-4-2

This individual was buried with the head toward the south, and the preservation state was poor. Sex was identified as “Male,” and the age at death was classified as “Young adult.” Poor preservation prevented the identification of certain characteristics. The femurs were pilastric, with an index of the central femur of 117.6.

Coffin [2020-5]

Figure 2 shows the unearthed coffin [2020-5]. One individual was buried in an extended position with head placed toward the north. A small sword with a handle of animal bone was placed on the side. Figures 3, 5, and 12 show the preservation, skull, and postcranial bones in this coffin, respectively.

2020-5-1

The preservation status of the individual was poor. Sex was identified as “Female,” and the age at death was classified as “Young adult.” The cranium was mesocephalic (cranial index, 79.4). The brow arches were weak, as were the muscle attachment areas on the skull and long bones. Bone resorption was observed in the left auricular surface, and bony deformity was observed in the left auricular surface of the sacral vertebra, suggesting a disease.



Fig. 11. Photographs of the postcranial bones excavated from coffins [2020-2] and [2020-3].

Coffin [2020-7]

Figure 2 shows the unearthed coffin [2020-7]. One individual was buried in an extended position with head placed toward the north. Figures 3, 5, and 12 show the preservation, skull, and postcranial bones in this coffin, respectively.

2020-7-1

The preservation status of the individual was poor. Sex was identified as “Female,” and the age at death was classified as “Young adult.” The brow arches were weak, as were the muscle attachment areas on the skull. The nasal root was flat (simotic index 13.3). Although the muscle attachment areas on the long bones were weak, the femurs were pilastric, as an index of the central femur of 105.8.

Discussion

Table 2 summarizes the human skeletal remains

excavated at the Hitachinaka seaside tumulus cluster. There were 19 individuals in total, including seven males and nine females. The age-at-death classification was as follows: two infants, one adolescent, seven young adults, and five middle adults; there were no old adults. Although the absence of old adults is probably coincidental, the deaths of many young adults implies life in a harsh environment. Additionally, the number of individuals with poor oral hygiene was relatively high among the six individuals.

In terms of the burial system at this site, males were buried with other males (see coffin [2015-2] and coffin [2020-4]) or in groups of males, females, and children assumed to be family members (coffin [1990-29] and coffin [2020-3]); no single male burials were discovered. In contrast, all individuals buried alone were females (coffin [2011-1], coffin [2016-1], coffin [2016-6],



Fig. 12. Photographs of the postcranial bones excavated from coffins [2020-4], [2020-5], and [2020-7].



Fig. 13. Morphological traits discovered in the skull of 2020-4-1.

The upper-left figures show the absence of nasal bone in this individual. The red circle in the lower-left figure indicates caries in the left first molar of the mandible. The left figure shows partial disappearance of the coronal and sagittal sutures.

coffin [2020-2], coffin [2020-5], and coffin [2020-7]). Burial practices during the Kofun period generally allowed multiple burials in a single burial facility (Seike, 2020). Until the latter-half of the 5th century, single burials corresponded to 60% males and 40% females—later, this changed to 70% males and 30% females (Tanaka, 1995). Thus, it is likely that the gender balance in terms of single burial at this site was unique, and intentional.

Additionally, the two male individuals in coffin [2015-2] share morphological characteristics, suggesting kinship. The burial of this coffin indicates that the additional burial of 2015-2-1 was performed after the individual in 2015-2-2 had been skeletonized enough that his manubrium of the sternum could be removed. Although times have passed after the adolescent individual of 2015-2-2 was buried, the individual of 2015-2-1

and/or their community dared to bury them in same coffin. This contrasts with the fact that two females were buried accompanied only by children (coffin [2016-3] and coffin [2020-3]).

These points indicate that the burial system practiced at this site might have been radically different from those practiced in inland tumuli, such as tunnel tombs and clusters of small tumuli. Inada (2019) assumed the existence of maritime peoples in the Kofun period, given that the tomb system and artifacts shared similarities with other seaside burial tumuli in other regions. It is possible that the peculiarities of the people who used this tumulus were responsible for these differences in the burial system. Further accumulation of examples of seaside tumulus and DNA analyses, radiocarbon dating, and dietary analyses of human remains will reveal new aspects of the Kofun period.

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