The Development of Kofun-period Iron-framed Armour

SAKAGUCHI Hideki[1]

Editor's note:
What follows is a part of SAKAGUCHI Hideki's book, Kofun Jidai Kacchū no Gijutsu to Seisan『古墳時代甲冑の技術と生産』*[Technology and Production of Armour in the Kofun Period] (2019), for which the author posthumously received the 2021 Japanese Association Award. At the time of his death on 16 December 2020, he was only 49 years old.*
When an archaeologist receives the Japanese Association Award for his/her book, we ask the author to write a summary of the book, which is then translated into English for publication in the JJA. For the article below, the Chief-Editor slightly revised Sections 3 to 5 of Chapter 6 so that these sections could be read as an independent article.
Sakaguchi studied and received professional training in archaeology at Kyoto University where the first archaeology department was founded in Japan in 1911. He completed his undergraduate study in archaeology in 1995 and a revised version of his bachelor's thesis was published as "Chōhōban kawatoji tankō to sankakuban kawatoji tankō: Hensen to sono tokushitsu [Rectangular-plate and triangular-plate laced cuirasses: Development and significance]" in the prestigious history journal, Shirin*, Vol. 81, No. 5. He completed master's program in 1997, and the article below is the core of his master's thesis. He left a doctoral program in 1999 to assume the position of lecturer in archaeology at Kyoto University, the position that he held until his death. He was granted a doctoral degree for his thesis entitled Kofun Jidai Kacchū Seiritsu, Tenkai-Ki no Kisoteki Kenkyū*「古墳時代甲冑成立・展開期の基礎的研究」*[Comprehensive study on the emergence and development of iron armour during the Kofun period]. He revised this doctoral thesis and added a new chapter, which was published as the book for which the JAA award was given. Sakaguchi was the foremost specialist in Kofun period iron armour of his generation. He still had much to contribute to his field and his loss is felt by all in the archaeology community.*

ABSTRACT
This article traces the development of iron-framed armour, namely the emergence of the framed horizontal-plate cuirass, from a perspective that emphasises its technical lineage inherited from earlier generations of armour. When we focus on changes in plate shape and placement in the vertical-plate cuirass and the horizontally organised plate cuirass, we get a clearer idea of the way that design principles and assembly processes continually shifted in the direction of the framed horizontal-plate cuirass. At the same time the technical basis for the creation of the frame, the determinant factor in the development of iron-framed armour, is considered to have been realised as a result of the establishment of intra-tier joints in the horizontally organised plate cuirass. Re-examining and reconfiguring the frame of reference and attributes of interest in this paper from a different perspective allows for a more systematic and concrete explanation of the process of development of iron-framed armour than has hitherto been possible.

[1] Deceased; correspondence should be addressed to Ken'ichi Sasaki, the Chief Editor
Category: Original Article Received and Accepted: 31 January 2023

KEYWORDS: Kofun period of protohistoric Japan, technological history, iron armour

"Iron-framed armour" (Furuya 1990: p. 117, 1996: pp. 64–65) designates a stylistic category of Kofun-period iron armour constructed of belt-shaped iron strips known as "bands" (*obigane*) making up a frame, and iron plates filling the gaps between them. The emergence of its earliest form, the framed horizontal-plate, leather-laced cuirass (*chōhōban kawatoji tankō*), has been regarded as the "standardisation of cuirass forms"[1] since the beginning of recorded research on Japanese armour, and is considered a major milestone (Kobayashi, Y. 1965: p. 34; Nogami 1968: p. 17; Kobayashi, K. 1974a: p. 52). The fact that Fujita's concept of "Middle-period type armour" (Fujita 1984: p. 55) and Hashimoto's "Middle-period armour" (Hashimoto, T. 1996: p. 255) both refer to virtually the same data-set as "iron-framed armour" clearly indicate that this was the leading form of armour used in the Middle Kofun period. In recent years, evaluation of artefacts most representative of the era have led some to propose a theory of periodic divisions demarcating the Middle Kofun period according to the emergence and decline of iron-framed armour (Hashimoto, T. 2005: p. 552).

However, while the creation of iron-framed armour is hailed as an important innovation, relatively few in-depth discussions have addressed the process of its emergence. A survey of the history of research shows that material is nevertheless extremely limited, although one can cite studies such as Takahashi Katsuhisa's discussion of the technical lineage of the vertical-plate, leather-laced cuirass (*tatehagiita kawatoji tankō*) and the horizontally organised plate leather-laced cuirass (*hōkeiban kawatoji tankō*) in the Early Kofun period and framed horizontal-plate cuirass (Takahashi, K. 1993), Kobayashi Ken'ichi's research summarising the attributes of the horizontally organised plate cuirass and discussing its relationship with the framed horizontal-plate cuirass (Kobayashi, K. 1995), and Tatsuya Hashimoto's multifaceted discussion of the initial phase of iron-framed armour (Hashimoto, T. 2005). This author also conducted studies of changes in the framed horizontal-plate cuirass (Sakaguchi 1998) but was unable to discuss the process of its emergence. Later, in a summary of the technical genealogy of armour in the Early and Middle periods offered an opportunity to touch on this topic, the limited space available meant that no more than a brief outline was possible (Sakaguchi 2009: pp. 10–11).

[1] The wording ('*keishiki* - forms' or '*katashiki* - types') varies between these studies, for example *Tankō no katashiki ga tōitsu sareta* 'Cuirass types were standardised' (Kobayashi, Y. 1965: p. 34), *Keishiki ga tōitsuka saretekuru* 'Forms become standardised' (Nogami 1968: p. 17), *Tankō keishiki no tōitsu* 'Unification of the cuirass form' (Kobayashi 1974a: p. 52). In the current paper, data organised according to the shapes of the plates and the way of connecting them, for example the 'framed horizontal-plate cuirass', are known as 'forms', and when these forms are further subdivided according to specific criteria, the subdivisions are referred to as 'types'. This paper therefore employs the phrase "standardisation of cuirass forms."

Explaining the emergence of iron-framed armour not only sheds light on the specific technological improvements that went into the most structurally complex hand-crafted production of the period, but also clarifies the way that politically significant artefacts, thought to confer the highest level of authority, were created and distributed by the centre of authority in the Middle Kofun period. Moreover, studying the technical lineage of iron-framed armour also impacts our understanding of the disputed issue of the geographical region where the vertical-plate cuirass and the horizontally organised plate cuirass were produced (Sakaguchi 2009: p. 10). This paper focuses anew on iron-framed armour, building on the outline given in the previous paper (Sakaguchi 2009)[2] and adding some additional material, in order to give a clearer picture of its emergence.

I. A Summary of the Research History and Analytical Approaches

(1) Research history

Standardisation of cuirass forms

Study of iron armour of the Kofun period began with Suenaga Masao's research (Suenaga 1934) and by the mid-1970s the research framework and approach that we continue to use today had largely been established (Nogami 1968; Kobayashi, K. 1974a, 1974b). Scholars considered that by this Middle Kofun stage, with the emergence of the framed horizontal-plate cuirass consisting of a front-chest panel, rear-shoulder panel, iron bands, and base panels, cuirass forms had been more or less standardised (Kobayashi, Y. 1965: p. 34; Nogami 1968: p. 17), and together with the creation of additional protective iron accessories like neck and shoulder guards, this was recognised as a highly significant landmark (Kobayashi, K. 1974a: p. 52).[3] While this achievement was explained in terms of domestic developments in forging technology, it was also pointed out that there were factors that "could not be attributed to domestic development alone" and so assumed to be the influence of "imported technology" from outside the Japanese archipelago (Kobayashi, K. 1974b: p. 38). The sources of this imported technology were, however, not specified. Kobayashi Yukio was probably the first to point to the southern part of the Korean Peninsula as the source of imported technology, stating that "it is correct to assume that either technology was imported, or artisans came over from Korea" at the stage when the

[2] In an earlier publication (Sakaguchi 2009), space limitations forced the author to significantly abbreviate the explanations, and to leave out illustrations. The current paper aims to provide this missing material but will inevitably also duplicate some of the contents of the earlier paper.

[3] However, it has recently been proposed that iron accessories developed through the same technological genealogy as the triangular-plate leather-laced cuirass and triangular-plate leather-laced beaked helmet, at a slightly different date from the appearance of the framed horizontal-plate cuirass (Hashimoto, T. 2005: p. 549), a view supported by this author.

framed horizontal-plate cuirass emerged (Kobayashi, Y. 1982: p. 33).[4]

Genealogical relationships with preceding forms

While the standardisation of cuirass forms was recognised as an important milestone, the process leading to it remained largely unexamined for a lengthy period. This is thought to be due to the scarcity of excavated examples of the preceding forms of the vertical-plate cuirass and the horizontally organised plate cuirass, and the even more limited availability of artefacts that could be reconstructed for research purposes. However, from 1990 onwards, many more detailed reports of artefacts in a good state of preservation were published, and research into both cuirass types advanced dramatically (Takizawa 1990; Takahashi, K. 1993; Hashimoto, S. *et al.* 1994; Takahashi, T. 1993, 1995; Kobayashi, K. 1995, 2000, 2002; Hashimoto, T. 1996, 1998; Ishii & Arii ed. 1997; Nakaya ed. 2005; Furuya 2005, 2006; Sakaguchi 2005 and others).

In particular, the view presented by Takahashi Katsuhisa, clearly pointing out the technical and morphological continuity of the vertical-plate cuirass, the horizontally organised plate cuirass, and the framed horizontal-plate cuirass based on the orientation of frame construction and manner of combining the placket plates (*hikiawase-ita*) (Takahashi, K. 1993: pp. 123–124) provided a normative framework for further research into the development of iron-framed armour. In light of this, the development of forging techniques was explained in greater detail (Takahashi, T. 1993: p. 18), and the methods of leather lacing used in horizontally organised plate cuirasses, the overlaying of iron plates, as well as the properties of the placket plates and other elements were more clearly defined (Kobayashi, K. 1995). Moreover, this approach was further corroborated by the shared aspects of leather lacing method 1 and bordering techniques, so providing a basis for more detailed research into Early Kofun armour (Hashimoto, T. 1996, 1998).

The influence of armour made from organic materials

As the features of Kofun-period armour made from organic materials (wood, leather, etc.) have gradually become clearer, its morphology and structure have been postulated as factors influencing the development of iron-framed armour, alongside the domestically developed forging techniques and imported iron-armour construction technology mentioned earlier (Furuya 1990: p. 117, 1996: pp. 78–79; Kobayashi, K. 2002: p. 81; Hashimoto, T. 2003: p. 195).

[4] However, he proposed that even prior to this the ‘unification of cuirass types’ was mediated by a “demand for large quantities of armour during actual warfare [……] most probably reflecting military action in Korea,” as interaction with the Korean Peninsula provided this opportunity (Kobayashi, Y. 1965: p. 35).

The initial period of iron-framed armour

The work of investigating the emergence of iron-framed armour was also taken forward, not by examining changes in preceding forms, but by studying artefacts from the initial period of iron-framed armour. Hashimoto Tatsuya has conducted a multifaceted study documenting previously unknown data on emergent iron-framed armour, placing the phenomenon of iron-framed armour emergence in the broader context of the Middle Kofun period history (Hashimoto, T. 2005).

(2) Analytical approaches

As outlined in the previous section, the development of iron-framed armour, namely the emergence of the framed horizontal-plate cuirass, is considered to have been influenced by a number of factors including armour-making technology from the southern Korean Peninsula, techniques derived from the preceding vertical-plate cuirass and horizontally organised plate cuirass, as well as the morphology and structure of armour made from organic materials. Which of these factors to prioritise also depends on problematic issues such as the production areas of the vertical-plate cuirass and horizontally organised plate cuirass, so a comprehensive understanding that deals with these interrelated issues in a consistent manner is required.

This paper supports the view that the framed horizontal-plate cuirass is in a continuous line of development from the vertical-plate cuirass and horizontally organised plate cuirass (Sakaguchi 2009: p. 11), and sets out to elucidate the developmental process of iron-framed armour by placing primary emphasis on the technical heritage of the previous era. In other words, while discovering the seeds of the emergence of the framed horizontal-plate cuirass in the transformations of the preceding vertical-plate cuirass and the horizontally organised plate cuirass, the author would like to trace the emergence of the framed horizontal-plate cuirass by examining the background to the structural changes which occurred as it emerged.

II. History Preceding the Development of Iron-framed Armour—The Vertical-plate Cuirass and the Horizontally Organised Plate Cuirass

(1) Available artifacts and previous views of the changes

This section examines the changes in the vertical-plate cuirass and horizontally organised plate cuirass which have already been largely confirmed (Takahashi, K. 1993; Hashimoto, T. 1996, 1998) from the perspective of the design principles and assembly process of the framed horizontal-plate cuirass, and point out the emergence of the incipient framed horizontal-plate cuirass. The overview presented here also reaffirms the continuity of the technological

lineage of these three forms. Furthermore, as there is only one extant example of the collared, horizontally organised plate cuirass, reference will be made to this when necessary.

Available artifacts. Excavations on the Japanese archipelago have uncovered three vertical-plate cuirasses and nineteen horizontally organised plate cuirasses (Table 1). Three horizontally organised plate cuirasses have also been excavated on the Korean Peninsula, from Bukcheondong tomb no. 64 and Daeseongdong tomb no. 1 and tomb no. 88.

Previous views of transition. It is highly likely that both the vertical-plate cuirass and the horizontally organised plate cuirass have the same technological lineage (Takahashi, K. 1993: pp. 123–124; Hashimoto, T. 1996: pp. 264–265, 1998: p. 49). Takahashi Katsuhisa pointed out a change from a three-tiered to a one-tiered configuration of the rear-shoulder panel, and a change in the shape of the iron plates from longitudinal rectangles to inverted trapezoids or parallelograms, proposing a transition "from the vertical-plate cuirass to the horizontally organised plate cuirass with two-tier rear-shoulder panel, to the horizontally organised plate cuirass with single-tier rear-shoulder panel" (Figure 2). He interprets this transition in terms of "advances in iron-working technology" (Takahashi, K. 1993: pp. 121–124).

With the exception of two features, the use of lacing method 1 and long vertical plates, the items grouped together as "vertical-plate cuirasses" at Ōmaruyama Kofun in Yamanashi prefecture and Shikinzan Kofun in Osaka prefecture have virtually nothing in common (Takahashi, K. 1993: p. 121; Hashimoto, T. 1998: pp. 60–61). Even taking into account the recently identified examples at Okunomae Kofun no. 1, the disparities are still great, so it is appropriate to describe these in terms of "one piece–one type." Nevertheless, considering that lacing method 1 is employed in the case of tomb 38 at Bukcheondong in the southern Korean Peninsula, we cannot rule out the possibility that these do form a mono-sequential series (Sakaguchi 2005: pp. 342–343).

Hashimoto Tatsuya developed Takahashi's work on the horizontally organised plate cuirass, focusing on six of its attributes: (1) rear-shoulder panel structure, (2) front torso structure, (3) plate sequence, (4) number of plates, (5) height–width ratio of plates and (6) bordering. He placed particular emphasis on (1), (3), and (5) as key typological features of the basic structure which he used to categorise the horizontally organised plate cuirass into five types, A to E, as follows:

A: Two-tier rear-shoulder panel/Overlapping middle tier/Plate length–width ratio 4/2–3 (Wakahachimangū and Sonobekaichi examples)

B: Single-tier rear-shoulder panel/Overlapping middle tier/Plate length–width ratio 4/2 (Azuchi-hyōtanyama example)

C: Single-tier rear-shoulder panel/All tiers overlap upwards/Plate length-width ratio 4/3 (Inadō tomb no. 15, Kumamoto-yama Kofun, Nakayama tomb B-1, Niizawa Senzuka tomb no. 500, Uedono Kofun [South end of coffin] and Kawaradani tomb no. 1 example).

D: Single-tier rear-shoulder panel/All tiers overlap upwards/Plate length–width ratio 4/4

Table 1. Vertical-plate cuirasses and horizontally organised plate cuirasses excavated in the Japanese archipelago

Burial Mound *(kofun)* excavated	Location (prefecture)	Form	Placket plate/s	Front-chest panel	Rear-shoulder panel	Plates							TYPE (Hashimoto, T. 1998)
						Upward overlap (plate edges overlap those above)	Length/ width ratio	Number of tiers	Number of plates			Shape, organisation	
									Upper tier	Middle tier	Lower tier		
Ōmaruyama	Yamanashi (2)	Vertical/Leather	×	×	×	—	—	1	17			—	—
Okunomae No. 1-	Okayama (7)	Vertical/Leather	Left and right	×	×	—	—	1	12 or 13			—	—
Shikinzan	Osaka (14)	Vertical/Leather	Left	○	3 tiers	—	—	1	33			—	—
Wakahachimangū	Fukuoka (10)	Horizontally-organised/Leather	×	○	2 tiers	Middle tier	3/2	3	17	19	19	Group I	A
Sonobekaichi	Kyoto (13)	Horizontally-organised/Leather	Left and right	○	2 tiers	Middle tier	4/3	3	13	13	13	Group I	A
Azuchi-hyōtanyama	Shiga (18)	Horizontally-organised/Leather	×	○	1 tier	Middle tier	4/2	3	(17)	13	13	Group I	B
Ame-no-miya No.1	Ishikawa (4)	Horizontally-organised/Leather	Left	○	1 tier	Middle tier	4/3	3	11	11	11	Group I	[B]
Kawaradani No.1	Kyoto (17)	Horizontally-organised/Leather	Left and right	○	1 tier	All tiers	4/3	3	(17)	(13)	(13)	Group I	C
Uedono (South end of coffin)	Nara (21)	Horizontally-organised/Leather	Left	○	1 tier	All tiers	4/3	3	14	14	14	Group I	C
Niizawa No.500	Nara (22)	Horizontally-organised/Leather	Left	○	1 tier	All tiers	4/3	3	9 ≦	14	13 ≦	Group I	C
Kamotsuba No.1	Nara (23)	Horizontally-organised/Leather	Right	○	1 tier	All tiers	4/3	3	(9)	(9)	(9)	Group I	[C]
Nakayama B-1	Shimane (8)	Horizontally-organised/Leather	Left	○	1 tier	All tiers	4/3	3	13	14	15	Group II	C
Funakiyama No.98	Gifu (5)	Horizontally-organised/Leather	×	○	1 tier	All tiers	4/3	3	12	12	12	Group II	[C]
Inadō No.15	Fukuoka (9)	Horizontally-organised/Leather	×	○	1 tier	All tiers	4/3	3	11	12 or 13	12 or 13	Group II	C
Kumamoto-yama	Saga (11)	Horizontally-organised/Leather	Left and right	○	1 tier	All tiers	4/3	3	11	12	13	Group II	C
Taniguchi No.1	Nara (24)	Horizontally-organised/Leather	Left and right	×	1 tier	All tiers	4/4	3	9	9	9	Group II	D
Kuraokayama No. 3	Kyoto (16)	Horizontally-organised/Leather	Left	○	1 tier	All tiers		3	3	7	7	Group II	
Uedono (North end of coffin)	Nara (21)	Horizontally-organised/Leather (collar)	Left?	Connected type	Collar attached	All tiers	3/4	5	3・5	9・9	9	Group II	E
Hitachi Kitsunezuka	Ibaraki (1)	Horizontally-organised/Leather	Right?	○	(3 tiers)	—	—	—	—	—	—	—	—
Gojō Ōhaka	Nara (25)	Horizontally-organised/Leather	×	×	×	—	—	—	—	—	—	—	—
Ibaraki Shōgunyama	Osaka (15)	Vertical/Leather or Horizontally-organised/Leather	—	○	—	—	—	—	—	—	—	—	—

Notes:
- The number in parentheses in the column of prefecture indicates the location of *kofun* in Figure 1, and it corresponds to a site report number.
- The data are based on Hashimoto's Tables 1 and 2 (Hashimoto, T. 1998) with the addition of subsequently published material. Brackets [ ] in the TYPE column indicate material that was published subsequently.
- "Upward overlap of plates" and "Plate length/width ratio" classification is taken from Hashimoto, T. 1998.
- The number of plates for the cuirass at Uedono Kofun (North end of coffin) has been summarised as, from the top downwards, levels 1 and 2 "Upper tier"; levels 3 and 4 "Middle tier" and level 5 "Lower tier."

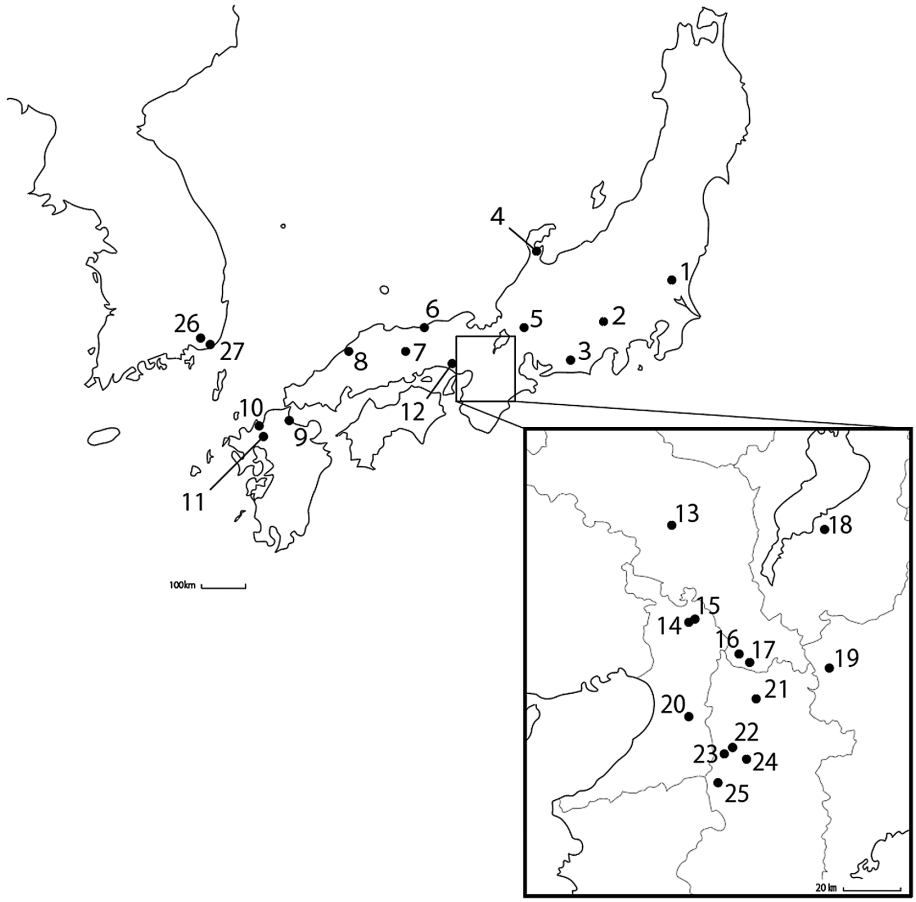

Figure 1. Locations of the Kofun mentioned in the text; the number corresponds to a site report number.

1. Hitachi Kitsunezuka; 2. Ōmaruyama; 3. Akuro No. 3; 4. Ame-no-miya No. 1; 5. Funakiyama No. 98; 6. Kokōge No. 1; 7. Okunomae No. 1; 8. Nakayama B-1; 9. Inadō No. 15; 10. Wakahachimangū; 11. Kumamoto-yama; 12. Ono-ōzuka; 13. Sonobekaichi; 14. Shikinzan; 15. Ibaraki Shōgunyama; 16. Kuraokayama No. 3; 17. Kawaradani No. 1; 18. Azuchi-hyōtanyama; 19. Ishiyama; 20. Tatezuka; 21. Uedono; 22. Niizawa No. 500; 23. Kamotsuba No. 1; 24. Taniguchi No. 1; 25. Gojō Ōhaka.

(Taniguchi tomb no. 1 example).

E: Curved rear-shoulder panel/All tiers overlap upwards/Plate length–width ratio 3/4 (Uedono Kofun [North end of coffin] example).

His view of development was largely in line with Takahashi's but his definition of Type B, which combines the attributes of a single tier rear-shoulder panel, overlapping middle

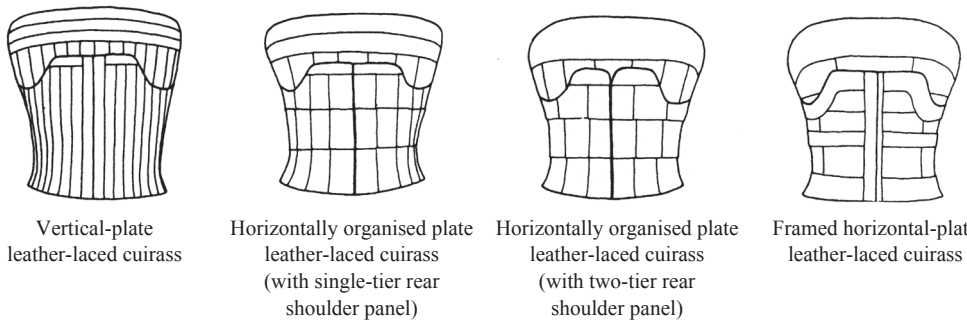

Figure 2. "Fourth-century Cuirasses" by Takahashi Katsuhisa.

tier, and plate length–width ratio of 4/2 (Azuchi-hyōtanyama Kofun, Shiga prefecture, Figure 3-2), led Hashimoto to conclude that "It is difficult to designate typological position solely in terms of rear-shoulder panel morphology" (Hashimoto, T. 1996: p. 266). Also, although not directly presenting a view of transition, Kobayashi Ken'ichi classified the leather lacing methods used in the horizontally organised plate cuirass into two techniques, of which he described "II: Lacing adjacent plates in each tier together on the left and right, and then attaching the plates above and below" as the primary method of lacing for this cuirass, and also pointed out that this technique had links with the framed horizontal-plate cuirass[5] (Kobayashi, K. 1995: p. 60). This is an important observation that is closely related to the view of horizontally organised plate cuirass transition based on plate shapes and placement, as explained in the next section below.

(2) Views of the changes based on plate shapes and placement

Classification according to plate shapes and placement. Takahashi and Hashimoto's assessments of the transition in vertical-plate cuirass and horizontally organised plate cuirass attributes appear to be highly appropriate, with no changes in the basic framework needed. However, the changes that took place in the horizontally organised plate cuirass bear reexamining. The present study shifts the emphasis to prioritise plate shapes and placement (Takahashi, K. 1993: pp. 121–123; Nakaya ed. 2005: p. 156; Furuya 2005: pp. 272–273). Horizontally organised plate cuirasses are divided into two groups based on plate shape and placement as shown below[6] (Table 1; Figure 3).

Group I: Cuirasses constructed of long, vertical rectangular plates, with the vertical alignment of the plates tending to be a straight line.

Group II: Cuirasses constructed with an inverted trapezoidal plate in the upper centre of

[5] Another technique where "I: Rectangular plates were first connected above and below, and then adjacent plates sewn together left and right" was identified only in the front left torso of the example excavated at Kawaradani tomb no. 1.

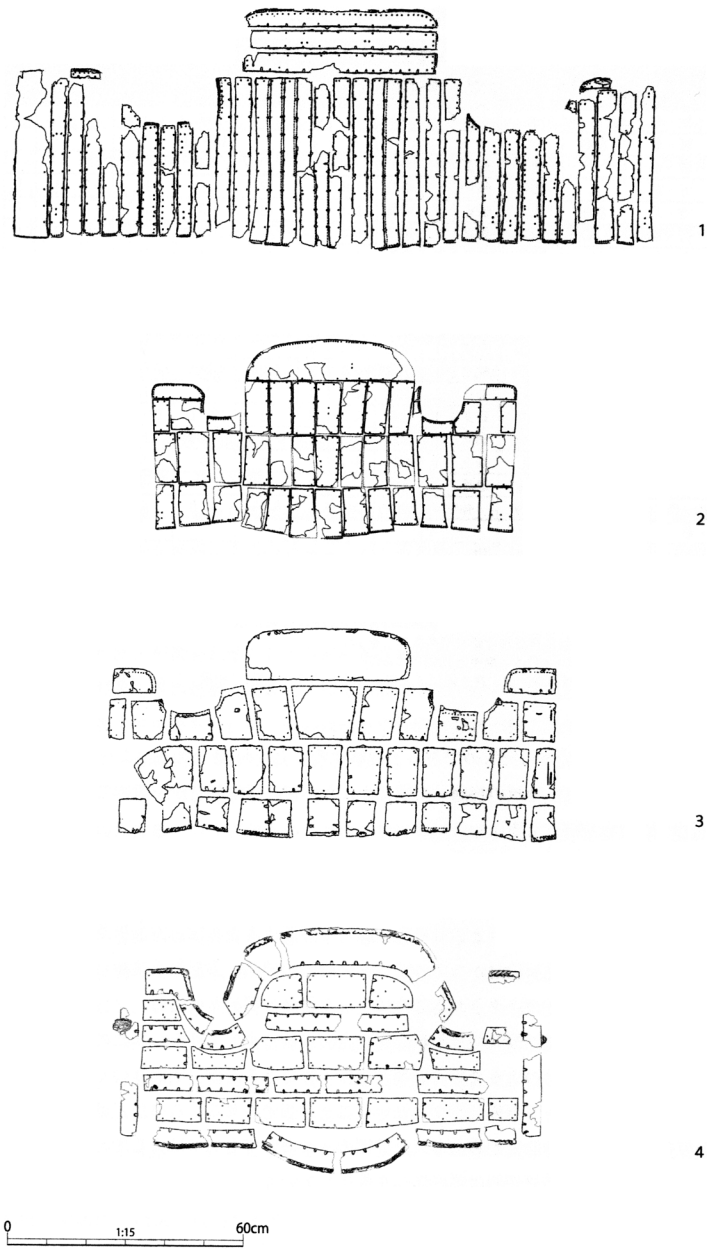

Figure 3. The vertical-plate cuirass, the horizontally-organised plate cuirass and the framed horizontal-plate cuirass.
1. Vertical-plate cuirass (Shikinzan Kofun); 2. Horizontally organised plate cuirass Group I (Azuchihyōtan-yama Kofun); 3. Horizontally organised plate cuirass Group II (Inadō tomb no. 15) ; 4. Framed horizontal-plate cuirass (Ono-ōzuka Kofun).

the rear torso, flanked by wide parallelogram-shaped plates on either side, where the vertical alignment of the plates tends not to form a straight line.

As we can see from the research history, scholars' basic approach was to focus on the difference in plate size between Group I horizontally organised plate cuirasses and Group II horizontally organised plate cuirasses, and to assume the shift from Group I horizontally organised plate cuirasses to Group II horizontally organised plate cuirasses based on advances in forging techniques; but this analysis now also seeks to emphasise changes in design principles and assembly processes. In other words, the author notes that the plate design of the Group II horizontally organised plate cuirass presupposed intra-tier joints, which were commonly found in iron-framed armour (Furuya 1996: p. 65).

In the vertical-plate cuirass, long vertical strips are connected left and right, and then laced together above and below to make up the entire piece. The plate structure of Group II horizontally organised plate cuirasses, on the other hand, clearly shows that groups of plates connected within each tier are first joined to other tiers above and below (Furuya 1996: p. 65), and then the whole piece is made up by lacing these sections together left and right (Kobayashi Ken'ichi, Leather lacing process II).[7] Some Group I horizontally organised plate cuirasses, for example those at Kawaradani tomb no. 1 in Kyoto prefecture, are reported to have passed through a process similar to the vertical-plate cuirass, in which each row of plates was first connected left to right, before being laced up above and below to compete the piece (Kobayashi Ken'ichi, Leather lacing process I), (Hashimoto, S. *et al.* 1994: p. 49; Ishii & Arii eds. 1997: pp. 58, 130).[8] On the other hand, looking at cuirasses at Sonobekaichi Kofun in Kyoto prefecture and Wakahachimangū Kofun in Fukuoka prefecture, we find that although their plate structure fits that of Group I horizontally organised plate cuirasses, the overlap of the plates makes it clear that these are connected within their tier, so it is possible to see the attribute of "overlapping middle tier" in these

[6] When actually classifying the data, there were examples for which determining the allocation to Group I or Group II was very difficult. Because it is not the purpose of this paper to allocate every individual piece to a group, but rather, as explained later, to point out the vital importance of the definitive establishment of intra-tier joints at a specific stage of horizontally organised plate cuirass development, items clearly constructed with an inverted trapezoidal shape in the upper centre of the rear torso flanked by parallelogram-shaped wide plates on both sides, and items in which the vertical alignment of the plates is confirmed not to be straight, have been assigned to Group II. Moreover, as discussed in this paper, even items in Group I generally have a high probability of intra-tier joining.

[7] Lee Hyeonju makes the same observations about plate armour excavated in the south of the Korean Peninsula (Lee 2008: pp. 59–61, 83–84). In other words, Lee considers horizontally organised plate armour an intermediate morphology between vertical plate armour based on vertical design principles, and iron-framed plate armour based on horizontal design principles, so maintains that horizontally organised plate armour was already in the process of changing to horizontal design principles. As only plate morphology is selected, while types of joining technique and derivation are disregarded, and the forms are not organised in chronological order, this suggestion is not convincing.

[8] The general state of preservation of artefacts at Kawaradani tomb no. 1 is not good, and this process was noted in only an extremely limited section of the left front torso. It is assumed to be a 'special' or 'irregular' procedure applied just in this area (Kobayashi, K. 1995: p. 60; Hashimoto, T. 1998: p. 53).

two examples as a reflection of intra-tier joining. This feature leads us to think that intra-tier joints were the norm in the horizontally organised plate cuirass regardless of the plate shape and placement (Kobayashi, K. 1995: p. 60).

However, at the very least, the Group II horizontally organised plate cuirass, which had a plate design clearly intended for intra-tier joining, can be confirmed as postdating the Group I horizontally organised plate cuirass, whose plate design is morphologically very similar to the vertical-plate cuirass. If we evaluate these according to their assembly process and design principles, we find that Group I items were created at a stage where plate design was clearly not predicated on intra-tier joining, and Group II at a stage where intra-tier joining had been established and fed back into plate design.

It is thought that one factor leading to the establishment of intra-tier joining is that it is easier to fit the armour to the human body, especially where it narrows at the waist, by adopting a "ring-building" type of design principle and assembly process in which horizontal plates are joined one above the other, rather than tall vertical plates connected in a horizontal direction. This assumption probably constitutes one of the factors behind the introduction of the basic design of the horizontally organised plate cuirass, namely its three-tier plate structure. In other words, the horizontally organised plate cuirass adopted a form oriented toward the use of intra-tier joints from its inception.

Correspondence with the rear-shoulder panel and placket plates

The following is a summary of what we can deduce about changes in the horizontally organised plate cuirass, based on correspondence between the views of the changes presented above and the various attributes of the cuirass such as the rear-shoulder panel and placket plates (Table 1).

Firstly, with regard to the rear-shoulder panel: because the two-tier structured examples at Sonobekaichi Kofun and Wakahachimangū Kofun both belong to Group I horizontally organised plate cuirasses, they are considered, in essence, to each support this view of the other's development. However, it is important to bear in mind that these two examples of two-tier structure appear to employ intra-tier joining, as mentioned earlier. In view of this, as well as the fact that there exist examples of Group I horizontally organised plate cuirasses, like that at Kawaradani tomb no. 1, with single-tier rear-shoulder panels and incomplete use of intra-tier joints, we should assume that the process of change from the Group I horizontally organised plate cuirass to the Group II horizontally organised plate cuirass did not feature a monophyletic transition from a two-tier to a one-tier rear-shoulder panel. Furthermore, in the cuirass from Wakahachimangū Kofun there is a perforation in the central upper edge of rear-shoulder panel, and in that from Funakiyama Kofun tomb no. 98 in Gifu prefecture, a perforation made in the central lower edge of the rear-shoulder panel is used to lace in a semi-circular plate, signifying that rear-shoulder panel

morphology includes a number of variations that make it difficult to attribute changes to technical factors. This also suggests, from another angle, how difficult it is to designate typological position solely in terms of rear-shoulder panel morphology.

Secondly, with regard to placket plates, there is a view, based on the morphological similarity with the framed horizontal-plate cuirass, that placket plates fitted at both the left and right sides were a later development (Ishii & Arii eds. 1997: pp. 58, 130). However, while Group I does include examples like those at Sonobekaichi Kofun and Kawaradani tomb no. 1 with placket plates fitted on left and right, because there are examples of Group II horizontally organised plate cuirasses, such as Nakayama tomb B-1, with a placket plate fitted in the left front torso only, it is not possible to justify the hypothesis of a monophyletic line of transition from items with no placket plate to those with placket plates at left and right. This is also supported by the fact that although not numerous, there are examples of framed horizontal-plate cuirasses, like those at Kokōge tomb no. 1 in Tottori prefecture and Akuro tomb no. 2 in Shizuoka prefecture, with no placket plates (Takahashi, K. 1993: p. 124).

Having examined the correlation with rear-shoulder panels and placket plates, no discrepancies were found with respect to other attributes either, so one can naturally conclude that these results correspond well with the list of Types A–E established by Hashimoto (Table 1). Furthermore, this also points to the possibility of subdividing Type C.[9] Specifically, it could be divided into examples from Kawaradani tomb no. 1, as well as Uedono Kofun (South end of coffin), Niizawa Senzuka tomb no. 500 and Kamotsuba tomb no. 1 in Nara prefecture, which belong to Group I; and Nakayama tomb B-1, Shimane prefecture, Funakiyama tomb no. 98, Gifu prefecture, Inadō tomb no. 15 in Fukuoka prefecture, and Kumamoto-yama Kofun in Saga prefecture, which belong to Group II.

Because the rear-shoulder panel, placket plates and other attributes of the horizontally organised plate cuirass each display variations, their distinctive and non-standard aspects were often the ones to be emphasised. Although this certainly is one characteristic feature of the horizontally organised plate cuirass, by changing the perspective somewhat and tracing changes in plate shape and placement, the transition in design principles and production processes that link the vertical-plate cuirass with the framed horizontal-plate cuirass will emerge more clearly.

Accompanying grave goods

Let us now examine the picture of transition in vertical-plate cuirasses and horizontally organised plate cuirasses obtained so far, from the perspective of other grave goods buried alongside them.

[9] Hashimoto Tatsuya also discusses the subdivision of Type C (Hashimoto, T. 1996: pp. 266–267, 1998: p. 62).

If we look at Morishita Shōji's study (Morishita 2005), although examples of Group II horizontally organised plate cuirasses available for research are in short supply, those studied generally correspond well with the chronology of the mirrors and stone artefacts that accompanied them. There are, however, some cases of cuirasses that are somewhat at odds with the dating of other burial goods, such as those found at Kamotsuba tomb 1 where excavations revealed a horizontally organised plate cuirass which although in Group I, belonged to Type C, and at Shikinzan Kofun, where a vertical-plate cuirass was excavated. It is necessary to study these with great care, bearing in mind factors like the uncertainty about the time-lag between production and burial in the tomb, and the possibility that some of the burial objects might have been long-time possessions before they were interred. Judging by the evidence currently available, it appears that the vertical-plate cuirass was produced for only a short period, and that its production and that of the horizontally organised plate cuirass began at approximately the same time.

III. The Emergence of Iron-framed Armour

As we saw from the research history, it has been posited that the framed horizontal-plate cuirass was the initial form of iron-framed armour, as part of the technical heritage of the horizontally organised plate cuirass. In the previous section that view was augmented from a different perspective, based on the fact that the phenomenon of intra-tier lacing, using the same assembly process as the framed horizontal-plate cuirass, was identified at the stage when production of horizontally organised plate cuirasses had advanced to a certain extent. This section focuses on the new structure of this framed horizontal-plate cuirass, namely the emergence of the frame itself, consisting of front-chest panel, rear-shoulder panel, iron bands and base panels.

The emergence of the frame was considered a momentous change, which may have been explained in terms of overseas contact involving "imported technology," possibly because of the large difference in external appearance from the horizontally organised plate cuirass (Kobayashi, K. 1974b: p. 38; Kobayashi, Y. 1982: p. 33). Certainly, factors like the shift from the semi-circular front-chest panel and rear-shoulder panel of the horizontally organised plate cuirass to the front-chest- and rear-shoulder panels of the framed horizontal-plate cuirass, whose edges drop down at the sides, and the emergence of the iron bands and base panels, constituted a major change involving fundamental alterations in design. However, as we can see from the existence of examples like the horizontally organised plate cuirass with collar excavated from Uedono Kofun (North end of coffin; Figure 4) with the latter type of front-chest panel shape but no iron bands or base panels, there is a high likelihood that these changes occurred in stages.[10] Moreover, the horizontally organised plate cuirass excavated in 2010 from Kuraokayama tomb no. 3 in

Kyoto prefecture (Figure 5) featured the latter type of rear-shoulder panel shape as well as base panels, but no iron bands. These examples make the hypothesis described above even more likely (Ōtsubo 2011: p. 103; Sakaguchi 2013: Note 4; Hashimoto, T. 2014: 94; Kawahata 2015: Note 13).

Although a detailed report has yet to be published, we shall now look at findings on the horizontally organised plate cuirass excavated from Kuraokayama tomb no. 3 revealed in a measured drawing (Ōtsubo 2011: Figure 5), and then go on to examine the emergence

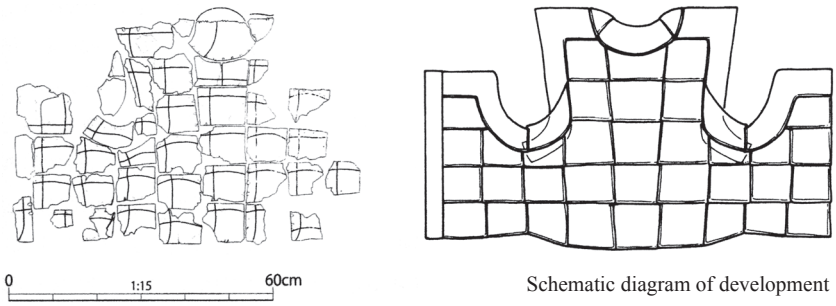

Figure 4. Horizontally organised plate cuirass with collar, excavated from Uedono Kofun.

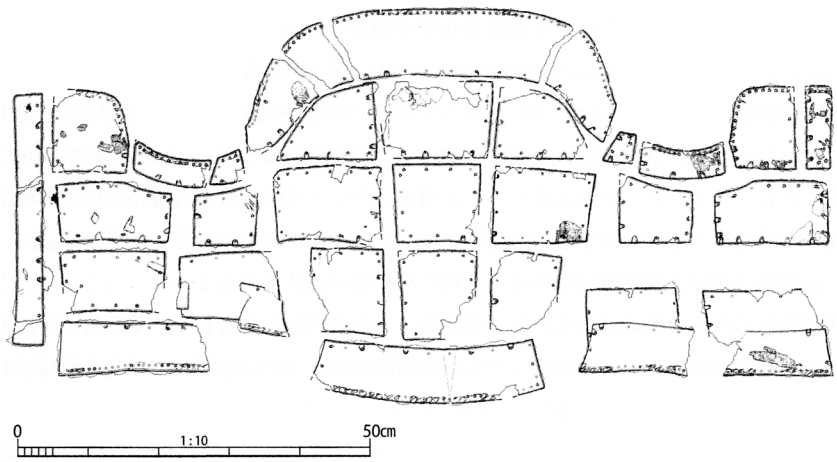

Figure 5. Horizontally organised plate cuirass excavated from Kuraokayama tomb no. 3

[10] Takahashi Katsuhisa stated that "the collared version originally developed separately from the horizontally organised plate cuirass, evolving a frame sooner through the use of iron bands, and, along with the use of long horizontal plate, must be regarded as having a different derivation" (Takahashi, K. 1993: p. 124), but because coloured examples share features like leather-lacing method 1 and their method of bordering, they can be considered to have the same lineage as other horizontally organised plate cuirasses (Hashimoto, T. 1996: p. 267, 1998: pp. 62–63). This author would like to consider that among Group II horizontally organised plate cuirasses they are the closest to the framed horizontal-plate cuirass.

of the iron-framed cuirass, that is, the emergence of the frame, examining separately the front-chest panel, rear-shoulder panel, base panels and iron bands.

Cuirass excavated at Kuraokayama tomb no. 3

At the time of writing the previous paper (Sakaguchi 2010), the collared, horizontally organised plate cuirass excavated from Uedono Kofun (Figure 4) was the only example we knew of that clearly demonstrated transitional morphology towards the cuirass. The horizontally organised plate cuirass excavated from Kuraokayama tomb no. 3 in 2010 displays a morphology transitional towards the framed horizontal-plate cuirass, although its characteristics differ from the Uedono Kofun example. The official report is yet to be published, but the survey drawings of the most important artefacts have been made public (Ōtsubo 2011: Figure 5). Here, its characteristics are discussed within the range of this section, based on the measured drawing of the cuirass (Figure 5).

The overall structure

This horizontally organised plate cuirass has a four-tier front torso and five-tier rear torso structure. It is constructed from a total of 29 iron plates. Horizontal joining is organised with the lowest plate at the centre of the rear torso, and each new plate overlapping the previous one, around to the front torso. Vertical joining is organised with upper tiers overlapping the ones below on both the front and rear torso as a general rule, with only the base panel of the lowest tier contravening this rule and overlapping the layer above.

The front torso

The front torso structure consists of one upper tier and three lower tiers on the left and right sides, with a placket plate at the left front only. There are perforations at the edge of the right front torso beside the placket plate, and the structure allows for a series of placket plates; it appears that a leather strap was wound through these perforations in a spiral. Although not tight enough in structure to be called bordering, it is assumed that this was applied with the same intended effect as bordering.

The left front torso is constructed of nine iron plates including the packet plate. The first tier of the upper cuirass consists of three front-chest panels. All three have leather-bordering on the upper edge. One plate nearest the placket is shaped as though it had originally been created by joining together the upper half of the front-chest panel and a plate of the second upper tier of a framed horizontal-plate cuirass. The middle plate and the plate nearest the back torso are shaped as though created by splitting the lower half of the front-chest panel of a framed horizontal-plate cuirass into two. The first tier of the lower torso is composed of two plates. Both of these are pierced with perforations at their upper edge that fit the shape of the front-chest panel. The second tier of the lower torso also

consists of two metal plates, both of which are horizontal rectangles. The third tier of the lower torso is a single base panel. Leather-bordering has been adopted to the lower edge.

The right front torso is composed of nine iron plates. The first tier of the upper torso consists of four iron plates. All have leather bordering along the upper edge. The two plates on the placket side look as though the plate nearest the placket was split into two. From the first lower tier downwards, all plates are exactly as on the left front torso.

The rear torso

The rear torso is composed of two upper tiers and three lower tiers. The first upper tier is a single-plate rear-shoulder panel. The edges extend down to the sides, just as in the framed horizontal-plate cuirass. The second upper tier consists of three plates. The upper edge is shaped to fit the rear-shoulder panel, and is similar in shape to the second upper tier of the framed horizontal-plate cuirass. The first lower tier consists of three plates. All three are basically horizontal rectangles, although the central plate has a very slight inverted trapezium form, and the plates on either side tend slightly towards parallelogram forms. The second lower tier also consists of three plates. All three are vertical rectangles, although the central plate has a very slight inverted trapezium form. The third lower tier is a single base panel. Leather-bordering was adopted to its lower edge.

Distinctive features

The following features of this piece can be classified as transitional characteristics, changing towards the framed horizontal-plate cuirass:

A. The shape of the rear-shoulder panel, whose edges drop to the sides.

B. It has a base panel consisting of two plates for the front torso and one plate for the back torso.

C. The front-chest panel does not adopt the same shape as that of the framed horizontal-plate cuirass, but it does share with the framed horizontal-plate cuirass the fact that this panel descends at the sides and is connected to the rear-shoulder panel, making it clearly distinct from the front-chest panels found in other horizontally organised plate cuirasses.

D. Plates are vertically aligned only in the central column of the back torso, and have clearly been joined within their tier.

A and B are elements of the frame shared with the framed horizontal-plate cuirass, and if C is taken into account, the outer frame can be considered virtually complete. However, it is significant that there are no iron bands, so it cannot be classified as iron-framed armour. Until now this piece has been treated as a horizontally organised plate cuirass without any particular explanation; it is this point that provides the basis for this decision.

Comparison with the framed horizontal-plate cuirass

The characteristics that lie within the scope of this paper are detailed above, but there are other important points to mention when this piece is compared with the framed horizontal-plate cuirass.

The back torso plates are structured in three tiers, matching those of the framed horizontal-plate cuirass. In other words, if a metal band were inserted between each tier of plates, the structure of the components would be the same as the framed horizontal-plate cuirass. Because the iron bands are absent, the height of each tier of plates is greater than those of the framed horizontal-plate cuirass; this is particularly noticeable in the vertical rectangles forming the second lower tier.

When it comes to the front, too, although the structure of the upper torso is different; the lower torso is constructed such that if an iron band were interposed between two tiers of iron plates, it would result in a stable structure like the framed horizontal-plate cuirass. Just as in the rear torso, the absence of iron bands means that all plates are taller than those of the framed horizontal-plate cuirass.

Because of these points, along with features A and B described above, this example was considered a framed horizontal-plate cuirass without the iron bands, but the fact that it varies considerably from the framed horizontal-plate cuirass—its front-chest panel is divided into three plates—and especially because one plate attached to the rear-shoulder panel is small and irregularly shaped, it appears to belong to a phase before standardisation, so this hypothesis does not hold up.

Furthermore, it is important to note that tiers one and two of the lower torso in this piece are each composed of seven plates, as compared with the earliest type—Type I—of framed horizontal-plate cuirass, where we have an example of the first and third tiers of the lower torso each consisting of nine plates (see Chapter 7). This means that not only the height but also the horizontal width of each of these plates exceeded those of the Type I framed horizontal-plate cuirass. This fact is at odds with the direction of typological change that we envisage in the framed horizontal-plate cuirass, namely the reduction in plates numbers that accompanied the expansion of large iron-plate forging technology.

When it comes to this example, one might presume that immediately prior to the establishment of iron-framed armour, namely at the exploratory stage just before the standardisation of armour, large plates were used on a trial-and-error basis. Since large rear-shoulder panels were already in use at this stage, production techniques had certainly reached a level where it was possible to forge large plates. However, even though it may have been possible to produce certain components using the latest technology available at that point, if the costs required to exploit the technology were disproportionate to production costs, it is quite conceivable that an artefact did not take hold and was not mass-produced. We can envisage this example as having been produced under such

circumstances.

Based on the excavation of this example, let us take a fresh look at the creation of the front-chest panel, the rear-shoulder panel, base panels and iron bands in turn below.

The front-chest panel and the rear-shoulder panel

As outlined above, these panels changed from a "semi-circular" shape to one where their "edges drop down to the sides." The greatest difference between these is that the former case only defines the shape and size of the front torso and rear torso separately, whereas the latter case defines the shape and size of the entire cuirass because the front-chest panel and rear-shoulder panel connect at the sides. According to this characteristic, the former are known as "Independent front-chest and rear-shoulder panels" and the latter as the "Linked front-chest and rear-shoulder panels."

From a morphological point of view, the shift from "Independent front-chest and rear-shoulder panels" to "Linked front-chest and rear-shoulder panels" certainly gives the impression of an abrupt change, but if we consider the differences between the two formats described above, it is perfectly possible that this shift occurred autonomously in the context of improvements in cuirass production to create proportions better fitting the human body, as well as moves to improve functionality through greater strength and other adaptations. At this stage, the oldest known example of a cuirass fitted with a linked front-chest panel like that of the framed horizontal-plate cuirass is the collared horizontally organised plate cuirass excavated from Uedono Kofun. Taking full account of this, and bearing in mind the theory that the morphology of the collared cuirass emerged through a change of media, when wooden armour switched to iron (Suzuki 1999: p. 494; Hashimoto, T. 2003: p. 195), one can suppose that the effort to achieve this complex form triggered the creation of the linked front-chest panel.

On the other hand, at this stage the oldest known example of a linked rear-shoulder panel is that of the horizontally organised plate cuirass excavated at Kuraokayama tomb no. 3. Its front-chest panel does fit the criteria of the linked front-chest panel in that it connects to the rear-shoulder panel, but it consists of a complex set of connected iron plates, so differs in structure and shape from that of the framed horizontal-plate cuirass, whose front-chest panel consists of a single plate. In other words, we do not, at this point, know of any horizontally organised plate cuirasses fitted with linked front-chest and rear-shoulder panels that fully match the framed horizontal-plate cuirass. Nevertheless, its production was technically entirely feasible, so if we postulate that it was produced at the exploratory stage immediately prior to standardisation, it is quite possible that such an artefact existed. When we survey armour and artefacts from the Chinese continent and Korean Peninsula, we currently do not find any contemporaneous data considered to be genealogically related to the connected front-chest panel and rear-shoulder panel.

Considering that fact, we can rule out the need to prioritise external triggers for its emergence.

The base panel

It is clear from the excavation at Kuraokayama tomb no. 3 that examples of armour fitted with base panels existed since the stage of the horizontally organised plate cuirass. The base panel in this example consists of two plates in the front torso and one for the back torso, displaying the same base-panel structure as the framed horizontal-plate cuirass. It is clear that there was a transition from a base panel made up of a connected group of iron plates, commonly found in horizontally organised plate cuirasses, to a base made up of three plates, and also that base panels emerged before iron bands; these two points are important new, mutually influential findings.

There is a view that the emergence of base panels in the Japanese archipelago is related to base panels found in vertical plate riveted armour in the south of the Korean Peninsula (Takahashi K. 1993: p. 125; Hashimoto, T. 2013: p. 339), and there certainly is a high level of morphological similarity between them. However, when we look at other parts of the cuirass, we find that the structure of the framed horizontal-plate cuirass and vertical plate riveted armour are totally different, so it is hard to imagine a direct technical influence applying only to the base panel. Nevertheless, if armour makers in the Japanese archipelago did have the occasion to come into direct contact with vertical plate riveted armour, it is absolutely feasible that they would see the base panel as a positive advancement which they could employ in the horizontally organised plate cuirass, and actually make copies of it. As a side note, the shape of the widening base panel has been identified since the stage of the vertical-plate cuirass (Takahashi, K. 1993: pp. 121–122).

On the other hand, if one considers the establishment of intra-tier joining in the horizontally organised plate cuirass, seen in the last section, to have occurred at the preceding stage, it is easy to see the creation of the base panels as an autonomous improvement. In other words, once a production process was established where groups of plates were joined within tiers, and the tiers connected above and below, the groundwork was laid for the creation of long horizontally aligned members such as the base panel.

The author would like to consider the background to the creation of this kind of long, horizontal member as an improvement in productivity. Because connecting components using leather lacing method 1 required all parts to be made using an advanced production system (Tsukamoto 1993: p. 23), rather than joining large groups of plates to form each tier and then further connecting these tiers together, it is conceivable that replacing one of these with a long transversal member would improve working efficiency. Moreover, it can also be assumed that avoiding the overlaps where the iron plates were joined together would improve robustness. Furthermore, switching the group of plates in the lowest tier, the base

panel, to a long transverse member, may well have triggered the idea that this could also serve as a frame.

The iron bands

When it comes to iron bands, their creation, seen from the same perspective as base panels, can also be considered an autonomous improvement. Just as the base panel, there are usually three plates surrounding the entire torso that form the iron band in the second lower tier, and these are joined in the same relative positions as base panels, so one can imagine that the origins of these components were very closely related.

Just as in the basal section, where a group of connected plates switched to a three-plate base panel, it is thought that instead of further connecting large groups of joined plates in tiers, the working process was rationalised by interposing an iron band. Moreover, one can again assume that makers increased resilience by avoiding overlapping iron-plate joints. There are a certain number of framed horizontal-plate cuirasses without an iron band in the third upper tier of the front torso, and this can be seen as a reflection of the fact that an iron band in the third upper tier of the front torso does not really make a structural contribution to improving operational efficiency and resilience.

Moreover, reconstructions have identified the iron band in the second lower tier as an important member defining the overall proportions of cuirasses (Aoki & Ozawa 1974: p. 13). This points to the significant role that iron bands played in the movement towards shaping the cuirass to better fit the proportions of the human body.

Summary

The creation of the frame in the development of iron-framed armour can in large part be explained in terms of advances in forging technology and accompanying autonomous improvements as described above. Moreover, one can assume that the establishment of intra-tier joints, a transitional development in the horizontally organised plate cuirass, provided the technical foundation for the creation of the frame.

In contrast, Hashimoto says of the creation of the front-chest panel, rear-shoulder panel and base panel, that “it is possible to follow the process of trial and error in vertical plate armour, and see their creation as a related phenomenon influenced by this process” (Hashimoto, T. 2013: Note (4)). This author concurs in not completely negating any influence from vertical plate armour. However, although it is true that vertical plate armour as a whole changed towards the use of linked front-chest and rear-shoulder panels, there is tremendous variation between individual artefacts. When we look at changes in vertical plate armour according to Song Jeong-Shik we find examples without a front-chest panel even at Stage II and others still bearing independent front-chest and rear-shoulder panels at Stage III (Song 2003, 2012). Moreover, Song draws attention to that fact that base

panels, fitted to vertical plate armour since its inception in the Korean Peninsula, were not used on iron cuirasses in the Japanese archipelago in the initial period. Contrasting these points with the arguments presented in this chapter lead one to think that the frame was created via a different route in the Korean Peninsula from that of the Japanese archipelago. Although it may be possible to see these as "linked phenomena" in the bigger picture, this publication is keen to emphasise the role of autonomous improvement.

Furthermore, the collared horizontally organised plate cuirass excavated from Uedono Kofun is fitted with a linked front-chest panel like the framed horizontal-plate cuirass but has no base panel, whereas the horizontally organised plate cuirass from Kuraokayama Kofun tomb no. 3, with linked rear-shoulder panel like the framed horizontal-plate cuirass, does have a base panel. In other words, the standardised usage of linked front-chest and rear-shoulder panels and base panels paints a complex picture, and it is difficult to accurately assess the order of their appearance. This situation is likely also indicative of the exploratory, trial-and-error phase of production, immediately before the standardisation of armour (Table 2).

The study above, when combined with the legacy of techniques like lacing method 1 and bordering techniques, can be considered to reconfirm that the three forms—the vertical-plate cuirass, horizontally organised plate cuirass, and framed horizontal-plate cuirass—are connected in a single technical lineage. The process leading to the emergence of the framed horizontal-plate cuirass is shown schematically (Figure 6) by combining the view of the transition of the vertical-plate cuirass previously published (Sakaguchi 2005) and the transition in the horizontally organised plate cuirass described in this paper.

Conclusion

This article has traced the development of iron-framed armour, namely the emergence of the framed horizontal-plate cuirass, from a perspective that emphasises its technical lineage inherited from earlier generations of armour. When we focus on changes in plate shape and placement in the vertical-plate cuirass and the horizontally organised plate cuirass, we get a clearer idea of the way that design principles and assembly processes continually shifted in the direction of the framed horizontal-plate cuirass. At the same time the technical basis for the creation of the frame, the determinant factor in the development of iron-framed armour, is considered to have been realised as a result of the establishment of intra-tier joints in the horizontally organised plate cuirass. The frame of reference and attributes of interest in this paper are, in the main, subjects of earlier research, but re-examining and reconfiguring them from a different perspective allows for a more systematic and concrete explanation of the process of development of iron-framed armour than has hitherto been possible.

Moreover, by doing this it is possible to confirm that, while being influenced in this process of emergence and change by organic armour and armour from the southern Korean

Table 2. Changes in the frame and number of plates during the development of the iron-framed cuirass

Kofun excavated	Form	Classification	Frame						Plates			
			Placket plate/s	Front chest panel	Rear shoulder panel		Base panel/s	Iron bands	Number of tiers	Number of plates		
		Hashimoto, T. 1998		Classification	Classification	Number of tiers				Upper tiers	Middle tiers	Lower tiers
Nakayama B-1	horizontally-organised/ leather laced	Group TYPE C II	Left	Independent	Independent	1	×	×	3	13	14	15
Funakiyama 98	horizontally-organised/ leather laced	Group〈TYPE C〉 II	×	Independent	Independent	1	×	×	3	12	12	12
Inadō 15	horizontally-organised/ leather laced	Group TYPE C II	×	Independent	Independent	1	×	×	3	11	12～13	12～13
Kumamotoyama	horizontally-organised/ leather laced	Group TYPE C II	Left and right	Independent	Independent	1	×	×	3	11	12	13
Taniguchi 1	horizontally-organised/ leather laced	Group TYPE D II	Left and right	×	Independent	1	×	×	3	9	9	9
Kuraokayama 3	horizontally-organised/ leather laced	Group — II	Left	(Linked)	Linked	1	○	×	3	3	7	7
Uedono (north end of coffin)	horizontally-organised' Collared/Leather laced	Group TYPE E II	(Left)	Linked	With collar		×	×	5	3・5	9・9	9
Kokōge 1	framed horizontal-plate/ Leather laced	Ia —	×	Linked	Linked	1	○	○	3	5	9	9
Tatezuka	framed horizontal-plate/ Leather laced	Ia —	Left and right	Linked	Linked	1	○	○	3	5	(9)	(9)
Ishiyama	framed horizontal-plate/ Leather laced	Ib —	Left and right	Linked	Linked	1	○	○	3	5	(9)	7

・Shaded cells indicate the latest phase of the "Frame" and "Plate" attributes.
・The number of plates given for the exhibit at Uedono Kofun (Small north entrance has been summarised as, from the top: levels 1 and 2, "Upper Tier"; levels 3 and 4, "Middle tier" and level 5, "Lower Tier."

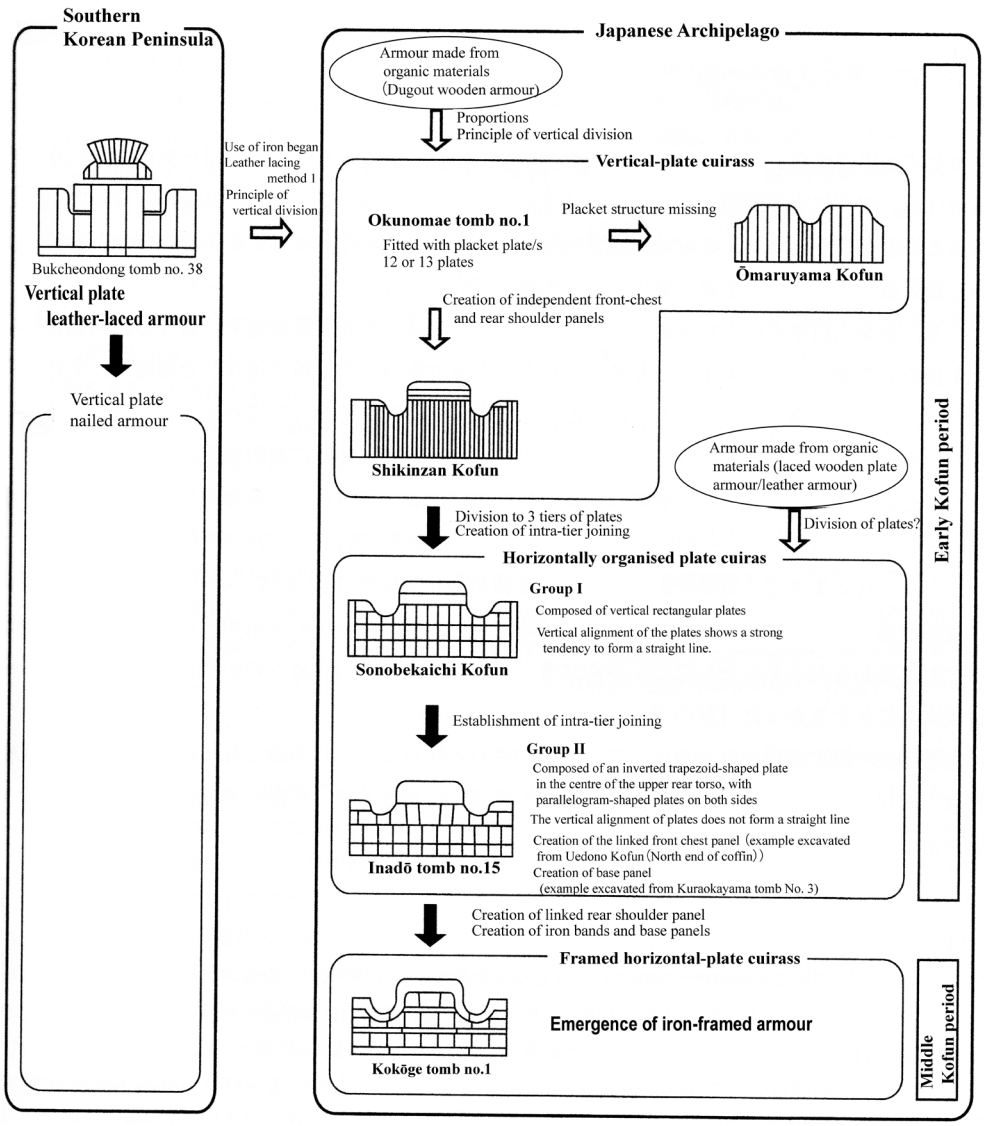

Figure 6. The emergence of iron-framed armour

Peninsula, Early Kofun period production of vertical-plate cuirasses and horizontally organised plate cuirasses in the Japanese archipelago was based on an uninterrupted technical lineage which can be considered to presage the beginnings of iron-framed-armour production that flourished in the Middle Kofun era to follow (Sakaguchi 2009: p. 11). Iron-framed armour, a politically significant artefact which appears to have been

distributed along with the granting of the highest level of authority by central government in the Middle Kofun period, can be thought to have been created autonomously in the midst of a search for improvements in productivity and functionality, in the context of developments in forging techniques built upon the technical legacy of earlier generations.

References

AOKI Shigeo & OZAWA Masami 1974. Nagatoro-Nishi Kofun shutsudo tankō no hozon shūri to fukugen mozō nitsuite [Preservation, restoration, and construction of a replica of iron cuirass excavated at the Nagatoro-Nishi Mounded Tomb, Gunma Prefecture]. *MUSEUM* No. 285: 10–18. 青木繁夫・小沢正実 1974「長瀞西古墳出土短甲の保存修理と復原模造について」『MUSEUM 東京国立博物館美術誌』No. 285、pp. 10–18.

FUJITA Kazutaka 1984. Keikō hennen to sono igi [Chronology of Kofun-period iron gorget]. *Kansai Daigaku Kōkogaku Kenkyū Kiyō* 4: 55–72. 藤田和尊 1984「頚甲編年とその意義」『関西大学考古学研究紀要』4、pp. 55–72.

FURUYA Takeshi 1990. Kofun jidai katchū kenkyū no hōhō to kadai [Methods and issues in research on Kofun-period armor]. *Kōkogaku Zasshi* 76(1): 117–118. 古谷毅 1990「古墳時代甲冑研究の方法と課題」『考古学雑誌』第 76 巻第 1 号、pp. 117–118.

FURUYA Takeshi 1996. Kofun jidai katchū kenkyū no hōhō to kadai [Methods and issues in research on Kofun-period armor]. *Kōkogaku Zasshi* 81(4): 58–85. 古谷毅 1996「古墳時代甲冑研究の方法と課題」『考古学雑誌』第 81 巻第 4 号、pp. 58–85.

FURUYA Takeshi 2005. 15-gō-fun shutsudo no hōkeiban kawatoji tankō no kōzō to tokuchō [Structure and features of a horizontally organized plate leather-laced cuirass excavated in the Tomb No. 15], in YAMANAKA Hidehiko (ed.) *Inadō Kofun-Gun* [Inadō Mounded Tomb Group]: 268–275. Reports of Investigations into Cultural Heritages of Yukuhashi City, No. 32. Yukuhashi, Fukuoka Prefecture: Yukuhashi Municipal Board of Education. 古谷毅 2005「15 号墳出土の方形板革綴短甲の構造と特徴」『稲童古墳群』行橋市文化財調査報告書第 32 集、pp. 268–275. 福岡県行橋市：行橋市教育委員会.

FURUYA Takeshi 2006. Hōkeiban kawatoji tankō no kisoteki kenkyū [Comprehensive study of a horizontally organized plate leather-laced cuirasses] (1). *Tokyo Kokuritsu Hakubutsukan Kiyō* No. 41: 101–171. 古谷毅 2006「方形板革綴短甲の基礎的研究 (1)」『東京国立博物館紀要』第 41 号、pp. 101–171.

HASHIMOTO Seiichi, KOBAYASHI Ken'ichi & IGA Takahiro 1994. Kofun jidai zenki no tetsusei katchū no fukugen: Kyoto-Fu Kizu Chō Kawaradani Kofun shutsudo no kozane kawatoji kabuto, hōkeiban kawatoji tankō [Reconstruction of iron armor of the Early Kofun period: Iron leather-laced lamellar helmet and rectangular-plate leather-laced cuirass excavated at the Kawaradani Mounded Tomb, Kyoto Prefecture]. *Kōkogaku to Shizen Kagaku* 27: 35–58. 橋本清一・小林謙一・伊賀高弘 1994「古墳時代前期の鉄製甲冑の復原—京都府木津町瓦谷古墳出土の小札革綴冑・方形板革綴短

甲—」『考古学と自然科学』第 27 号、pp. 35–58.
HASHIMOTO Tatsuya 1996. Kofun jidai zenki katchū no gijutsu to keifu [Technology and evolution of iron armor of the Early Kofun period], in FUKUNAGA Shin'ya & SUGII Takeshi (eds.) *Yukinoyama Kofun no kenkyū, Kōsatsu-hen* [Study on the Yukinoyama Mounded Tomb: Discussion]: 255–292. Yōkaichi City, Shiga Prefecture: Yōkaichi Municipal Board of Education. 橋本達也 1996「古墳時代前期甲冑の技術と系譜」『雪野山古墳の研究』考察篇、pp. 255–292. 滋賀県八日市市：八日市市教育委員会.
HASHIMOTO Tatsuya 1998. Tatehagi-ita, hōkeiban kawatoji tankō no gijutsu to keifu [Technology and evolution of vertical plate cuirasses and rectangular-plate leather-laced cuirass]. *Seikyū Gakujutsu Ronshū* 12: 47–76. 橋本達也 1998「竪矧板・方形板革綴短甲の技術と系譜」『青丘学術論集』第 12 集、pp. 47–76.
HASHIMOTO Tatsuya 2003. Yūkishitsu-sei katchū, tate, yugi, koroku, yumi [Armor, shields, quivers, and bows made from organic materials], in CHIGA Hisashi & MURAKAMI Yasuyuki (eds.) *Kōko Shiryō Taikan* [Archaeological data: Illustrated survey], Vol. 7: 194–199. Tokyo: Shōgakukan. 橋本達也 2003「有機質製甲冑・盾・靫・胡籙・弓」千賀久・村上恭通（編）『考古資料大観』第 7 巻、pp. 194–199. 東京：小学館.
HASHIMOTO Tatsuya 2005. Kofun jidai chūki katchū no shutsugen to chūki kaishi ron: Shōrinzan Kofun to Tsudō-Shiroyama Kofun kara [Appearance of Middle-Kofun-period type armor and consideration of the beginning of the Middle Kofun period: Approach from the Shōrinzan and Tsudō-Shiroyama Mounded Tombs]. *Machikaneyama Kōkogaku Ronshū* [Collected Papers in Celebration of Professor TSUDE Hiroshi's Retirement]: 539–556. Toyonaka City, Osaka Prefecture: Dept. of Archaeology, Osaka University. 橋本達也 2005「古墳時代中期甲冑の出現と中期開始論—松林山古墳と津堂城山古墳から—」『待兼山考古学論集—都出比呂志先生退任記念—』pp. 539–556. 大阪大学考古学研究室.
HASHIMOTO Tatsuya 2013 Kofun Sangoku jidai no bankō no keifu [Genealogy of plate cuirasses in the Kofun period of Japan and the Three Kingdom period of Korea]. In OKAUCHI Mitsuzane (ed.) *Gijutsu to kōryū no kōkogaku* [Archaeology of techniques and interactions]: 336–347. Tokyo: Dōseisha. 橋本達也 2013「古墳・三国時代の板甲の系譜」岡内三眞（編）『技術と交流の考古学』pp. 336–347. 東京：同成社.
HASHIMOTO Tatsuya 2014 Kofun jidai zenki kacchū no keishiki, keifu, nendairon [Forms, genealogy, and chronology of iron armour in the Early Kofun period]. Zenki kofun *hen'nen wo saikō suru: Kōiki hen'nen sai-kōchiku no kokoromi* [Reconsideration of chronological framework of the Early Kofun period: an attempt to reconstruct cross-regional framework of chronology]: 91–99. Matsue, Shimane Prefecture: Chūgoku, Shikoku Zempō-kōen-fun Kenkyū-Kai Dai-17-kai Kenkyū Shūkai. 橋本達也2014「古墳時代前期甲冑の形式・系譜・年代論」『前期古墳編年を再考する—広域編年再構築の試み—』中国四国前方後円墳研究会第 17 回研究集会、pp. 91–99.

ISHI Kiyoshi & ARII Hiroyuki (ed.) 1997. *Kawaradani Kofun* [Kawaradani Mounded Tomb]. Kyoto-Fu Iseki Chōsa Hōkoku-Sho [Reports of Archaeological Excavations in Kyoto Prefecture]. Kyoto: Kyoto Prefectural Center for Archaeological Excavations and Research. 石井清司・有井広幸（編）1997『瓦谷古墳群』京都府遺跡調査報告書第 23 冊　京都府向日市：京都府埋蔵文化財調査研究センター.

KAWAHATA Jun 2015 *Bugu ga kataru kodai-Shi: Kofun jidai shakai no kōzō tenkan* [Ancient Japanese history from the perspective of iron armour: structural transformation of the Kofun period society]. Kyoto: Kyoto University Press. 川畑純『武具が語る古代史　古墳時代社会の構造転換』京都大学学術出版会.

KOBAYASHI Ken'ichi 1974a. Katchū seisaku gijutsu no hensen to Kōjin no keitō [Evolution of armor production technology and schools of craftsmanship], Pt. 1. *Kōkogaku Kenkyū* 20(4): 48–68. 小林謙一 1974a「甲冑製作技術の変遷と工人の系統（上）」『考古学研究』第 20 巻第 4 号、pp. 48–68.

KOBAYASHI Ken'ichi 1974b. Katchū seisaku gijutsu no hensen to Kōjin no keitō [Evolution of armor production technology and schools of draftsmanship], Pt. 2. *Kōkogaku Kenkyū* 21(2): 37–49. 小林謙一 1974b「甲冑製作技術の変遷と工人の系統（下）」『考古学研究』第 21 巻第 2 号、pp. 37–49.

KOBAYASHI Ken'ichi 1995. Kofun jidai ni-okeru shoki no katchū [Early types of armor in the Kofun period], in Nara National Cultural Properties Research Institute staff (eds.) *Bunkazai Ronsō* [Advances in the study of cultural properties], Vol. 2: 57–63. Kyoto: Dōhōsha. 小林謙一　1995「古墳時代における初期の甲冑」『文化財論叢』II、pp. 57–63. 京都：同朋舎出版.

KOBAYASHI Ken'ichi 2000. Kofun jidai katchū no genryū wo saguru [In search for the prototype of Kofun period armor], in KOBAYASHI Ken'ichi (ed.) *Nikkan kodai ni-okeru maisō-hō no hikaku kenkyū* [Comparative studies of mortuary practices in ancient Korea and Japan]: 22–28. Report of Grant-in-Aid for Scientific Research (Category A[2]) for Fiscal Years from 1997 to 1999. Nara: Nara National Cultural Properties Research Institute. 小林謙一 2000「古墳時代甲冑の源流を探る—日本と伽耶—」『日韓古代における埋葬法の比較研究』平成 9 年度～ 11 年度科学研究費補助金（基盤研究 (A)(2)）研究成果報告書、pp. 22–28. 奈良：奈良国立文化財研究所.

KOBAYASHI Ken'ichi 2002. Kofun jidai katchū no keifu to mokkō [Yayoi period wooden cuirasses and the origins of Kofun period armor], in Nara National Cultural Properties Research Institute staff (eds.) *Bunkazai Ronsō* [Advances in the study of cultural properties], Vol. 3: 77–84. Nara: Nara National Cultural Properties Research Institute. 小林謙一 2002「古墳時代甲冑の系譜と木甲」『文化財論叢』III 、pp. 77–84. 奈良文化財研究所学報第 65 冊　奈良：奈良文化財研究所.

KOBAYASHI Yukio 1965. "Jingū-Ōjin Ki" no jidai [Era of Empress Jingū and reign of Emperor Ōjin as described in the *Chronicles of Japan* (720)]. *Chōsen Gakuhō* No. 36: 25–47. 小林行雄 1965「神功・応神紀の時代」『朝鮮学報』第 36 輯、pp. 25–47.

KOBAYASHI Yukio 1982. Kofun jidai no tankō no genryū [Origins of Kofun period cuirasses], in Tezukayama Institute of Archaeology staff (eds.) *Nikkan kodai bunka no*

nagare [Evolution of cultures in ancient Korea and Japan]: 21–33. Nara: Tezukayama Institute of Archaeology. 小林行雄 1982「古墳時代の短甲の源流」『日・韓古代文化の流れ』、pp. 21–33. 奈良：帝塚山考古学研究所.

LEE Hyeonju 2008. Samgukshidae eui Gapchu. *Nikkan no Bugu*: 56–90. Miyazaki: Miyazaki Prefectural Museum of Archaeology at Saitobaru. 李賢珠 2008「三国時代甲冑」『日韓の武具』宮崎県立西都原考古博物館、pp. 56–90.

MORISHITA Shōji 2005. Zenki kofun fukusōhin no kumiawase [Assemblage of goods deposited with the dead in the Early Kofun period]. *Kōkogaku Zasshi* 89(1): 1–31. 森下章司 2005「前期古墳副葬品の組合せ」『考古学雑誌』第 89 巻第 1 号、pp. 1–31.

NAKAYA Katsuhiko (ed.) 2005. *Shiseki Amenomiya Kofun-Gun* [Amenomiya Mounded Tomb Group, A nationally designated historic site]. Nakanoto Town, Ishikawa Prefecture: Rokusei Township Board of Education. 中屋克彦（編）2005『史跡雨の宮古墳群』石川県中能登町：鹿西町教育委員会.

NOGAMI Jōsuke 1968. Kofun jidai ni-okeru katchū no hensen to sono gijutsu-shi teki igi [Evolution of armor in the Kofun period and its technological and historical significance]. *Kōkogaku Kenkyū* 14(4): 12–43. 野上丈助 1968「古墳時代における甲冑の変遷とその技術史的意義」『考古学研究』第 14 巻第 4 号、pp. 12–43.

SAKAGUCHI Hideki 1998. Chōhōban kawatoji tankō to sankakuban kawatoji tankō: hensen to sono tokushitsu [Rectangular-plate and triangular-plate laced cuirasses: Development and significance]. *Shirin* 81(5): 607–645. 阪口英毅 1998「長方板革綴短甲と三角板革綴短甲—変遷とその特質—」『史林』第 81 巻第 5 号、pp. 607–645.

SAKAGUCHI Hideki 2005. Shikinzan kofun shutsudo bugu no sai-kentō [Re-examination of armor excavated at the Shikinzan Mounded Tomb], in SAKAGUCHI Hideki (ed.) *Shikinzan Kofun no Kenkyū: Kofun jidai zenki ni-okeru taigai kōshō no kōkogaku-teki kenkyū* [Study on the Shikinzan Mounded Tomb: Archaeological approach to foreign interactions in the Early Kofun period]: 339–346. Report of Grant-in-Aid for Scientific Research (Category B[2]) for Fiscal Years from 2002 to 2004. Kyoto: Graduate School of Letters, Kyoto University. 阪口英毅 2005「紫金山古墳出土武具の再検討」『紫金山古墳の研究—古墳時代前期における対外交渉の考古学的研究—』平成 14 〜 16 年度科学研究費補助金（基盤研究 (B)(2)）研究成果報告書、pp. 339–346. 京都大学大学院文学研究科.

SAKAGUCHI Hideki (ed.) 2006. *Ono-ōzuka kofun shutsudo ibutsu hozon shori hōkoku-sho* [Report of conservation treatment of artifacts excavated at the Ono-ōzuka Mounded Tomb]. Ono City, Hyogo Prefecture: Ono Municipal Board of Education. 阪口英毅（編）2006 『小野王塚古墳出土遺物保存処理報告書』小野市文化財調査報告第 17 集　小野市教育委員会.

SAKAGUCHI Hideki 2009. Zenki, chūki-gata katchū no gijutsu keifu [Technical lineage of Early Kofun and Middle Kofun types of iron armour]. *Kōkogaku Journal* No. 581: 7–11. 阪口英毅 2009「前期・中期型甲冑の技術系譜」『月刊考古学ジャーナル』 No. 581、pp. 7–11.

SAKAGUCHI Hideki 2010 Obigane-shiki kacchū no seiritsu [Appearance of iron-framed

armour]. *Enko Tōhan* [Collected papers in memory of Mr. Tōyama Akito] (Private publication): 305–320. Kyoto: Shin'yōsha. 阪口英毅2010「帯金式甲冑の成立」『遠古登攀』pp. 305–320. 遠山昭登君追悼論文集刊行会（京都：眞陽社）.

SAKAGUCHI Hideki 2013 Kacchū [Iron armour]. In HŌJŌ Yoshitaka (ed.) *Kofun jidai no kōkogaku* [Kofun period archaeology] *Volume 4: Fukusōhin no keishiki to hen'nen* [Typology and chronological frameworks of goods deposited with the dead]: 111–124. Tokyo: Dōseisha. 阪口英毅2013「甲冑」北條芳隆（編）『古墳時代の考古学』第4巻『副葬品の型式と編年』東京：同成社、pp. 111–124.

SUENAGA Masao 1934. *Nihon jōdai no katchū* [Armor in early Japan]. Tokyo: Oka Shoin. 末永雅雄 1934『日本上代の甲冑』東京：岡書院.

SUZUKI Kazunao 1999. Chōsō no bujin [Soldier in a bird costume]. *Kokka Keisei-ki no kōkogaku* [Archaeology of state formation: Collected Papers in Celebration of the Tenth Anniversary of the Dept. of Archaeology, Osaka University]: 487–502. Toyonaka City, Osaka Prefecture: Dept. of Archaeology, Osaka University. 鈴木一有 1999「鳥装の武人」『国家形成期の考古学—大阪大学考古学研究室 10 周年記念論集—』、pp. 487–502. 大阪府豊中市：大阪大学考古学研究室.

SONG Jeongsik 2003. *Gaya Silla Jongjangpangap eui Jongjangpangap Yeongu, Gujo Bokwon eul Jungshimeuro*. Master's thesis submitted to the Dept. of Archaeology, Graduate School of National Busan University. 宋禎植 2003「加耶・新羅縦長板甲研究—構造復元舎号令」幺呈—」釜山大学校大学院考古学科文学碩士学位論文.

SONG Jeongsik 2021. Gaya Jongjangpangap eui Jangshikjeok Yoso wa Sangjingjeok Euieui. *Yangdong-ri, Gaya reul Boda.* National Gimhae Museum. 宋禎植 2021「加耶縦長板甲の装飾的要素と象徴的意義」『良洞里、加耶を見る』国立金海博物館

TAKAHASHI Katsuhisa 1993. 4-seiki ni-okeru tankō no henka [Evolution of cuirasses in the fourth century]. *Shikinzan Kofun to Ishiyama Kofun* [Shikinzan and Ishiyama Mounded Tombs: Exhibition Catalogue]: 120–125. Kyoto: Kyoto University Museum. 高橋克壽 1993「4 世紀における短甲の変化」『紫金山古墳と石山古墳』pp. 120–125. 京都大学文学部博物館図録第6冊 京都：京都大学文学部博物館.

TAKAHASHI Takumi 1993. Kawatoji kacchū no gijutsu [Techniques adopted to leather-laced armor]. *Kōkogaku Journal* No. 366: 17–21. 高橋工 1993「革綴甲冑の技術」『月刊考古学ジャーナル』No. 366、pp. 17–21.

TAKAHASHI Takumi 1995. Higashi-Asia ni-okeru katchū no keitō to Nihon [The armour of East Asia and Japan: With particular emphasis on manufacturing styles and techniques during and before the fifth century]. *Nihon Kōkogaku* No. 2: 139–160. 高橋工 1995「東アジアにおける甲冑の系統と日本—特に5世紀までの甲冑製作技術と設計思想を中心に—」『日本考古学』第2号、pp. 139–160.

TAKIZAWA Makoto 1990. Kitsunezuka Kofun shutsudo no tankō [Cuirass excavated at the Kitsunezuka Mounded Tomb]. *Ibaraki-Ken Shi Kenkyū* No. 64: 45–56. 滝沢誠 1990「狐塚古墳出土の短甲」『茨城県史研究』第 64 号、pp. 45–56.

TSUKAMOTO Toshio 1993. Byōdome katchū no gijutsu [Techniques adopted to rivetted armor]. *Kōkogaku Journal* No. 366: 22–26. 塚本敏夫 1993「鋲留甲冑の技術」『月刊考

古学ジャーナル』No. 366、pp. 22–26.
YAMANAKA Hidehiko (ed.) *Inadō Kofun-Gun Fukuoka-ken Yukuhashi-shi Inadō shozai no Inadō Kofun-Gun hakkutsu chōsa hōkoku* [Inadō Mounded Tomb Group]. Reports of Investigations into Cultural Heritages of Yukuhashi City, No. 32. Yukuhashi, Fukuoka Prefecture: Yukuhashi Municipal Board of Education. 山中英彦（編）2005『稲童古墳群—福岡県行橋市稲童所在の稲童古墳群調査報告—』行橋市文化財調査報告書第 32 集　行橋市教育委員会

Site Reports

1. NISIMIYA Kazuo 1969. *Hitachi Kitsunezuka* Ibaraki Prefecture: Iwase Township Board of Education. 西宮一男 1969『常陸狐塚』岩瀬町教育委員会；Takizawa 1990; Hashimoto 1998
2. NISINA Yoshio 1931. Ōmaruyama kofun, in *Yamanashi-Ken shiseki meishō tennen kinenbutsu chōsa hōkoku* 仁科義男 1931「大丸山古墳」『山梨縣史蹟名勝天然記念物調査報告』第5輯　山梨縣 pp. 52–77; HOSAKA Kazuhiro 1999. Bugu, in *Yamanashi Ken-shi* (Data, Pt. 2 [Prehistoric and Ancient period]: Archaeology): pp. 266–274. Yamanashi: Yamanashi Prefectural Government. 保坂和博 1999「武具」『山梨県史』資料編2 原始・古代2 考古（遺構・遺物）山梨県 pp. 266–274; MOGI Masahiro (ed.) 2007. *Kai Ōmaruyama kofun: Maisō shisetsu no chōsa* [Ōmaruyama Mounded Tomb in Yamanashi Prefecture: Investigations into burial facilities]. Ibaraki: Hakuko Kenkyūkai. 茂木雅博（編）2007『甲斐大丸山古墳—埋葬施設の調査—』茨城県水戸市：博古研究会
3. Iwata Municipal Center for Archaeological Operations Staff 1989. *Akuro 2, 3-Gōfun no shashinshū* [Photographs of the Akuro No. 2 and 3 Tombs]. Shizuoka Prefecture: Iwata Municipal Center for Archaeological Operations. 磐田市埋蔵文化財センター 1989『安久路2・3 号墳の写真集』静岡県：磐田市埋蔵文化財センター
4. NAKAYA Katsuhiko (ed.) 2005. *Shiseki Amenomiya Kofun-Gun* [Amenomiya Mounded Tomb Group, A nationally designated historic site]. Nakanoto Town, Ishikawa Prefecture: Rokusei Township Board of Education. 中屋克彦（編）2005『史跡雨の宮古墳群』石川県中能登町：鹿西町教育委員会
5. YOSHIDA Hidetoshi (ed.) 1999. *Funakiyama Kofun-Gun* [Funakiyama Mounded Group]. Gifu Prefectute: Inonuki Township Board of Education and Motosu Township Board of Education. 吉田英敏（編）1999『船来山古墳群』糸貫町教育委員会・本巣町教育委員会（船来山古墳群発掘調査団）
6. TAKATA Ken'ichi (ed.) 2013. *Kokōge 1-Gōfun, Rokubuyama 3-Gōfun no kenkyū: Shutsudohin saiseiri hōkokusho* [Studies on the Kokōge No. 1 Tomb and Rokubuyama No. 3 Tomb: Report of re-analysis of the excavated artifacts]. Tottori: Tottori Prefectural Government.　高田健一（編）2013『古郡家1 号墳・六部山3 号墳の研究—出土品再整理報告書—』鳥取県
7. KURABAYASHI Masato, YAMADA Shunsuke & SAWADA Hidemi 2000. Okunomae 1-Gōfun (Yuki Takatsuka kofun). In *Mimasaka no shuchō-fun: Funkyū sokuryō chōsa hōkoku* [Elite mounded tombs in the Mimasaka Region, Northern Okayama Prefecture: Report of mapping mounded tombs]: 78–88. Okayama: Kibito Shuppan. 倉林眞砂斗・

山田俊輔・深田秀実　2000「奥の前1号墳〈油木高塚古墳〉」『美作の首長墳—墳丘測量調査報告—』（美作地方における前方後円墳秩序の構造的研究 I）、pp. 78–88. 吉備人出版；KURABAYASHI Masato (ed.) *Zempō-kōen-fun jidai no shuchō network ni-kansuru takakuteki kenkyū* [Multi-faceted studies on the elite network during the Kofun period]. Report of Grant-in-Aid for Scientific Research (Category C) for Fiscal Years from 2000 to 2003. Chiba Prefecture: Josai International University. 倉林眞砂斗（編）2004『前方後円墳時代の首長ネットワークに関する多角的研究』平成 12 年度～平成 15 年度科学研究費補助金（基盤研究 C 一般）研究成果報告書

8. MIYAKE Hiroshi, MATSUMOTO Iwao & MAEJIMA Miki 1977. *Nakayama Kofun-Gun hakkutsuchōsa gaihō* [Preliminary report of excavations at the Nakayama Mounded Tomb Group]. Shimane Prefecture: Iwami Township Board of Education. 三宅博士・松本岩雄・前島己基 1977『中山古墳群発掘調査概報』石見町教育委員会；HASHIMOTO 1998
9. YAMANAKA Hidehiko (ed.) *Inadō Kofun-Gun* [Inadō Mounded Tomb Group]. Reports of Investigations into Cultural Heritages of Yukuhashi City, No. 32. Yukuhashi, Fukuoka Prefecture: Yukuhashi Municipal Board of Education. 山中英彦（編） 2005『稲童古墳群—福岡県行橋市稲童所在の稲童古墳群調査報告—』行橋市文化財調査報告書第 32 集　行橋市教育委員会；FURUYA 2006.
10. YANAGIDA Yasuo & SOEJIIMA Kunihiro 1971. Wakahachimangū Kofun [Wakahachimangū Mounded Tomb], in *Imajuku Bypass kankei maizō bunkazai hōkoku* [Report of excavations conducted prior to the construction of the Imajuku Bypass], No. 2: 7–43. Fukuoka: Fukuoka Prefectural Board of Education. 柳田康雄・副島邦弘 1971「若八幡宮古墳」『今宿バイパス関係埋蔵文化財調査報告』第2集、pp. 7–43. 福岡県教育委員会
11. KINOSHITA Yukiharu & ODA Fujio 1967. Kumamotoyama funagata sekkan bo [Boat-shaped stone coffin at Kumamotoyama]. *Saga-Ken bunkazai Chōsa hōkoku-sho* No. 16: 27–47. Saga: Saga Prefectural Government. 木下之治・小田富士雄 1967「熊本山船型石棺墓」『佐賀県文化財調査報告書』第 16 集、pp. 27–47. 佐賀県教育委員会；HASHIMOTO 1998.
12. SAKAGUCHI Hideki (ed.) 2006. *Ono-ōzuka kofun shutsudo ibutsu hozon shori hōkoku-sho* [Report of conservation treatment of artifacts excavated at the Ono-ōzuka Mounded Tomb]. Ono City, Hyogo Prefecture: Ono Municipal Board of Education. 阪口英毅（編）2006『小野王塚古墳出土遺物保存処理報告書』小野市文化財調査報告第 17 集　小野市教育委員会
13. MORI Kōichi & TERASAWA Tomoko (eds.) 1990. *Sonobe Kaichi Kofun* [Sonobe Kaichi Mounded Tomb]. Kyoto: Dept. of Cultural Studies, Faculty of Letters, Doshisha University. 森浩一・寺沢知子（編）1990『園部垣内古墳』（同志社大学文学部考古学調査報告第6冊）同志社大学文学部文化学科
14. Kyoto University Dept. of Archaeology staff (eds.) 1993. *Shikinzan Kofun to Ishiyama Kofun* [Shikinzan and Ishiyama Mounded Tombs: Exhibition Catalogue]. Kyoto: Kyoto University Museum. 京都大学文学部考古学研究室1993『紫金山古

墳と石山古墳』京都大学文学部博物館図録第6冊　京都：京都大学文学部博物館；SAKAGUCHI Hideki (ed.) 2005 *Shikinzan Kofun no Kenkyū: Kofun jidai zenki ni-okeru taigai kōshō no kōkogaku-teki kenkyū* [Study on the Shikinzan Mounded Tomb: Archaeological approach to foreign interactions in the Early Kofun period]: 339–346. Report of Grant-in-Aid for Scientific Research (Category B[2]) for Fiscal Years from 2002 to 2004. Kyoto: Graduate School of Letters, Kyoto University. 阪口英毅 2005「紫金山古墳出土武具の再検討」『紫金山古墳の研究—古墳時代前期における対外交渉の考古学的研究—』平成 14 〜 16 年度科学研究費補助金（基盤研究 (B) (2)）研究成果報告書．京都大学大学院文学研究科

15. KOBAYASHI Yukio 1956. Ibaraki-Shi Shōgun'yama Kofun chōsa gaihō [Preliminary report of archaeological excavations at the Shōgun'yama Mounded Tombs in Ibaraki City, Osaka Prefecture]. *Nihon Kōkogaku Kyōkai ihō* [News of the Japanese Archaeological Association], Appendix 6: 13–14. Tokyo: Japanese Archaeological Association. 小林行雄 1956「茨木市将軍山古墳調査概報」『日本考古学協会彙報』別篇6、pp. 13–14 日本考古学協会；KATADA Tadashi 1968. *Ibaraki-Shi Shōgun'yama Kofun sekishitsu ichiku hōkoku* [Report of the project of moving the burial chamber of the Shōgun'yama Mounded Tombs in Ibaraki City]. Nara: Tezukayama University Dept. of Archaeology. 堅田直 1968『茨木市将軍山古墳石室移築報告』考古学シリーズ3 帝塚山大学考古学研究室；HIROSE Satoru (ed.) 2005. *Shōgun'yama Kofun-Gun* [Shōgun'yama Mounded Tomb Group], I. Osaka Prefecture: Ibaraki Municipal Government. 廣瀬覚（編）2005『将軍山古墳群 I—考古学資料調査報告集—』（新修茨木市史史料集8）茨木市；WAKASUGI Tomohiro (ed.) 2008. *Shōgun'yama Kofun-Gun* [Shōgun'yama Mounded Tomb Group], II. Osaka Prefecture: Ibaraki Municipal Government. 若杉智宏（編）2008『将軍山古墳群 II—考古学資料調査報告集—』新修茨木市史史料集 12 茨木市
16. ŌTSUBO Shūichirō 2011. Kyoto-Fu Seika-Chō Kuraokayama 3-Gōfun no chōsa [Excavation at the Kuraokayama No. 3 Tomb in Seika Town, Kyoto Prefecture]. *Kōkogaku Kenkyū* 58(1): 100–102. 大坪州一郎 2011「京都府精華町鞍岡山3号墳の調査」『考古学研究』第 58 巻第1号、pp. 100–102; ŌE Katsumi, UEMURA Akio, ISHIYAMA Yōichi & MURAKAWA Toshiaki 2012. Kyoto-Fu Seika-Chō Kuraokayama 3-Gōfun shutsudo tankō no kōzō fukugen [Reconstruction of cuirass excavated at the Kuraokayama No. 3 Tomb in Seika Town, Kyoto Prefecture], in *Nihon Bunkazai Kagaku-Kai dai-29-kai taikai kenkyū happyō yōshishū* [Abstracts of Papers Presented at the 29th JSSSCP Meeting]: 226–227. Nara: Japan Society for Scientific Studies on Cultural Properties. 大江克己・植村昭男・石山要一・村川俊明　2012「京都府精華町鞍岡山3号墳出土短甲の構造復元」『日本文化財科学会第 29 回大会研究発表要旨集』日本文化財科学会第 29 回大会実行委員会事務局、pp. 226–227.
17. HASHIMOTO Seiichi, KOBAYASHI Ken'ichi, & IGA Takahiro 1994. Kofun jidai zenki no tetsusei katchū no fukugen: Kiyoto-Fu Kizu-Chō Kawaradani Kofun shutsudo no kozane kawatoji Kabuto, Hōkeiban kawatoji tankō [Reconstruction of leather laced iron armor of the Early Kofun period: Leather laced iron helmet and cuirass excavated at the Kawaradani Mounded Tomb, Kizu Town, Kyoto Prefecture]. *Kōkogaku to*

Shizenkagaku 27: 35–58. 橋本清一・小林謙一・伊賀高弘 1994「古墳時代前期の鉄製甲冑の復原—京都府木津町瓦谷古墳出土の小札革綴冑一方形板革綴短甲—」『考古学と自然科学』第 27 号、pp. 35–58.; ISHII Seiji & ARII Hiroyuki (ed.) 1997. *Kawaradani Kofun-Gun* [Kawaradani Mounded Tomb Group]. Kyoto: Kyoto Prefectural Centre for Archaeological Excavations and Research. 石井清司・有井広幸（編）1997『瓦谷古墳群』（京都府遺跡調査報告書第23 冊）京都府埋蔵文化財調査研究センター

18. UMEHARA Sueji 1938. Azuchi Hyōtanyama Kofun [Azuchi Hyōtanyama Mounded Tomb]. *Shiga-Ken Shiseki Chōsa hōkoku* [Reports of Historic Sites in Shiga Prefecture], No. 7: 1–45, Pls. 1–29. Shiga: Shiga Prefectural Government. 梅原末治 1938「安土瓢箪山古墳」『滋賀縣史蹟調査報告』第7 冊、pp. 1–45，図版1–29．滋賀縣；TAKAHASHI 1993.
19. Kyoto University Dept. of Archaeology staff (eds.) 1993. *Shikinzan Kofun to Ishiyama Kofun* [Shikinzan and Ishiyama Mounded Tombs: Exhibition Catalogue]. Kyoto: Kyoto University Museum 京都大学文学部考古学研究室 1993『紫金山古墳と石山古墳』（京都大学文学部博物館図録第6 冊）京都大学文学部博物館；TSUTSUI Masa'aki (ed.) 2005. *Ishiyama Kofun* [Ishiyama Mounded Tomb]. Mie: Mie Prefectural Centre for Archaeological Operations. 筒井正明（編）2005『石山古墳』（第 24 回三重県埋蔵文化財展）三重県埋蔵文化財センター
20. SUENAGA Masao (ed.) 1991. *Tatezuka, Kutazuka, Shukinzuka Kofun* [Tatezuka, Kutazuka, and Shukinzuka Mounded Tombs in Osaka Prefecture]. Nara: Yura Research Association for the Ancient Yamato. 末永雅雄（編）1991『盾塚　鞍塚　珠金塚古墳』由良大和古代文化研究協会
21. DATE Muneyasu 1966. *Wani Uedono Kofun* [Uedono Mounded Tomb]. Nara: Nara Prefectural Board of Education. 伊達宗泰 1966『和爾上殿古墳』（奈良県史跡名勝天然記念物調査報告第 23 冊）奈良県教育委員会；HASHIMOTO 1998
22. ABOSHI Yoshinori, DATE Muneyasu, MORI Kōichi, YAMADA Ryōzō, INOKUMA Kanekatu, HOTTA Keiichi, TERASAWA Tomoko & SUGAYA Fuminori 1981. 500-gō fun (Chausuyama kofun) [Tomb No. 500 (Chausuyama Mounded Tomb)], in *Niizawa Senzawa Kofun-Gun*: 23–78. Nara: Nara Prefectural Board of Education. 網干善教・伊達宗泰・森浩一・山田良三・猪熊兼勝・堀田啓一・寺沢知子・菅谷文則 1981「500 号墳（茶臼山古墳）」『新沢千塚古墳群』奈良県史跡名勝天然記念物調査報告第 39 冊　奈良県教育委員会、pp. 23–78.
23. Gose Municipal Board of Education 2001. *Kamotsuba 1-gōfun chōsa gaihō*. Tokyo: Gakuseisha. 御所市教育委員会 2001『鴨都波 1 号墳調査概報』東京：学生社
24. KAWAKAMI Kunihiko & SAITŌ Kiyohide (ed.) 1996. *Taniguchi Kofun-gun (fu Taniguchi Funbo-Gun) hakkutsuchōsa hōkoku* [Report of archaeological excavations at the Taniguchi Mounded Tomb Group (with appendix on the Taniguchi Burial Mound Group)]. Nara Prefecture: Takatori Township Board of Education. 河上邦彦・西藤清秀（編）1996『タニグチ古墳群（付タニグチ墳墓群）発掘調査報告』高取町文化財調査報告第 17 冊　高取町教育委員会
25. Suenaga 1934; Furuya 2006