Bull. Natl. Mus. Nat. Sci., Ser. D, 47, pp. 11–23, December 24, 2021

Material report: Two human skeletal remains suggesting the unique burials of the Jomon period excavated from the Nakatsu Shell Mound, Kurashiki City, Okayama Prefecture

Kazuhiro Sakaue

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

Abstract The aim of this paper is to present the morphological descriptions and unique burial styles of human skeletal remains excavated from the Nakatsu shell mound, which is located at Tamashima kurosaki, Kurashiki City, Okayama Prefecture. The human skeletal remains of burial pit No.1 indicated that the bones of young individuals were buried in this pit, and the skull and long bones, except for forearms, had been removed intentionally. Those of burial pit No.2 was of a young adult female, and suggested the possibility of placing a pair of stones on the eyes of the deceased among the Jomon people that has never been reported earlier.
Key Words: Human skeletal remains, the Jomon period, collective secondary burial

Introduction

The social composition and customs of the Jomon period have been estimated mainly by analyses of burial systems, cemeteries, and settlements among archaeological sites (Harunai, 1973; Takahashi, 1991; Yamada, 1995, 2008). the discovery of a newly found burial system can provide clues to our understanding the society of the Jomon period.

This paper presents the morphological characteristics and unique burial styles of two individuals found at the same site. The site is the Nakatsu shell mound, which is located at Tamashima Kurosaki Kurashiki City, Okayama Prefecture. This site is also famous as the type site of Jomon pottery of the late Jomon period in western Japan. Two human skeletal remains were found as part of excavation research to confirm the area of the Nakatsu shell mound in 2018–2019 (Ono, 2020). The burial pits No. 1 and No. 2 were close to each other, at a distance of approximately 1 m (Figure 1). Radiocarbon dating of the human skeletal remains of No. 1 indicated that it dates back to approximately 3,100 years, as the early stage of the final Jomon period (Seike *et al.*, 2021).

Description

The estimations for sex and age at death followed the criteria of Kajigayama and Sakaue (2014). Table 1 shows the results of the identification of bones found at the burial pit No.1 with the numbers that correspond to those in Figures 3, 5, and 6. Tables 2 and 3 indicate the cranial and postcranial measurements of the human skeletal remains of the burial pit No. 2. The definitions of all measurements followed Martin's (Baba, 1991) except for three measurements on the mid-shaft of the humerus. The mid-shaft position was defined as the lowest point of the deltoid tuberosity in this paper. The reference

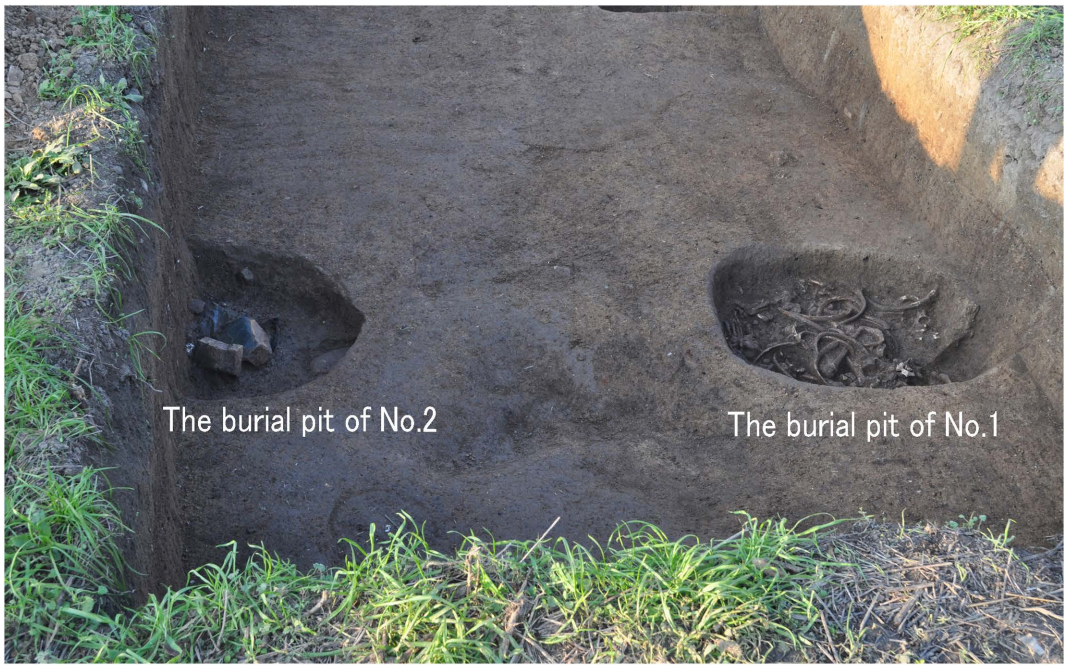

Fig. 1. Two burial pits No. 1 and No. 2 in the Nakatsu shell mound.

data were quoted from the summarized data of many human skeletal remains of the middle to final Jomon periods (Ogata, 1981).

Figure 2 shows the human skeletal remains of the burial pit No.1 immediately after excavation. It appeared to have been a secondary burial because of the disturbance of its anatomical positions. The preservation state of this individual is shown in Figure 3. The remaining bones of the major part of the trunk, right and left forearms with hands, and right and left feet without cranium, the first cervical vertebra, majority of the right scapula and all left scapula, right and left humeri, majority of right innominate bone and all left one, right and left femurs, right and left tibias, and right and left fibula. It could be said that these bones belonged to one person because they had no duplicated elements, and the morphological traits of almost all the bones indicated those of a young individual. The category of age at the death of this individual was estimated as "Adolescent" (11–20 years of age) based on no fusion of distal epiphyseal bones of radius and ulna, and ischial tuberosity (Scheuer and Black, 2000). The sex of the individual was unclear because there was no indication for estimation. The fourth and fifth vertebrae of the individual had the sagittal defects of cleft in the posterior part of the vertebral body without neural arch involvement (Figure 4). It can be thought to be a butterfly vertebra that is caused by failure of fusion of lateral chondrification centers during embryogenesis (Müller *et al.*, 1986). These changes in the adjacent vertebrae can result in scoliosis or kyphosis (Aufderheide and Rodriguez-Martin, 1998).

The skeletal assembly of No.1 could be divided into upper (Figure 5) and lower layers (Figure 6). The numbers in these pictures are in accordance with those in Table 1 and Figure 3. The bones painted in bluish shades indicated those on the right side, the reddish bones to those on the left side, and the grayish bones to vertebrae in these figures. As seen in Figure 5, the bones were dispersed without articulation except for the cervical vertebrae, and the bones on the right and left sides were commingled in the

Table 1. List of identification of No. 1 excavated from the Nakatsu shell mound.

Number	Side	Identification
1	right	upper central incisor
2	left	upper central incisor
3	right	upper lateral incisor
4	left	upper lateral incisor
5	right	upper 1st premolar
6	left	upper 1st premolar
7	right	upper 2nd premolar
8	left	upper 2nd premolar
9		greater horn of hyoid bone
10		2nd cervical vertebra
11		3rd cervical vertebra
12		4th cervical vertebra
13		5th cervical vertebra
14		6th cervical vertebra
15		7th cervical vertebra
16	right	clavicle
17	left	clavicle
18	right	acrominal epiphysis
19		manubrium of sternum
20		body of sternum
21		body of sternum
22		body of sternum
23	right	1st rib
24	left	1st rib
25	right	2nd rib
26	left	2nd rib
27	right	3rd rib
28	left	3rd rib
29	right	4th rib
30	left	4th rib
31	right	5th rib
32	left	5th rib
33	right	6th rib
34	left	6th rib
35	right	7th rib
36	left	7th rib
37	right	8th rib
38	left	8th rib
39	right	9th rib
40	left	9th rib
41	right	10th rib
42	left	10th rib
43	right	11th rib
44	left	11th rib
45	right	12th rib
46	left	12th rib
47		1st thoracic vertebra
48		2nd thoracic vertebra
49		3rd thoracic vertebra
50		4th thoracic vertebra
51		5th thoracic vertebra
52		6th thoracic vertebra
53		7th thoracic vertebra
54		8th thoracic vertebra
55		9th thoracic vertebra
56		10th thoracic vertebra
57		11th thoracic vertebra
58		12th thoracic vertebra
59		1st lumbar vertebra
60		2nd lumbar vertebra
61		3rd lumbar vertebra
62		4th lumbar vertebra
63		5th lumbar vertebra
64		1st sacral vertebra
65		2nd sacral vertebra
66		3rd sacral vertebra
67		4th sacral vertebra
68		epiphysis of iliac crest
69		epiphysis of ishial tuberosity
70·71	right	radius
72·73	left	radius
74	right	ulna
75	right	distal epiphysis of ulna
76	left	ulna
77	right	scaphoid
78	left	scaphoid
79	right	lunate
80	left	lunate
81	right	trapezium
82	left	trapezium
83	right	trapezoid
84	left	trapezoid
85	right	capitate
86	left	capitate
87	right	hamate
88	left	hamate
89	left	triquetrum
90	right	1st metacarpal
91	left	1st metacarpal
92	right	2nd & 3rd metacarpal
93	left	2nd metacarpal & proximal phalanx bones
94	left	3rd metacarpal bone
95	right	4th metacarpal bone
96	left	4th metacarpal bone
97	right	5th metacarpal bone
98	left	5th metacarpal bone
99	left	1st proximal phalanx bone of hand
100	left	1st proximal phalanx boneof hand
101	right	2nd proximal phalanx bone of hand
102	right	2nd middle phalanx bone of hand
103	right	2nd distal phalanx bone of hand
104	left	2nd proximal phalanx bone of hand
105	left	2nd middle phalanx bone of hand
106	left	3rd proximal phalanx bone of hand
107	left	3rd middle phalanx bone of hand
108	left	4th proximal phalanx bone of hand
109	right	4th middle phalanx bone of hand
110	right	4th distal phalanx bone of hand
111	left	4th middle phalanx bone of hand
112	left	5th proximal phalanx bone of hand
113	right	patella
114	left	patella
115	right	calcaneus
116	left	calcaneus
117	right	talus
118	left	talus
119	right	navicular
120	left	medial cuneiform
121	right	intermediate cuneiform
122	left	intermediate cuneiform
123	right	lateral cuneiform
124	left	lateral cuneiform
125	right	cuboid
126	left	cuboid
127	right	1st metatarsal bone
128	left	1st metatarsal bone
129	right	2nd metatarsal bone
130	left	2nd metatarsal bone
131	right	3rd metatarsal bone
132	left	3rd metatarsal bone
133	right	4th metatarsal bone
134	left	4th metatarsal bone
135	right	5th metatarsal bone
136	left	5th metatarsal bone
137	right	1st proximal phalanx bone of foot
138	right	1st distal phalanx bone of foot
139	left	1st proximal phalanx bone of foot
140	left	1st distal phalanx bone of foot
141	right	2nd proximal phalanx bone of foot
142	left	2nd proximal phalanx bone of foot
143	left	2nd middle phalanx bone of foot
144	left	3rd proximal phalanx bone of foot
145	left	3rd middle phalanx bone of foot

Table 2. Cranial measurements of No. 2 individual excavated from the Nakatsu shell mound.

Martin's No.	Variables	No. 2	Middle to Final Jomon
		Female	Female
1	Maximum length	183.1	176.6
5	Basion-Nasion length	99.6	
7	Foramen magnum length	34.6	
8	Maximum breadth	144.3	140.6
9	Least frontal breadth	93.1	96.6
10	Maximum frontal breadth	121.3	118.5
11	Biauricular breadth	129.0	123.4
12	Biasterionic breadth	116.3	
13	Mastoid width	111.2	
14	Minimum cranial breadth	70.2	
16	Foramen magnum breadth	32.0	
17	Basion-Bregma height	133.9	137.4
23	Horizontal circumference	523.0	507.4
24	Transverse arc	302.0	308.8
25	Total sagittal arc	374.0	362.6
26	Frontal sagittal arc	119.0	
27	Parietal sagittal arc	128.0	
28	Occipital sagittal arc	127.0	
29	Frontal sagittal chord	108.3	
30	Parietal sagittal chord	113.8	
31	Occipital sagittal chord	106.0	
40	Basion-Prosthion length	100.6	100.1
43	Outer biorbital breadth	106.8	106.7
43a	Bifrontal breadth	102.2	
	Nasion subtence (calculated)	11.8	
44	Biorbital breadth	102.7	99.2
45	Bizygomatic breadth	135.9	134.2
46	Bimaxillary breadth (zm)	104.8	97.9
46b	Bimaxillary breadth (zm:a)	104.7	
	Subspinale subtence (calculated)	20.7	
48	Upper facial height	65.7	64.0
48H	Upper facial height (Howells)	61.5	
48d	Malar height	22.1	
49a	Interorbital breadth	21.4	
50	Anterior interorbital breadth	16.5	
51	Orbital breadth	44.5	39.3
52	Orbital height	32.1	33.1
54	Nasal breadth	27.0	25.3
55	Nasal height	43.9	46.4
57	Least nasal breadth	9.1	
	Nasal subtense (calculated)	3.1	
60	External palate length	51.4	
61	External palate breadth	67.4	
62	Internal palate length	47.5	43.2
63	Internal palate breadth	43.8	35.8
65	Bicondylar breadth	129.5	
66	Bigonial breadth	93.1	97.5
68	Projective length of mandible	72.8	70.0
65(1)	Bicoronoid breadth	97.1	97.4
67	Bimental breadth	47.7	58.9
69	Height of mandibular symphysis	34.0	30.4
69(1)	Mandibular body height	31.6	28.5
69(2)	Mandibular body height at M2	28.3	
69(3)	Mandibular body breadth	14.5	12.6
69b	Mandibular body breadth at M2	16.9	
70	Height of mandibular ramus	60.8	55.7
71a	Minimum width of ramus	37.5	
71(1)	Condylo-cornoid breadth	36.7	35.6
	Mandibular condyle breadth (right)	22.4	
	Mandibular condyle breadth (left)	22.9	
72	Total profile angle	79.5	
73	Nasal profile angle	47.6	
74	Alveolar profile angle	66.0	
79	Mandibular angle	120.1	
8/1	Cranial index	78.8	79.5
17/1	Index	73.1	78.0
17/8	Index	92.8	97.7
(1 + 8 + 17)/3	SchadelModulus	153.7	151.5
9/10	Index	76.8	81.5
9/8	Index	64.5	69.0
8/12	Index	124.1	
40/5	Index	101.1	
16/7	Index	92.5	
27/26	Index	107.6	
28/26	Index	106.7	
29/26	Index	91.0	
30/27	Index	88.9	
31/28	Index	83.4	
43/8	Index	74.0	
46/45	Index	77.1	73.2
48/45	Index	48.4	
48/46	Index	62.7	65.5
9/45	Index	68.5	72.5
45/8	Index	94.2	
50/44	Index	16.1	
52/51	Index	72.2	84.1
54/55	Index	61.4	
61/60	Index	131.2	
63/62	Index	92.8	83.1
68/65	Index	56.2	58.9
69(3)/69(1)	Index	45.7	44.4
69b/69(2)	Index	59.8	
71/70	Index	61.6	61.7
	Frontal index of flatness	11.6	
	Zygomatic index of flatness	19.8	
	Simotic index	33.6	

upper layer of this burial pit. However, in the lower layer, it can be said that many bones had remained their side. Bone alignment from the 12th thoracic vertebra to the 5th lumbar vertebra with the right and left ribs, left hand, and left foot bones with small finger bones had been retained in anatomical position. The right and left hand bones were adjacent to the feet bones on the same sides, which meant that the deceased had been buried without lying on its back but in squatting posture while holding its spine vertically or dorsal position with raising its back a little in this pit as its primary burial. It seemed that the disturbance of its anatomical position in the upper layer occurred later.

In the upper layer, two bone alignments of cervical vertebrae from 2nd to 3rd and from 4th to 6th were found away in each lump while main-

Table 3. Postcranial Measurements of No. 2 individual excavated from the Nakatsu shell mound.

Martin's No.	Variables	No. 2		Middle to Final Jomon
		right	left	Female (right)
HUMERUS				
5	Maximum diameter of mid-shaft	18.2	17.3	21.0
6	Minimum diameter of mid-shaft	14.2	13.1	15.2
6/5	Index	77.9	75.9	73.1
7a	Circumference of mid-shaft	52.0	49.0	60.7
7	Least circumference	52.0	49.0	
12	Width of articular surface	40.1	39.0	
13	Trochlea depth	23.7	24.0	
14	Width of fossa olecrani	24.1	24.7	
RADIUS				
3	Least circumference	34.0	34.0	
4	Maximum transverse shaft diameter	15.0	15.0	14.5
5	Minimum sagittal shaft diameter	9.7	9.4	10.8
5/4	Index	64.5	62.7	72.0
4(1)	Transverse head diameter	21.5		
5(1)	Sagittal head diameter	23.0	30.1	
ULNA				
1	Maximum length		240.0	231.7
3	Least circumference	31.5	31.0	
6(1)	Breadth of proximal epiphysis	21.0	21.1	
7	Depth of olecranon	21.8	21.6	
7(1)	Trochlear notch height	20.1	20.9	
11	Sagittal shaft diameter	12.1	11.9	12.6
12	Transverse shaft diameter	15.4	15.3	14.1
11/12	Index	78.6	77.2	80.7
11a	Sagittal head diameter		17.2	
12a	Transverse head diameter	16.1	15.8	
FEMUR				
1	Maximum length	415.0	415.0	392.5
2	Physiological length	412.0	412.0	
6	Sagittal diameter of mid-shaft	26.1	25.0	26.2
7	Transverse diameter of mid-shaft	25.8	26.2	23.8
6/7	Index	101.2	95.4	110.6
8	Circumference of mid-shaft	80.0	78.5	79.8
8/1	Robustisity index	19.3	18.9	20.1
8/2	Index	515.0	524.8	
10	Sagittal diameter of upper-shaft	23.3	22.4	22.1
9	Transverse diameter of upper-shaft	28.2	27.8	28.2
10/9	Index	82.6	80.5	78.4
16	Sagittal diameter of neck	27.8	25.8	22.6
15	Vertical diameter of neck	32.4	28.8	26.7
16/15	Index	86.1	89.8	85.0
18	Sagittal diameter of head	43.6	43.9	39.4
19	Vertical diameter of head	44.1	44.1	39.4
21	Bicondylar breadth	71.4	72.9	69.3
23	Length of lateral condyle	60.2	59.8	54.3
24	Length of medial condyle	60.4	60.2	54.0
28	Torsion angle	10.9	11.1	22.3
29	Collo-diaphyseal angle	137.0	139.0	122.8
30	Condylo-diaphyseal angle	79.3	79.6	81.0
TIBIA				
3	Breadth of proximal epiphysis	68.3		64.5
8	Maximum diameter of mid-shaft	26.4	26.5	28.1
9	Minimum diameter of mid-shaft	17.6	18.2	19.5
9/8	Index	66.6	68.7	69.8
8a	Maximum diameter at nutrient foramen	29.6	28.6	30.2
9a	Transverse diameter at nutrient foramen	20.1	19.9	20.6
9a/8a	Index	67.8	69.6	68.0
10	Circumference of mid-shaft	72.0	70.5	75.9
10a	Circumference at nutirent foramen	80.0	76.0	
FIBULA				
1	Maximum length	335.0	337.0	313.4
2	Maximum diameter of mid-shaft	12.2	11.9	14.2
3	Minimum diameter of mid-shaft	10.1	10.2	10.2
3/2	Index	82.9	85.6	72.3
4	Circumference of mid-shaft	35.0	35.0	42.6
4(1)	Medio-lateral diamenter of head		26.6	

Fig. 2. The human skeletal remains at the burial pit No. 1 immediately after excavation.

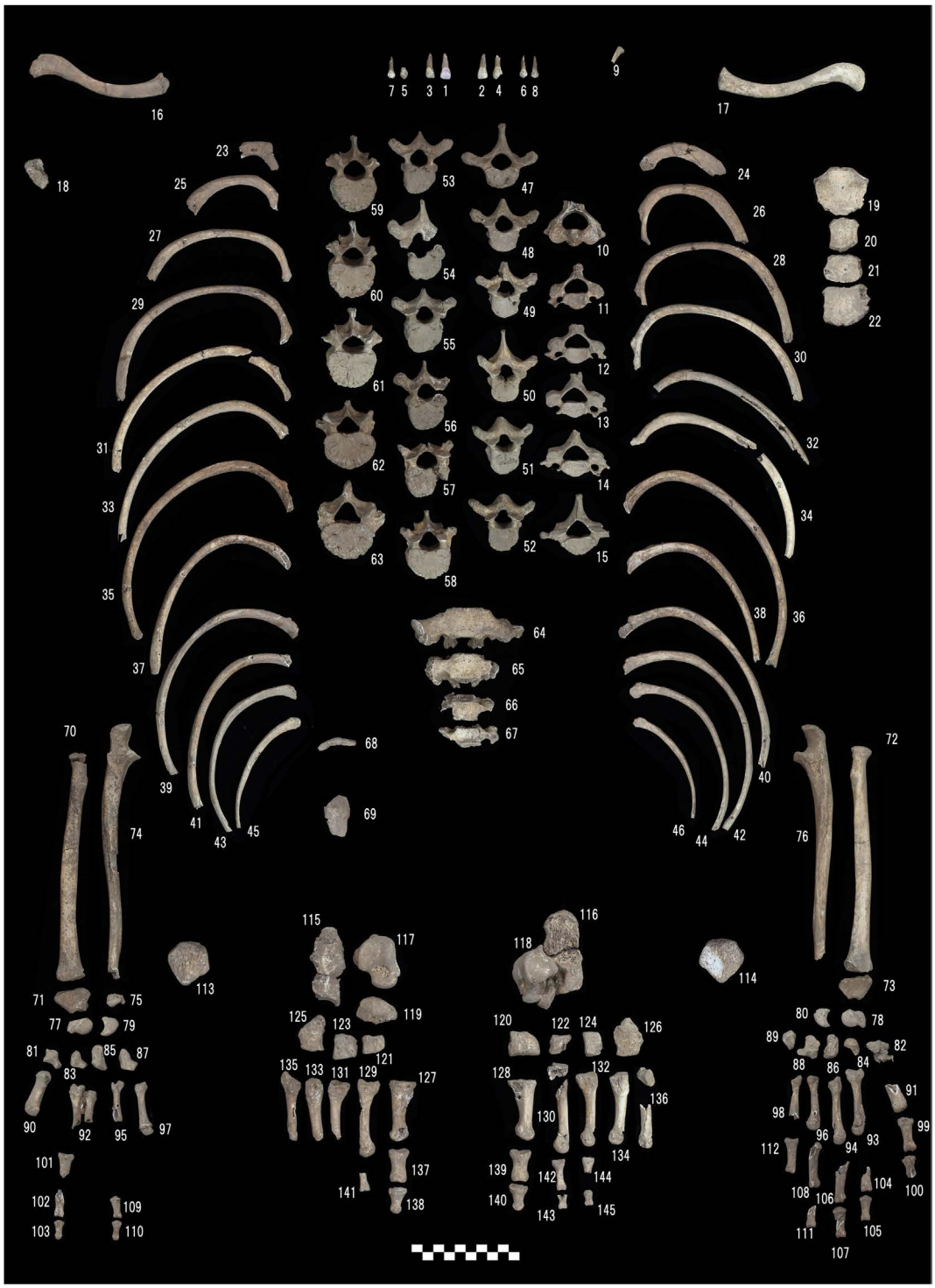

Fig. 3. Photographs of human skeletal remains at No. 1.
The numbers beside the bones correspond to those in Table 1 and Figures 3, 5, and 6.

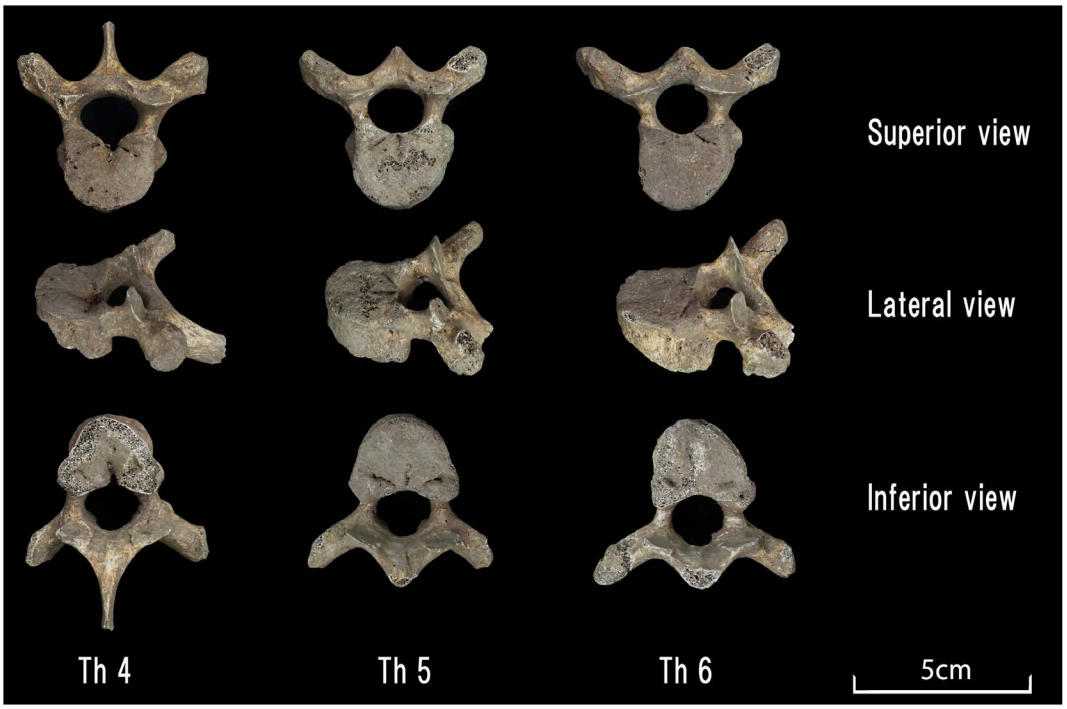

Fig. 4. some views of the fourth, fifth, and sixth thoracic vertebrae at No. 1.
The fourth and fifth vertebrae had sagittal defects of the cleft in their vertebral bodies.

taining their articulations (10·11 and 12·13·14, respectively, in Figure 5). Furthermore, the 1st cervical vertebra was missing because it might have been articulated with its cranium when disturbed. This indicated that this disturbance of burial may have occurred when almost all the soft tissues except for some ligaments had been decayed.

In the lower layer, the sacral vertebrae maintained their articulations with some disturbances. In contrast, the right and left innominate bones that had been articulated with these sacral vertebrae had disappeared. The right and left patellae (113 and 114 in Figure 6) were found on the same sides of the pit, which assumed that the knee joint had been located at this point. Nonetheless, the right and left long leg bones (femur, tibia, and fibula) also disappeared. Although the left radius had been disarticulated and moved to the upper layer (72 in Figure 5), it was left in keeping with its distal epiphysis. These incidents suggest that the bones that disappeared should have been intentionally picked up by someone.

The human skeletal remains of the burial pit No. 2 maintained the anatomical position as seen in Figure 7. This individual was buried and laid on the back by folding the knees. The preservation state of this individual is shown in Figures 8 and 9. The sex of the individual was identified as female based on the morphological characteristics of the greater sciatic notch and the existence of the preauricular sulcus of the innominate bone (Buikstra and Ubelaker, 1994). The age at death was classified as “Young adult” (age 20–30). The estimated stature was 150.3 cm using the formulae developed by Fujii (1960). No pathological changes were observed. The upper and lower canines of both sides were extracted during her lifetime, which is believed to be of a ritual tooth ablation during the Jomon period.

The remarkable characteristics of this individual are in her burial style. As demonstrated in

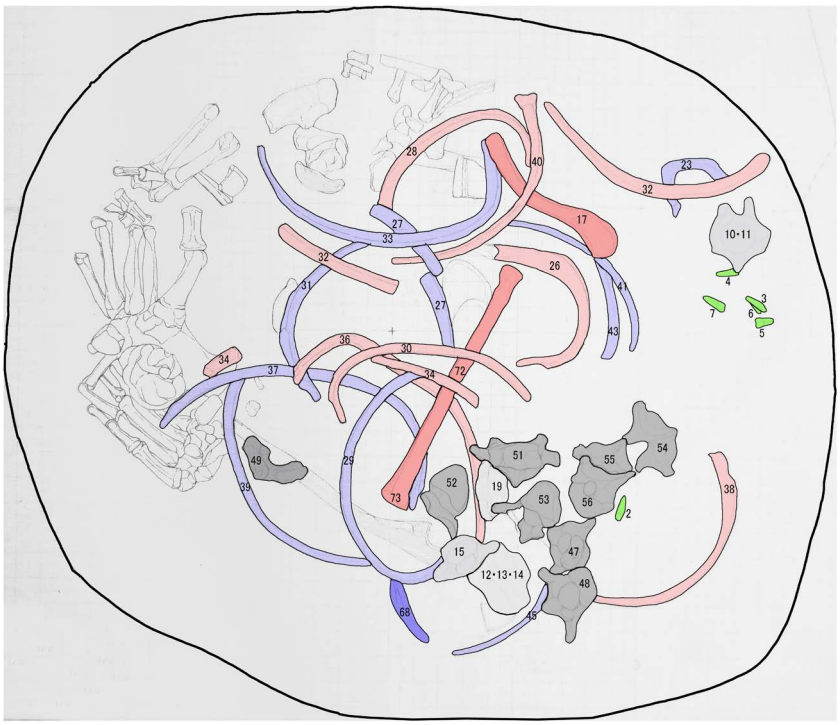

Fig. 5. The upper layer of skeletal assembly at the burial pit No. 1.

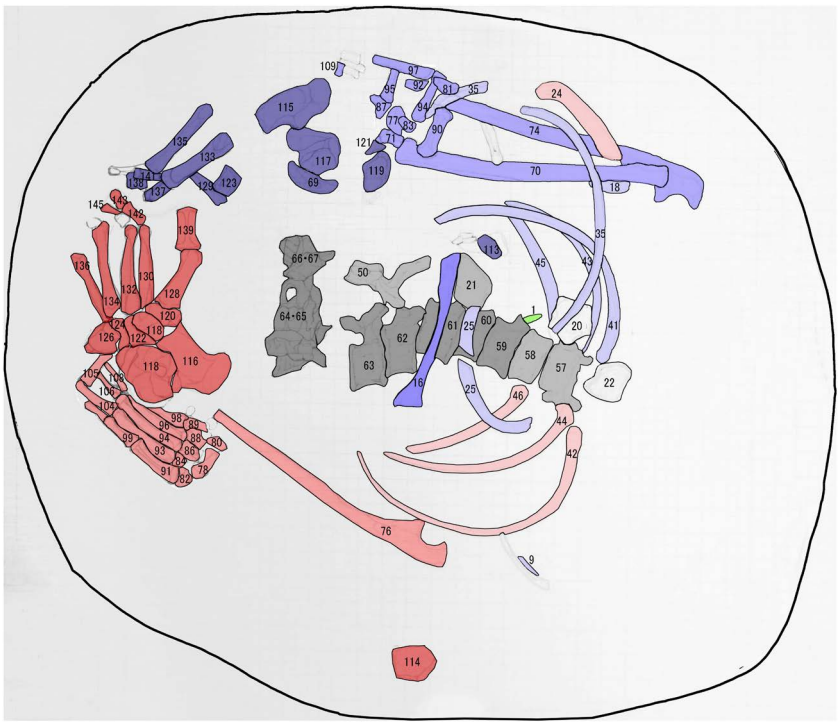

Fig. 6. The lower layer of skeletal assembly of the burial pit No. 1.

Fig. 7. The human skeletal remains at the burial pit No. 2 immediately after excavation.

Figures 7 and 10, a piece of stone was stuck at the lower margin of the right orbit when she was found. In order to unearth this stone and skull, the skull embedded with soil was carried to the anthropological laboratory of the National Museum of Nature and Science, Tokyo. While cleaning carefully, the other stone could also be found in the left orbit (Figure 10). The stone stuck in the right orbit was assumed to have a cuboid shape with a maximum length of 18.9 mm, maximum breadth of 9.2 mm, and maximum thickness of 3.5 mm. It has a large and flat surface and two relatively keen edges, which look like a flake of stone tool probably made of Sanukite (left side of Figure 11). The stone contained in the left orbit was assumed to be of a triangular prism shape with the maximum length of 12.7 mm, maximum breadth of 11.7 mm, and maximum thickness of 9.2 mm (right side of Figure 11). These stones could fall into her orbits occasionally. However, no stone over 3 mm in diameter was found in the soil around her skull, except for these two stones in the orbits after cleaning. These stones were found inside each orbit, which may have been caused by the entry of a small amount of soil into the orbits after the corruption of the eyeball. Therefore, it is possible that these stones were located intentionally on the right and left eyelids or eyeballs when she was buried. Even so, it is unclear whether the stone sticking into the margin of the right orbit is artificial or not.

Discussion

The aim of this paper is to present two unique burial styles of skeletal remains excavated from the Nakatsu shell mound. The human skeletal remains found at the burial pit No. 1 indicated that some bones were remaining after some were removed for the collective secondary burial. Those found at the burial pit No. 2 seemed to show the possibility of placing a pair of stones on the eyes of the deceased among the Jomon people that had never been reported before.

The similarity of the removed bones of the burial pit No. 1 individual can be seen in bones formed by the "Banjyo-shuseki bo," which was the collective secondary burial with long bones collected from some individuals piled in square or pentagon that contained some skulls and upper limbs bones inside. Mizushima *et al.* (2004) pointed out that the bone elements of the "Banjo-shuseki bo" found in the Hobi shell mound were composed of skulls, upper limb bones with scapulae, and lower limb bones with innominate bones, and biased toward a higher representation of the lower limb bones. Although the human skeletal remains of the burial pit No. 1 of the Nakatsu shell mound was restricted to an individual, all long bones of the lower limbs were removed in contrast with the long bones of the forearms left. Interestingly, these collective secondary burials have been reported in the Kanto,

Fig. 8. Photographs of the skull at No. 2.

Tohoku, and Chubu districts, but never in the Chugoku district of Japan.

Extraordinary burials, such as multiple burial and collective secondary burial, were recognized after the late Jomon period, which had been discussed in relation to the changes in their socio-cultural structure in the Kanto district (Yamada, 1995, 2008; Ishikawa, 2014). The burial style of No.1 suggests that the Jomon people after the late Jomon period had widely shared the idea that the same type of bone elements was collected for the secondary burial.

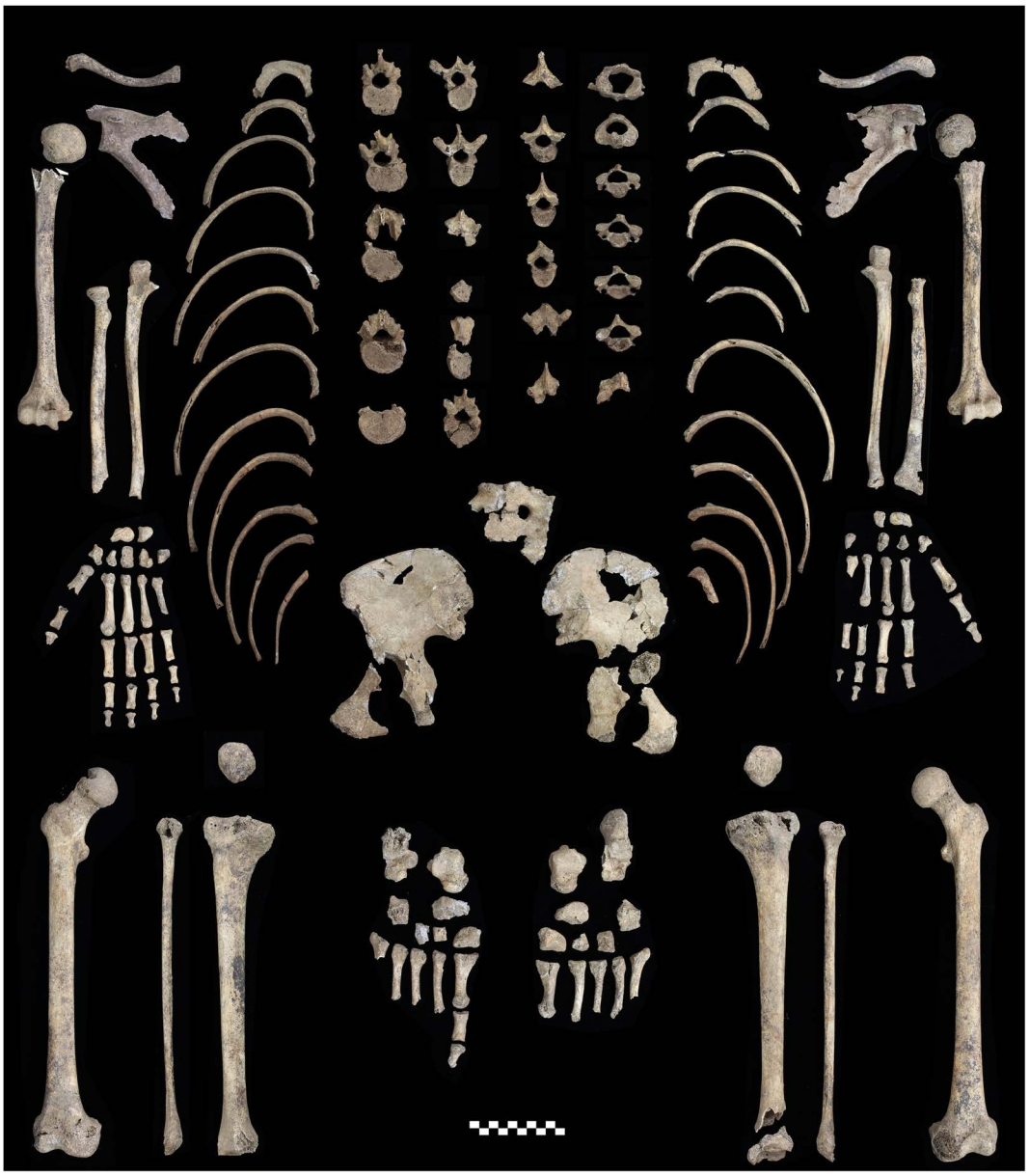

Fig. 9. Photographs of the postcranial bones at No. 2.

The burial custom of placing objects on the eyes can be seen in ancient Egypt and Greece. Although there is no clear evidence at burial pit No. 2 that the Jomon people also had this custom, this possibility cannot be denied. This will likely require further archaeological discoveries.

Acknowledgements

I wish to thank Ms. A. Nakatsuka and Ms. M. Kajigayma (The National Museum of Nature and Science, Tokyo) for their excellent preparation and reconstruction of specimens, and extensive support. I also wish to express my sincere grati-

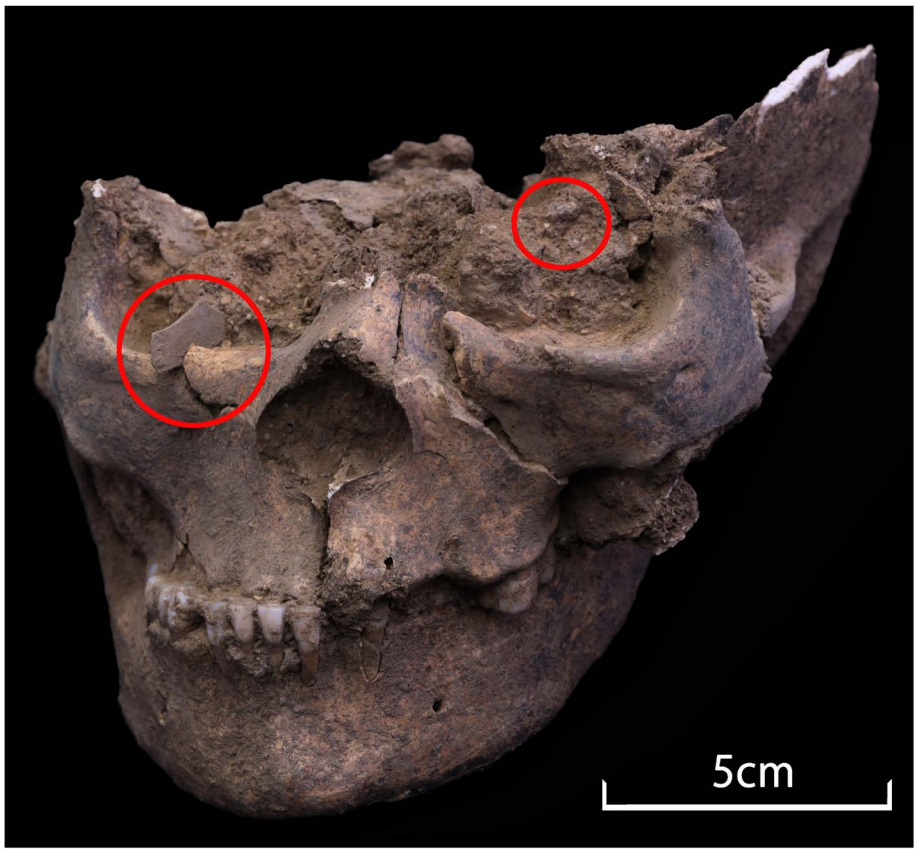

Fig. 10. Frontal view of the face at No. 2.
Circles indicate the stones in each orbit.

Fig. 11. Stones found in each orbit.
The photos on the left show the stone found in the right orbit, and the photos on the right show the stone in the left orbit.

tude to Dr. N. Adachi, professor at the University of Yamanashi, and Mr. M. Ono, senior curator of the Kurashiki Archaeological Center, for their helpful suggestions.

Reference

Aufderheide, A. C. and C. Rodriguez-Martin (1998) The Cambridge encyclopedia of Human paleopathology. Cambridge University Press, Boston.

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

Buikstra, J. E. and D. H. Ubelaker (1994) Standards for datacollection from human skeletal remains. Research Series. Arkansas Archaeological Survey, Fayetteville 44.

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

Harunari, H. (1973) Bashi no igi (1) (The significance of ritual tooth ablations (1)). Quarterly of Archaeological Studies 20: 25–48 (in Japanese).

Ishikawa, T. (2014) Social complexity in the Late Jomon period: The constitution of the Shimo'ota shell mound cemetery of the Boso Peninsula, eastern Kanto, Japan. Japanese Journal of Archaeology 2: 3–33.

Kajigayama, M. and K. Sakaue (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.

Mizushima, S., K. Sakaue and G. Suwa (2004) Human bones of the Latest Jomon period Hobi shell mound "Banjo-shuseki" burials. Anthropological Science (Japanese series) 112: 113–125 (in Japanese with English summary).

Müller F., R. O'Rahilly and D. R. Benson (1986) The early origin of vertebral anomalies, as illustrated by a 'butterfly vertebra.' Journal of Anatomy 149: 157–169.

Ogata, T. (1981) Jomon Jidai jinkotsu (Human skeletal remains of the Jomon period). In Ogata, T. (ed.),Jinruigaku Koza, 5: Nihonjin, I. Yuzankaku, Tokyo, pp. 27–55 (in Japanese).

Ono, M. (2020) Nakatsu kaiduka hani kakuninchosagaiyo (Overview of the excavation research to confirm the area of the Nakatsu shell mound). The Annual Report of Kurashiki Archaeological Center 17: 36–38.

Scheuer, L. and S. Black (2000) Developmental juvenile-osteology. Elsevier Academic Press, London.

Seike, A., M. Sakamoto and M. Takigami (2021) Archaeological report on the chronology of a humanbone of the Jomon periodexcavated at Nakatsu Shell Mound, Kurashiki-shi, Okayama pref. Bulletin of the National Museum of Japanese History 228: 341–344.

Takahashi, R. (1991) Jomon jidai no bosei (Mortuary practices of the Jomon Period). In Yamagishi, R. (ed.) Mortuary practices of primeval and ancient. Douseisha, Tokyo, pp. 48–84 (in Japanese).

Yamada, Y. (1995) Tasuugassourei no igi (Significance of mortuary cases of multiple-individual burials). Quarterly of Archaeological Studies 42: 52–67 (in Japanese).

Yamada, Y. (2008) Jinkotsushutudorei ni miru jomon no bosei to shakai (Mortuary practices and society of the Jomon Period as seen from skeletal remains). Douseisha, Tokyo (in Japanese).