Reexamination of Wooden "Mudguards": Excavated Examples of Yayoi and Kofun Periods

KUROSU Akiko[1]

ABSTRACT

This article examines the functions of "mudguards" (doroyoke) *attached to wide wooden hoes excavated from Yayoi and Kofun sites in the attempt to challenge the conventional theory that they were protective equipment to avoid mud splattering.*

First, the study re-classifies wide hoes and mudguards according to their mounting device shapes to reveal their possible combinations based on excavated examples by time and region. Next, based on excavation of examples, this article reconstructs specific mounting methods for the so-called "wide hoe type I" (which is divided in this article into "wide hoe type 0" and "Kinki-type hoe subtype I) and "mudguard type I." Their mounting method has been left obscure.

As a result, it has been found that improvements were made to hoes and mudguards to achieve three ideals: tightly securing the hoe and mudguard to each other, securing them at an acute angle, i.e., shortening the distance between the hoe blade's end and the mudguard's lower edge; and preventing breakage of the mudguard. It has also been found that a wide hoe with mudguard functioned to facilitate shallow scraping of the soil and its even distribution and that the mudguard itself functioned both as a brake to prevent the hoe from sinking too deeply and as a guide to hoeing the soil at an even depth.

KEYWORDS: Late prehistoric and proto-historic Japan, Western Japan, Agricultural Tools

Editor's note (by SASAKI Ken'ichi)

This is a full translation of KUROSU Akiko's paper published in No. 43 (2018) of *Nihon Kōkogaku*, the Japanese language journal of the Japanese Archaeological Association. Kurosu received the Japanese Archaeological Association Award for this publication in 2019. Although a mudguard attached to a hoe seems to be a rather minute subject, this paper makes a considerable contribution to our understanding of the subsistence activities of the Yayoi and Kofun Periods of late prehistoric and proto-historic Japan (seventh century B.C. to early seventh century A.D.). It is apparent that mudguards were widely used in rice paddies in western Japan, with wet rice cultivation being the major subsistence base in the archipelago.

[1] *Dept. of Cultural Heritage Preservation and Protection, Office for the Promotion of Culture and Arts of the City, Kyoto City Hall 604–8006 (kuqbd280@city.kyoto.lg.jp)*

Category: Original Article Received: 4 November 2014; Accepted: 27 March 2017; Translated: February 2020 Originally published in 'Nihon-Kōkogaku: Journal of the Japanese Archaeological Association' 43

As with the case of YAMADA Shunsuke's paper published in the *Japanese Journal of Archaeology*, Vol. 7, No. 2 (2019), this paper was originally written in Japanese and intended for a Japanese audience. Therefore, its structure and logical flow are of Japanese style, i.e., the author takes a strictly inductive approach. The author first classifies hoes and mudguards into several regional types and morphological subtypes therein. Then, she goes on to investigate the association between subtypes of hoes and types of mudguards in the archaeological contexts and how mudguards were mounted to hoes. Owing to these careful analyses, the author presents a new hypothesis that hoes with a mudguard used in wet fields functioned to scrape the surface layer of the soil in order to evenly distribute it, and that the mudguard itself had various functions such as preventing the hoe blade from sinking too deeply and serving as a guide for cultivating the soil at an even depth. Although not explicit, she also discusses interaction among different regions of western Japan during the Yayoi Period based on her detailed classification of regional types of hoes.

As is the case of this paper, the first three-fourths of a Japanese archaeology paper is devoted to typological and regional analyses of artifacts in detail. Reading the first three-fourths might give readers from the English-speaking world the impression that Japanese archaeologists pay little attention to theory. As this paper demonstrates, however, the author successfully approaches the broader issues of human behavior and regional interaction. The editor hopes that readers outside Japan will not only gain some understanding of the subsistence activities of the Yayoi and Kofun Periods, but will also become familiar with the Japanese style of writing.

From among wooden farming tools excavated from Yayoi and Kofun sites, this article focuses on the "mudguards" (*doroyoke*) attached to straight-handled hoes and examines their functions.[2] A straight-handled hoe with a wide head (hereafter referred to as "wide hoe" [*hiroguwa*]) is a kind of hoe that has a straight handle (*sugue*) inserted into a hole made in the hoe head. They are widely excavated from Yayoi-period and later sites in Japan. Around the end of the Final Jōmon period to the beginning of the Yayoi period (eighth and seventh centuries, B.C.), the *morotekuwa* hoe, characterized by two heads, upper and lower, appeared in northern Kyūshū and spread to the Seto Inland Sea coastal areas (Setouchi) and Shikoku and San'in regions. On the other hand, in the middle of the Early Yayoi period (fifth century, B.C.), wide hoes with mudguards were widely used in the coastal areas of Seto Inland Sea and Osaka

[2]The terms for wooden artifacts used in this article are according to the *Mokki shūsei zuroku* (Uehara 1993b).

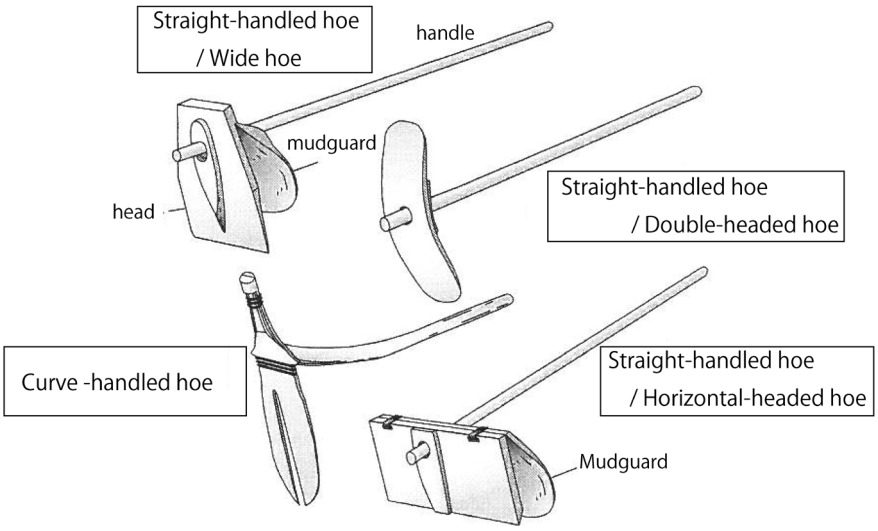


Figure 1. Main Types of Hoes (Illustration by the author)

Bay, and later spread to the Tōkai region. Meanwhile, the hoe with a curved handle (*magarie*), which appeared in the Jōmon period, continued to be used in various places (Yamada 2003) as a major cultivating implement in the Yayoi and Kofun periods. (See Figure 1.)

The mudguard was attached only to wide hoes and horizontal-headed hoes (*yokoguwa*). It has a hole—through which a handle is inserted—located in the center of a wooden board cut in a plank or lampshade shape. The mudguard was once thought of as a kind of hoe and called a *maruguwa* ("round hoe"), but the 1985 simultaneous discovery of a handle, head, and mudguard from the Naka-Kunryū site in Fukuoka prefecture prompted researchers to reexamine the functions of what had been called the "round hoe" until then (Kaneko 1988).

The author of the report on the discovery at the Naka-Kunryū site (Rikitake and Ōba 1987) said that he had assembled the three unearthed pieces and, referencing folk artifacts in Shizuoka prefecture (Anonymous 1983), assumed that the plank-shaped piece mounted on the head was likely a device to prevent mud from splashing the user when he was swinging the hoe in a wet field. The reporter considered the device as more or less equivalent to what is referred to as *teidei* and *neko* ("mud stopper") in the Tokugawa-period agricultural books *Kōka shunjū* (Tsuchiya 1707) and *Nōgu benri ron* (Ōkura 1822), arguing that, as far as historical documents go, the mudguards could date back to the middle of the Tokugawa period (1603–1868). Such mudguards are found even today in Shizuoka and Fukushima prefectures (Figure 2) and their existence in Osaka prefecture is also recorded in documents.

In response to the report from the Naka-Kunryū site, Kurosaki Tadashi (1988) estimated that the "round hoes" (*maruguwa*) excavated in the Kinki region corresponded to this mudguard and, using illustrations, showed how mudguards were mounted on wide hoes

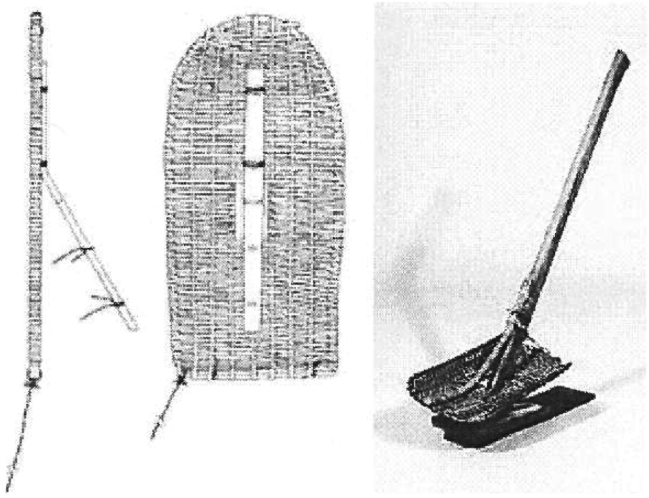


Figure 2. Scale Drawings of Teidei ("Mud Stopper") Farming Tool and Its Mounting[3]

(Figure 3). A series of discoveries of wide hoes and mudguards from wetlands in the region led researchers to support Kurosaki's theory of "round hoes" as a device for protection against mud splash and his reconstructed mounting methods. As for the excavated "wide hoes," too, Kurosaki at first thought of them as *uchiguwa* ("chopping hoes"), hoes used to break up the soil, but later withdrew that theory after experiments with reconstructed models (Kurosaki 1991). Uehara Mahito (1993a), too, put forth the theory that the wide hoes mounted with mudguards were *hikiguwa* ("pull hoes"), for moving muddy soil toward the user and that the mudguards were a device to prevent the mud from splashing. These theories by Kurosaki and Uehara made the functions of mudguards and their mounting methods widely known.

Later, however, as compilations of hoes and spades from across the country were published (Yamada 2003, Higami 2008, etc.) it became clear that the situation in the Kinki region did not always agree with tendencies in other parts of the country. That is to say, examples that could not be explained by Kurosaki's mounting method were discovered. With advances in experimental archaeology, moreover, doubts were raised over his assumptions. Yamada Masahisa (2012, Itō and Yamada 2017) doubted the functions of the mudguard and suggested the possibility that the

[3]Folk tool mudguard (left) and mudguard mounting. This example was most firmly attached to the hoe. Other examples include woven or wooden mudguards with a hole made in the center, but in most cases a mudguard is simply tied to a handle and hanging from it. Sources: Figure 2, left: reprinted from "Tadami-cho Internet Museum" compiled by Kanagawa University's 21st Century COE Program Group 4 "Dissemination of Regionally Integrated Information."
http://www.general-museum.fks.ed.jp/03_gallery/06_ minzoku/06_minzoku.html (accessed October 2014)
Figure 2, right: reprinted from material in the website of the Fukushima Museum.
http://www.general-museum.fks.ed.jp/03_gallery/06_ minzoku/06_minzoku.html (accessed October 2014)

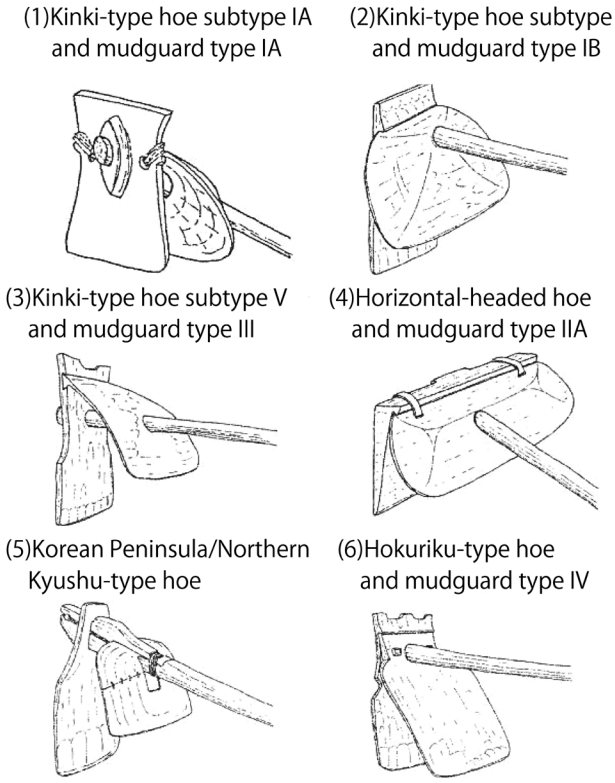


Figure 3. Methods of Mounting Hypothesized by Kurosaki and Uehara

"mudguard" was used to carry soil placed in between it and the hoe head.

In this way, the reconstruction of the mudguard mounting and the determination of mudguard functions began mainly by referring to folk implements either still in use or whose use is recorded in relatively recent documents. Kurosaki's assumption of a hoe having been combined with a different device was insightful and its impact on subsequent research was significant, but it is also true that examples suggesting the need to reconsider his theory have been increasingly discovered.

Looking at excavated examples of mudguards, we can roughly see that, while there were minor differences by region, mudguards appeared in the Early Yayoi period (sixth to fourth centuries, B.C.), decreased in number in the Kofun period, and dwindled in number in the Ancient period (seventh to tenth centuries, A.D.).[4] No examples from the Medieval period

[4]The plank-shaped examples excavated from the Sena, Ikegaya, and Takemi sites in Shizuoka prefecture and dating to the Heian to Kamakura periods, reported to be "mudguards," could fill in the gap in time between the Kofun and later periods. However, given that the areas of their discovery are very limited and that hoes are few compared with the number of other unearthed artifacts, some researchers assume those plank-shaped examples were not mudguards but had other functions.

were unearthed or appeared even in old records or pictures. Later, the *Hyakushō denki* [A Farmer's Handbook] (Anonymous 1681-84), said to have been written in the seventeenth century, contains a passage saying "The *kuwakasa* [hoe cover] is made by weaving bamboo strips and inserting it onto the handle and secured." The description of this device is almost the same as that of the *teidei* ("mud stopper") in the aforementioned agricultural book *Kōka shunjū* (Tsuchiya 1707), suggesting that mudguards were used in farming in the beginning of the Early Modern period. In short, the mudguards that were very widely used in the Yayoi period, declined in the Kofun and Ancient periods, temporarily disappeared in the Medieval period, and reappeared in the Early-modern period. It is also suggested that sometime in the meantime, the material used changed from wood to bamboo.

If Yayoi and Kofun mudguards had the same functions as those of *teidei* mud stoppers used by Early-modern farmers, and their existence continued into modern times, there must have been reasons for their increase and decrease, their disappearance and reappearance. We also need to check into regional differences in the frequency of their discovery. It is necessary, too, to explain why Yayoi and Kofun mudguards were not woven of bamboo strips or vine but made by carefully shaped wood. Techniques of using vine plants had been available since the Jōmon period, and using those techniques would have made it possible to make far simpler and effective mudguards than using wood. Using wood would have required immersion in water, shaping, and drying, and those processes repeated over and over.

This article reconsiders the mounting methods and functions of mudguards and presents a new perspective on this topic. I will first classify mudguards and wide hoes, present a comprehensive grasp of excavated examples, and organize them by period and region. I will then specifically examine mudguard mounting methods and how mudguards were used. By so doing, I hope to show the possibility that their functions were different from those of the farming tools used in later periods.

I. Classification of Wide Hoes and Mudguards

To get a grasp of overall trends in excavated wide hoes and mudguards, I first classify hoes and mudguards according to the characteristics of their shapes (Figure 4).

In the *Mokki shūsei zuroku* [Compendium of Wooden Artifacts] (Uehara 1993b; hereafter *Mokki* compendium), wide hoes unearthed in the Kinki region are classified into seven types by shape (wide hoe type I to type VII) and mudguards into four types according to mounting device type (mudguard type I to type IV). It is difficult, however, to apply this classification to all examples excavated from across the country. For that reason, in recent years, hoes with regional characteristics are often described using the name of region plus "-type" (Higami 2008, etc.). This article follows this trend and sets up four regional types—

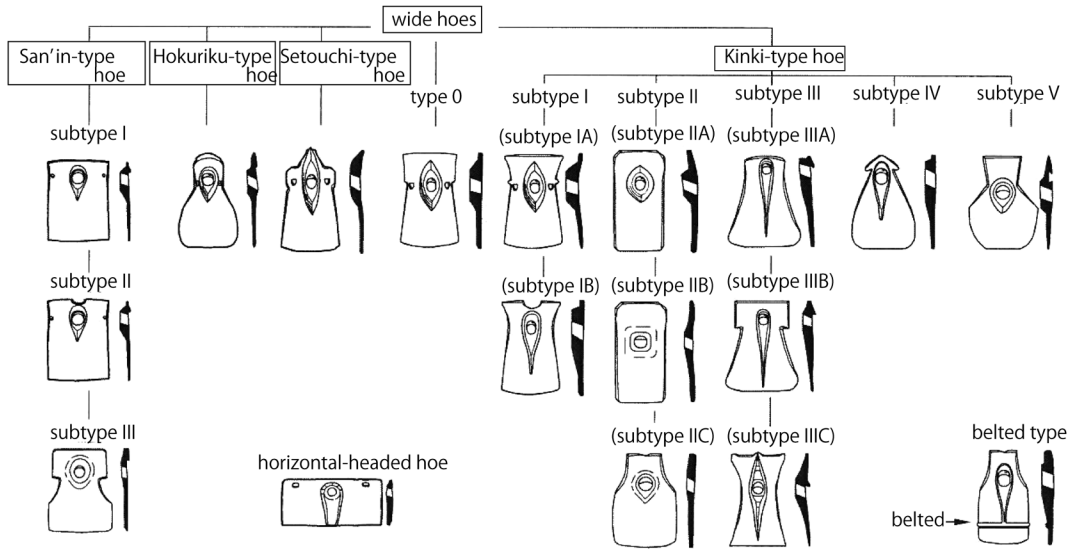


Figure 4. Subdivisions of Wide Hoes

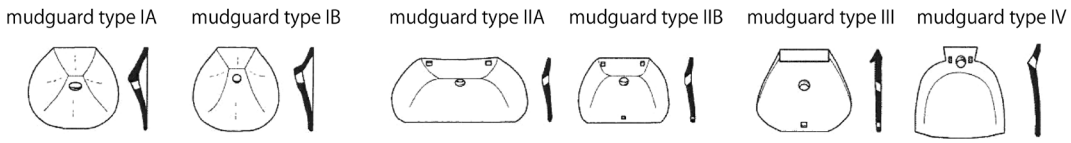


Figure 5. Subdivision of Mudguards

San'in, Setouchi (San'yō and Shikoku), Hokuriku, and Kinki. But, as in the case of other artifacts, hoes could be moved from one place to another, so San'in-type hoes, for example, may be unearthed in the Hokuriku region and San'in-type and Kinki-type hoes may have coexisted in either of those regions.

Then each type of hoe is further divided. The San'in-type hoe is divided by shape into subtypes I to III (to be discussed later). The Kinki-type hoe has five subtypes, I to V, following the *Mokki* compendium. That is to say, the *Mokki* compendium "wide hoe type I" corresponds to "Kinki-type hoe subtype I" here, the *Mokki* compendium "wide hoe type II" corresponds to "Kinki-type hoe subtype II," and so on. But, in this article, which focuses on how the mudguard is mounted on a hoe, the dovetail-grooved "wide hoes V to VII" in the *Mokki* compendium fall under "Kinki-type hoe subtype V." In addition, types I, II, and III of Kinki-type hoes are divided further according to their cross-sectional and planar shapes (to be discussed later).

Some of the examples that have fallen under the category of "wide hoe type I" are treated

as "wide hoe type 0" here.[5] Many examples of wide hoe type 0 have been excavated in the Kinki region, but their first appearance most likely occurred along the Seto Inland Sea coast (Kurosu 2015). They are the archetype of wide hoes, and so in this article, I describe them as "wide hoe type 0" without adding the name of any specific region. As for mudguards, the *Mokki* compendium "type I" and "type II" are each further divided in two, for a total of six types, including "type III" and "type IV" (Figure 5).

(1) Classification of hoes

San'in-type hoes (subtypes I, II, and III)

These are Early Yayoi wide hoes excavated mainly in Shimane prefecture. A marked feature is that there is clearly a ridge on the front surface of the hoe head (facing the user). Hoe heads with an indentation in the middle of the upper edge and those without it are already known, respectively, as "concave-head type" and "round-head type" (Nakagawa 2002, Higami 2010), but in this article the former are referred to as "San'in-type hoe subtype II" and the latter as "subtype I." Both have an inverted-drop-shape high bulge with a handle hole, as well as small rectangular or circular holes gouged on the right and left edges. Middle Yayoi (third to first centuries, B.C.) hoes excavated mainly in Tottori prefecture that have indentations on both sides and a low bulge at the handle hole are here called "San'in-type hoe subtype III." For all these San'in-type hoes, the upper part of mudguard was inserted in below the ridge on the front surface of the hoe head (facing the user) and then the mudguard was bound tightly with a cord utilizing the small holes or indentations on the right and left edges of the head, or the indentation in the middle of the upper edge.

San'in-type hoes spread to the San'yō and Hokuriku regions from the end of the Early Yayoi period to the early Middle Yayoi period (fourth to third centuries, B.C.). In Okayama prefecture, hoes with a blade made of non-wood material appeared in the second half of the Middle Yayoi period (late second and first centuries, B.C.). In San'in, Setouchi, and Kyūshū regions, such excavated examples include those that date from the Early Kofun period (late third and fourth centuries, A.D.). As of today, direct spread to the Kinki region has not been confirmed, but it is highly likely that San'in-type hoes had an influence on those used in the Kinki region.

Hokuriku-type hoes

These hoes derive from the San'in-type hoes that had spread to the Hokuriku region. Some have a round, wavy, or peaked head, and some have protruding shoulders (Ishikawa 2008).

[5]These hoes were referred to as "Kinki-type hoe subtype I0" in my study Kurosu 2015. Based on suggestions I received in writing this article, I refer to them as "wide hoe type 0" here.

All have a round or square-shaped hole on the right and left sides of the handle hole, and the mudguard was secured either by driving in a wedge or tying with bark.

These hoes were used widely in Hokuriku from the end of the Middle Yayoi to the Late Yayoi period (first century, B.C. to early third century, A.D.), spreading to San'in, Kinki, southern Kantō, and Tōhoku regions. In the Yōkaichi-jikata site in Ishikawa prefecture (Shimohama *et al.* 2013), among excavated examples from the early Middle Yayoi period (third century, B.C.) was a hoe that has not only the shape of Kinki-type hoe subtype IV but also a wedge driven in.

Setouchi-type hoe

I newly defined this type (Kurosu 2015). It is characterized by a head with a protruding upper end with a handle-hole bulge that is oval or spindle-shaped. Examples of this type, dating from the new phase of the Early Yayoi to Middle Yayoi periods (fourth to first centuries, B.C.), were unearthed in San'yō and Shikoku. There are no examples that show the direct introduction of hoes of this type to the Kinki region, but hoes with a protruding upper end (Kinki-type hoe subtype IIIC) were discovered at the Ebisuchō and Shinpō sites in Hyōgo prefecture (Yamamoto and Chigusa 1989).

Wide hoe type 0 and Kinki-type hoe subtypes I, II, III, IV, and V

In the *Mokki* compendium, wide hoes with a gentle constriction at the upper part of the head are grouped under the category of "wide hoe type I." In this article they are divided into three categories, "wide hoe type 0," "Kinki-type hoe subtype IA," and "Kinki-type hoe subtype IB."

Many examples of wide hoe type 0 were excavated in the Kinki region, but their first appearance was in the area along the coast of the Seto Inland Sea, as mentioned earlier. They have a boat- or drop-shaped handle-hole bulge, often with a ridge or a small projection on each side of the area. Some do not have a triangular hole on either side of the handle hole. The hoe head is not curved in cross section, which makes the type 0 distinctly different from the Kinki-type hoe subtype IA. The earliest example as of today is one unearthed at the Yamagoe site, Ehime prefecture (Miyazaki 1993), which dates from the first half of the middle phase of the Early Yayoi period (early fifth century, B.C.). Later, hoes of this type spread from the Inland Sea coast to various parts of the Kinki region.

Both Kinki-type hoe subtypes IA and IB originate from wide hoe type 0. Subtype IA hoes often have a triangular hole on either side of the handle-hole bulge and a ridge, projection, or shallow indentation on the sides of the head. The handle-hole bulge is boat-shaped. This type closely resembles wide hoe type 0 in shape, except that the head is curved in cross section. Kinki-type hoe subtype IB, on the other hand, is not curved in cross section. It has indentations in the middle of the upper edge of the head, making the upper right and left

corners conspicuous. The handle-hole bulge tends to be an introverted drop shape extending long downward. Subtype IA appeared along the coast of Osaka Bay in the second half of the middle phase of the Early Yayoi period (late fifth century, B.C.) and spread from the Settsu (present northern Osaka and southwestern Hyōgo prefectures), Yamashiro (present southern Kyoto prefecture), and Ōmi (present Shiga prefecture) areas to the Tōkai region (present Aichi and Shizuoka prefecture). It is found until the second half of the Middle Yayoi period (late second and first centuries, B.C.). In the coastal area of Osaka Bay, however, both types IA and IB disappeared at the beginning of the Middle Yayoi period (early third century, B.C.), followed by the spread of Kinki-type hoe subtypes III and IV.

Kinki-type hoe subtype II refers to a general category of hoes that have a vertically long rectangular shape or similar shapes. In the *Mokki* compendium, hoes with a somewhat wide head are referred to as "wide hoe type II" and those with a head narrow in width as "narrow hoe type II," but the lines that divide them are indistinct. In this study, Kinki-type subtype II hoes are divided into three: subtype IIA (with a rectangular head and handle-hole bulge), subtype IIB (without a bulge), and subtype IIC (with a wide head that narrows toward the base). Basically, hoe subtype II had no device for mounting a mudguard, and so they were probably used as *uchiguwa* ("chopping hoe"), i.e., to break up clods of soil. It is most likely that the wide-headed subtype IIC also had the function of *hikiguwa* ("pull hoe"), a hoe for drawing soil toward the user.

Kiniki-type subtype IIC has a trapezoidal, triangular, or convex head; hoes of this type do not have a protruding handle-hole bulge and are more or less flat in cross section. Dating from the end of Late Yayoi to Early Kofun periods, they were discovered not only in various parts of the Kinki region including Yamato (present Nara prefecture), Yamashiro, Ōmi, and northern Kawachi (northern half of eastern Osaka prefecture), but also in the Tōkai region. Partly because they had no device for mounting a mudguard and partly because no mudguards were unearthed from the sites where they were discovered, we can presume that Kinki-type subtype IIC hoes were used as they were, without mudguards.

Kinki-type hoe subtype III is a group of hoes with a ridge on the front surface of the head (facing the user). Here, hoes with a trapezoidal head are called subtype IIIA and hoes with indentations on the sides, subtype IIIB. These two subtypes have a very long drop-shaped handle-hole bulge. Apart from these, all the hoes with a long, vertical-spindle-shaped bulge are called Kinki-type hoe subtype IIIC. While the *Mokki* compendium treats all the hoes with a trapezoidal head as type III, in this article all the hoes with a ridge on the front surface of the head come under the category of subtype III, irrespective of shape.

A mudguard is thought to have been inserted and attached under the ridge on the head surface. The notches and projections on the sides of the head were probably for the purpose of more firmly securing the mudguard using a cord. The ridge was intentionally made at the stage of shaping the head. Heads with this ridge date to the beginning of the Middle Yayoi

period, and are excavated in Izumi (southern Osaka prefecture) and Settsu. They later are found to have spread to Yamashiro and Ōmi, and the Hokuriku region, but had disappeared by the second half of the Middle Yayoi period.

Kinki-type hoe subtype IV has a nearly triangular head with projections on each side at the top. It is flat in cross-section, and, with no curve or ridge on the front, it is thought that the mudguard was tied to the head with a cord bound around the projections. Hoes of this type appeared in the present-day central Kawachi area in eastern Osaka prefecture at the beginning of the Middle Yayoi period and spread widely east and west. In the Kinki and Setouchi regions their excavated examples date back to no later than the second half of the Middle Yayoi period and in the Tōkai, Hokuriku, and Kantō regions no later than the Late Yayoi–Initial Kofun periods (third century, A.D.). However, mudguards that seem to match this type of hoe were rarely excavated from the Tōkai region eastward.

Kinki-type subtype V hoes have a dovetail-groove in the front side of head. In the *Mokki* compendium, hoes of this type are divided into V, VI, and VII types by shape, but this categorization is essentially meaningless because when the head was reworked its shape could be changed. These hoes fall under the same subtype in this article, which focuses on mudguard mounting. The mudguard with a dovetail tenon of the same length as the dovetail groove (mudguard type III) can be mounted on the hoe by inserting the tenon into the mortise from the side. It was in the coastal area of the Osaka Bay that hoes of subtype V began appearing in the second half of the Middle Yayoi period and became popular in the Late Yayoi period. Later they, along with mudguard type III, spread to the Hokuriku and Tōkai regions, where they were in wide use. Excavated examples go back to no later than the Early Kofun period.

Horizontal-headed hoe

The horizontal-headed hoe has two types: "flat hoe" (*hiraguwa*) with a flat blade and the "fork hoe" (*mataguwa*) that has an edge with short prongs. The latter is also called *eburi* and *sarae*. The *mataguwa* appeared very early, the earliest example dating to the Final Jōmon period, excavated at the Nabatake site in Saga prefecture. From the northern part of Kyushu, fork hoes spread to San'in, Setouchi, Hokuriku, and Tōkai as well as the Chūbu Highlands. But, the use of mudguards is limited to hoes made from the Late Yayoi period to the Middle Kofun period. A mudguard was secured by cord or bark binding using two square holes near the upper edge of the hoe head.

Belted type

Hoes are also found with a ridge-like belt protruding horizontally on the lower portion of the head. These heads vary in shape or surface. Some hoes with a square-shaped and belted head are included in Kinki-type hoe subtype II, while others, which have a belted head with

a dovetail groove fall under Kinki-type hoe subtype V. The belted type does not fit with our classification that focuses on mudguard mounting devices and therefore cannot be treated as an independent type.

It is presumed that the protruding belt was made so that a blade of non-wood material would be installed onto the wooden head. The earliest example of this type was from the Middle Yayoi period, found in the San'yō region, and examples dating to the Late Yayoi period were unearthed in Shikoku and in Kawachi, Izumi, and Yamato in the Kinki region. Given the historical context, the blades installed were most likely metal, rather than stone. They were probably a flat iron blade with the right and left edges indented. An example excavated at the Kabe/Kawata site in Kagawa prefecture in Shikoku (see Figure 6-30; Mori 1997) suggests a flat iron blade smaller than the wooden hoe head was attached to the end.

(2) Classification of mudguards

Mudguard type I (type IA and IB)

The *Mokki* compendium categorizes lampshade-shaped mudguards in general as mudguard type I. But here, they are further divided into type IA and type IB: the former have a bulge at the center and a handle hole either at the top of or somewhat below the bulge, while the latter have a bulge and handle hole in the upper half.

Type IA shape is an irregular circle; part of the top side is a straight line. With the central portion carved out, this type is sharply bent in cross section. Type IB, too, is an irregular circle but the carved-out depression is somewhat shallower and the bend of the hoe-side face is not as sharp as type IA. Both types IA and IB were widely used in western Japan and their excavated examples date back to the second half of the Early Yayoi period to the Middle Yayoi period. In the Kinki region mudguards were often made of camphor, zelkova, or mulberry wood, the same material as used for carved-out containers.

Mudguard type II (type IIA and IIB)

Horizontally rectangular mudguards with rounded corners and two holes near the upper edge are categorized as mudguard type II in the *Mokki* compendium, which assumes that this type was mounted on a horizontal hoe. In this study, these mudguards are further divided into types IIA and IIB. Type IIA are horizontally rectangular mudguards while type IIB are nearly circular mudguards. The latter is mounted on a wide hoe.

Examples of type IIA were excavated in the area from Kyūshū to Tōkai from the Late Yayoi–Early Kofun periods and those of type IIB in the Setouchi region from the Middle Yayoi period. Type IIB may have a small hole at the center of the lower edge. Type II mudguards, like type I, were made of camphor or zelkova.

Mudguard type III

This is a group of mudguards with a dovetail tenon on the top edge. Their shape is an irregular circle swelling outward toward the bottom. The handle hole is made somewhat above the center. They are flat except for the dovetail tenon area. In many cases there is a small hole near a bottom edge. Basically the mudguards of this type, none of which are horizontally long, are mounted on Kinki-type subtype V hoes. They were often excavated in a state attached to a Kinki-type subtype V hoe. The dovetail tenon is carved at an angle, suggesting that the mudguard was made from a relatively thick board, which in turn was carved flat and thin along the bottom portion. Mudguards of this type were found in regions where Kinki-type subtype V hoes were excavated. They were often made of wood of Amur cork tree (*kihada*) or of Japanese evergreen oak (*akagashi*).

Mudguard type IV

Type IV has a characteristic form with its top portion made in a narrow, rectangular shape. The handle hole is in the middle of the uppermost part, with a small hole on either side. Mudguards of this type were mounted mainly on Hokuriku-type wide hoes, secured by driving a wedge into each small hole. They are almost flat, except that they are bent around the base of the bulge. Some have a gentle depression near the middle. In the Hokuriku region, many examples were made using the node of *kunugi* oak. Excavation of mudguard type IV examples is concentrated in and around the region, and so it is thought that they were made specially to match Hokuriku-type hoes. There are some cases in which they were unearthed in a state attached to a hoe, as in the case of mudguard Type III.

II. Excavated Examples of Wide Hoes and Mudguards

This section presents excavated examples of wide hoes and mudguards by region, with special attention given to their combinations (Figures 6–8).

San'in region (Figure 6)

Here we focus mainly on the eastern part of Shimane prefecture and the Japan Sea coast area of Tottori prefecture, where examples have been excavated in large quantities. While the San'in region maintained relations with the neighboring northern Kyūshū and San'yō regions, development of wide hoes and mudguards in the region was quite independent. The "San'in-type hoes" of this region were continually used from the Early Yayoi period to the Early Kofun period.

Examples from the Early Yayoi period, which were found in the Nishikawatsu and Tatechō sites in Shimane prefecture (Nakagawa 2006), are San'in-type subtype I (1; numbers from here on correspond to those given in Figure 6), San'in-type subtype II (2), mudguard type

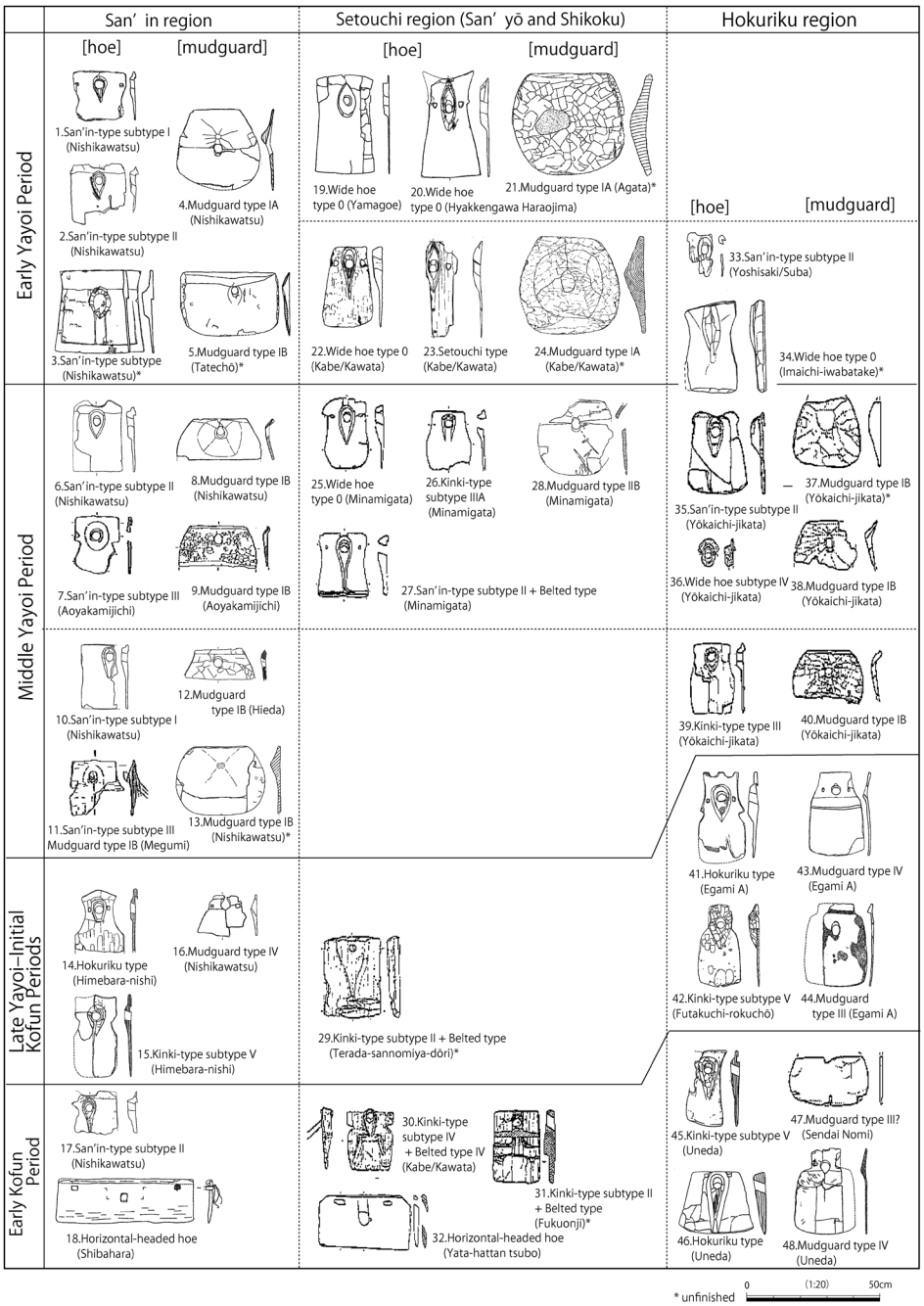


Figure 6. Excavated Examples of Wide Hoes and Mudguards by Region (1)
Note: Site name in parentheses

IA (4), and mudguard type IB (5). No. 5 has a wide upper edge, suggesting that mudguards of this type might have been mounted on a horizontal-headed hoe.

In the Middle Yayoi period, San'in-type subtype II hoes became predominant over San'in-type subtype I hoes while type IA mudguards disappeared and only type IB mudguards were in use. This indicates a high probability that San'in-type subtype I hoes were combined with type IA mudguards and San'in-type subtype II hoes with type IB mudguards.

In the middle of the Middle Yayoi period San'in-type subtype III hoes (7) appeared, mainly around present-day Tottori prefecture. An example of the San'in-type subtype III hoe with an example of the type IB mudguard attached to it was found at the prefecture's Megumi site (11; Nakagawa 2006).

In the Late Yayoi period, hoes of Hokuriku type (14) and Kinki-type type V (15) made their way to the San'in region. The former were probably brought over from the Hokuriku region via the Japan Sea route and the latter by way of the San'yō region. Examples of mudguard type IV, a mudguard type matched to Hokuriku-type hoes, were excavated at the Nishikawatsu site, but no excavation of mudguard type III, which matches Kinki-type hoes, has yet been confirmed in San'in.

Wide hoes from the Early Kofun period decreased. From the Middle Kofun onward, only horizontal-headed hoes with a type IIA mudguard have been discovered (18).

Setouchi (San'yō and Shikoku) region (Figure 6)

This section focuses mainly on Okayama prefecture (San'yō region) on the one hand and Ehime and Kagawa prefectures (in northern Shikoku) on the other. They face each other across the Seto Inland Sea. The San'yō region was subject to the influence of contiguous regions whereas developments on Shikoku Island took place rather more independently.

At the Yamagoe site in Shikoku's Ehime (Miyazaki 1993), an example of wide hoe type 0, dating to the first half of the middle phase of the Early Yayoi period, was unearthed (19). Excavations at the neighboring Agata site (Manabe *et al.* 2000) show examples with an oval bulge and a triangular hole were in common use. Changes in the form of wide hoe type 0, such as with projecting right and left corners on the upper end of the head, are observed in examples found at the Hyakkengawa Haraojima site in Okayama prefecture (20; Yanase *et al.* 1996, Kojima *et al.* 2004). Meanwhile, the mudguards used were only those of type IA.

In the new phase of the Early Yayoi period, Setouchi-type hoes came into being in Shikoku (23), a different development from the San'yō region, where "wide hoe type 0" continued to be used at that time. As for mudguards, on the other hand, mudguard type IA was still in use in both Shikoku and San'yō as in the previous phase of the period.

Abundant examples from the subsequent Middle Yayoi period were excavated at the Minamigata site in Okayama prefecture (Ōgizaki 2005). Added to the wide hoe type 0 example from the previous time (25) were a Kinki-type subtype IIIA hoe with a ridge (26)

and a San'in-type subtype II hoe with a protruding belt on the blade edge (27). The hoe with the protruding belt (belted type hoe) is the oldest example of this type as of now.

It is mudguard type IIB that is thought to have been combined with these wide hoes (28). Mudguards of this type have small holes in the upper corners, indicating that they were mounted on the hoe by cord binding.

From the second half of the Middle Yayoi period onward, these hoes are rarely found in San'yō or Shikoku. Kinki-type subtype II hoes (belted type) were found at Shikoku sites of the Late Yayoi to Early Kofun periods (29, 39). There is also a report on the discovery of a Kinki-type subtype IV hoe (belted type) from the Kabe/Kawata site in Kagawa (30; Ōkubo and Morishita 2000), but the area where a blade of non-wood material was attached is narrow in width, making it difficult to judge whether or not this hoe functioned as a wide hoe. It is not clear if a mudguard was used for these three examples.

Horizontal-headed hoes produced up to and including the Kofun period were excavated with mudguard type IIA attached to them (32).

Hokuriku region (Figure 6)

This section discusses examples excavated in the Hokuriku region—the Japan Sea coastal areas that are now Fukui, Ishikawa, and Toyama prefectures. The Hokuriku region was influenced by San'in from early on, and based on that influence, Hokuriku-type hoes came into being. There are also traces of information having been received from other regions as well.

The oldest wide hoe in Hokuriku is San'in-type subtype II hoe. It was unearthed at Ishikawa prefecture's Yoshisaki/Suba site (Shizuoka Prefecture Research Institute for Buried Cultural Properties 1994), which dates from the end of the Early Yayoi period to the beginning of the Middle Yayoi period (33). Meanwhile, the Imaichi-iwabatake site in Fukui prefecture (Shizuoka Prefecture Research Institute for Buried Cultural Properties 1994) yielded an unfinished example of wide hoe type 0 (34). It is considered to date to the beginning of the Middle Yayoi period, but artifacts unearthed from the same site suggest the possibility that it might go back further to the end of the Early Yayoi period. It is estimated that the former (33) was introduced from the San'in region while the latter (34) originated in Setouchi, from there spreading to Settsu and then to Ōmi before reaching Hokuriku. Mudguards that might have been attached to these hoes have not yet been confirmed.

Examples from the first half of the Middle Yayoi period were found at the Yōkaichi-jikata site in Ishikawa prefecture (Shimohama *et al.* 2013), including those of Kinki-type subtypes III and IV hoes and type IB mudguards, suggesting an affinity with the Kinki region. But, given that San'in-type subtype II hoes were used at the same time (35), Hokuriku likely had a close relationship with the San'in region as well. The use of wedges, which would continue thereafter, has been confirmed (36).

Toward the end of the Middle Yayoi period to the Late Yayoi period, Hokuriku-type hoes and their matching mudguard type IV were in wide use (41, 43) and spread to the San'in and Kinki regions. On the other hand, Kinki-type subtype IV hoes and type III mudguards were brought in from the Kinki region (42, 44). Both Kinki- and Hokuriku-type hoes were excavated at the Uneda site, Ishikawa prefecture (Shizuoka Prefecture Research Institute for Buried Cultural Properties 1994), which dates to the Early Kofun period (45, 46). This provides a glimpse of the situation at that time in which diverse hoes were used along with mudguards in Hokuriku. That situation continued until the Middle Kofun period.

Kinki region (Osaka Bay coastal area) (Figure 7)

The Kinki region is divided here into two parts: the area facing the Osaka Bay (the old provinces of Kii [present Wakayama prefecture], Izumi, Kawachi, and Settsu) and the area eastward from there (old provinces of southern Yamashiro, Ōmi, Yamato, and part of Ise [present Mie prefecture]).

On the northern coast of Osaka Bay was western Settsu and on the eastern coast were Kawachi and Izumi. The Bay was connected on the west to the Seto Inland Sea beyond the island of Awaji. Sea traffic is thought to have played an important role in bringing the products of Yayoi culture to the Kinki region by way of Osaka Bay. The same can be said of wooden farming tools. Artifacts have been found that suggest the region, especially the Kinokawa river basin and the coast of the Kii Channel, had a broad network of relationships with the Seto Inland Sea area and the Tōkai region (Pacific Ocean coast of Honshū Island).

Kii and Izumi

The Wakayama prefecture Tachino site (Kawasaki and Tanno 2013), which is located at the southern end of the Kii Peninsula, produced wide hoe type 0 and mudguard type IA that go back to the first half of the middle phase of the Early Yayoi period (49, 51). These examples are among the oldest found in the Kinki region, suggesting that information from the part of Shikoku that faces the Seto Inland Sea had reached the southern end of the peninsula earliest in the Kinki region.

From the subsequent new phase of the Early Yayoi period, Kinki-type subtype IA hoes, probably derived from the central Kawachi area hoes, were unearthed at the Katada site, Wakayama prefecture (Kugai 2002), on the western coast of the Kii Peninsula (50).

From the beginning of the Middle Yayoi period, examples of Kinki-type subtype III hoes and IB-type mudguards were found at the Ikegami-Sone site in Osaka prefecture (53, 55; Ono and Okuno 1978), indicating that the two were used as a set.

In Izumi, during the Late Yayoi period to the Initial Kofun period, the Kinki-type subtype V (56) hoes and their matching mudguards were in use. From the Early Kofun period, examples of Kinki-type subtype IIA hoes (belted type) were unearthed at the Shimoda site

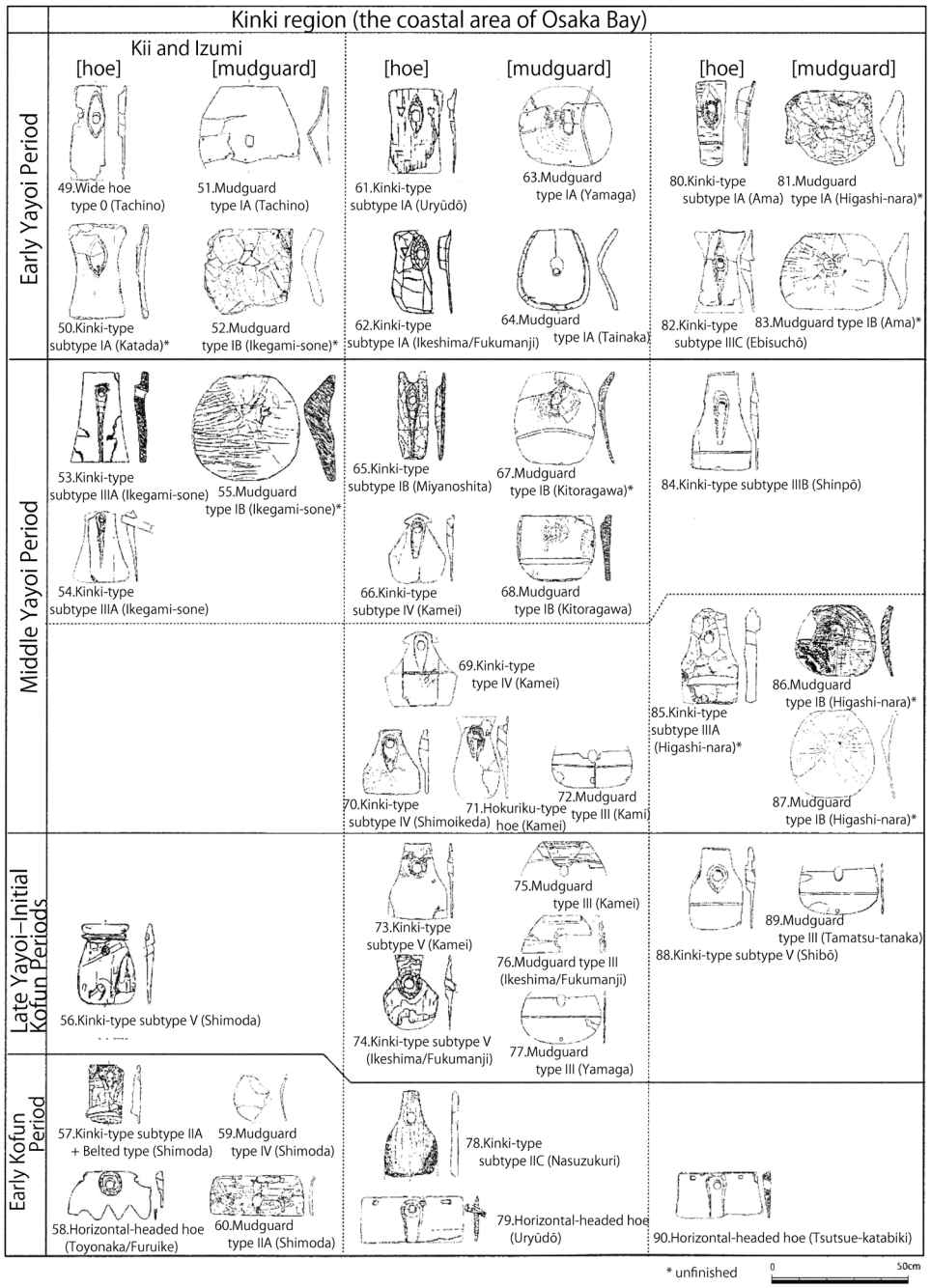


Figure 7. Excavated Examples of Wide Hoes and Mudguards by Region (2)
Note: Site name in parentheses

in Osaka prefecture (57; Nishimura *et al.* 1996). After the Middle Kofun period these wide hoes and mudguards ceased to be in use, and appear to have been replaced by horizontal-headed hoes and their matching mudguard type IIA.

Kawachi

In the Yayoi period the Osaka Plain was isolated from Osaka Bay by the Uemachi Height and the Tenma-sasu sandbar, and in the interior was the body of water called Kawachi Lake. Early settlements in the Early Yayoi period appeared around the wetlands along the shore of the lake.

At the Uryūdō site in Osaka prefecture (Horie and Nakanishi 1980; Akiyama and Kawase 2004) that was located on the southern shore of the Kawachi Lake, Kinki-type subtype IA hoes (61) were unearthed from remains dating from the second half of the middle phase of the Early Yayoi period. Type IA mudguards were found at the neighboring Yamaga site (Nakanishi and Morii 1983; Nishiguchi and Uenishi 1984). Because Kinki-type subtype IA hoes are thought to have derived from the wide hoe type 0 (Kurosu 2015), it was highly likely that information about wide hoe type 0 was transmitted from the Setouchi region to the Kawachi area at least by the middle phase of the period.

In the new phase of the Early Yayoi period the number of settlements doubled and so did the number of excavated wet paddy fields and wide hoes. A report on discoveries at the Ikeshima-Fukumanji site in Osaka prefecture (Inoue and Hata 2002; Hirose *et al.* 2007)—located at a higher elevation than the Uryūdō group of sites—includes mention of a Kinki-type subtype IA hoe with a pressure mark that seems to be a trace of a mudguard having been attached to the front of hoe head (62). At the Kinomoto site, Osaka prefecture (*Mokki* compendium), located to the south, Kinki-type subtype IA hoes and an unfinished example of a type IA mudguard were unearthed. This indicates that hoes of the same type were used around the same time in separate places.

From the end of the Early Yayoi period to the beginning of the Middle Yayoi period, Kinki-type subtype IB hoes with an indentation in the middle of the upper edge of the head were excavated at the Miyanoshita site (Shimomura and Imomoto 1996) in the eastern coast of the Kawachi Lake and the Takamiya-hatchō site in Osaka prefecture (65; *Mokki* compendium), along with type IB mudguards (67). Since Kinki-type subtype IA hoes and type IA mudguards disappeared almost at the same time, Kinki-type subtype IA hoes can be presumed to have been matched with type IA mudguards and Kinki-type subtype IB hoes were matched with type IB mudguards.

In the Middle Yayoi period, Kinki-type type IV hoes, as found at the Kitoragawa site (Takashima and Hirose 1980; Takashima *et al.* 1983; Nakanishi *et al.* 1984) in the eastern coast of the Kawachi Lake, appeared and spread widely (66, 69). Since an unfinished example of a type IB mudguard was also unearthed at the Kitoragawa site (68; Imomoto

1987a, 1987b, Ueno and Saibara 1987; Shimomura and Saibara 1988), type IB mudguards can be presumed to have been attached to Kinki-type subtype IV hoes as well as to Kinki-type subtype IB hoes. The Shimoikeda site, Osaka prefecture (Kondō 1983), which goes back to the second half of the Middle Yayoi period, yielded a trapezoidal wide hoe with a mortise groove cut in the front (70). This hoe has a projection on the right and left corners of the upper edge of head, suggesting that it was an example of a Kinki-type subtype IV hoe with a mudguard secured to it with a cord. The idea of cutting a mortise groove on the hoe head surface along the upper edge of the mudguard suggests the subsequent development into the Kinki-type subtype V hoe, which was to be in wide use later. Details of how the dovetail technique was introduced are not yet clear, but it is notable that the new technique was applied to the binding together of the hoe and mudguard in the Kawachi area. Discovery of a good example of a type III mudguard from this period has not yet been confirmed, but a likely example is a mudguard with a small hole on its edge, excavated at the Kami site in Osaka prefecture (72; Tanaka *et al.* 2015).

In addition, an example very similar to the Hokuriku-type hoe was found at the Kamei site (71; Takashima *et al.* 1983). From the same site, an example of the type III mudguard—although from the Late Yayoi period—that has a dovetail tenon and a device for attachment using a wedge was unearthed (75; Nakanishi *et al.* 1984). This indicates that information about Hokuriku-type hoes had already reached the Kawachi area by that time.

The use of Kinki-type subtype V hoes and type III mudguards reached its peak in the Late Yayoi period to the Initial Kofun period, as attested by the large number of examples discovered (73, 74, 76, 77). They ceased to be used by the Early Kofun period, however, and the only wide hoes in use were the Kinki-type subtype IIC hoe without a mudguard (78). Discoveries of horizontal-headed hoes and their matching type IIA mudguards increased in number.

Settsu

The Settsu area on the northern coast of the Osaka Bay can be roughly divided into West Settsu (present-day southeastern Hyōgo prefecture) and East Settsu (present-day northern Osaka prefecture). West Settsu was under the strong influence of the Setouchi region while East Settsu under a strong influence of Kawachi. Hoes were introduced earlier in West Settsu, where traces of making hoes were found in Hyōgo prefecture at the Motoyama site (Iwata 1998), which dates to the old phase of the Early Yayoi period. These hoes have a similar form to a *moroteguwa* double-headed hoe (Nakahara 2003), but have no device for mounting a mudguard.

Wide hoes that clearly had a mudguard mounted go back to the first half of the new phase of the Early Yayoi period. In East Settsu, a Kinki-type subtype IA hoe and an unfinished example of type IA mudguard were excavated respectively at the Ama site (Fujisawa *et*

al. 1969) and the Higashi-nara site (Tashiro and Okui 1979; Miki 1998), both in Osaka prefecture (80, 82, 83). Also, though limited in number, Kinki-type subtype IIIC hoes from the second half of the new phase of the Early Yayoi period were unearthed at the Ebisuchō and Shinpō sites in Hyōgo prefecture (81; Yamamoto and Chigusa 1989).

In the Middle Yayoi period, Kinki-type subtype III hoes were introduced to Settsu. At the Shinpō site in Hyōgo, Kinki-type subtype IIIC hoes were replaced by subtype IIIB (84). At the Higashi-nara site in Osaka a Kinki-type subtype III hoe and an unfinished example of a type IB mudguard were unearthed, indicating that they were used as a set in the Settsu area as well (85, 86, 87).

Kinki region (from Yamato eastward) (Figure 8)

In the Yamashiro, Yamato, and Ōmi areas, examples of types made under the strong influence of the Hokuriku region were unearthed along with examples of types introduced by way of Kawachi and Setsu. Along the western coast of the Ise Bay, although very locally, examples were excavated of the type that seems to have spread to this area from Kawachi in the early stage of the Early Yayoi period.

Yamato

Settlements in the Yamato Basin (northern part of present-day Nara prefecture) had close cultural exchange with other areas using the Kizu, Yamato, and Ki-no rivers. The configuration of wooden farming tools used there had high affinities, in particular, with the Ōmi area to the north.

A report from the Karako-Kagi site, Nara prefecture, describes the discovery of examples of wide hoe type 0 with indentations on both sides that date from the new phase of the Early Yayoi period (92; Suenaga *et al.* 1943). Many of the unfinished wide hoes found at this site are of type 0, making Yamato different from the Kawachi area where Kinki-type subtype IA hoes began being frequently used. As of this writing, no discovery of mudguards from that period has been confirmed.

From the Middle Yayoi period, the number of examples of Kinki-type subtype IIIA increased at this Karako-Kagi site. Mudguard type IB were also discovered, and so we can presume that these hoes and mudguards were used as a set (104, 106). An example of a Kinki-type subtype IV hoe unearthed at the Kamotsuba site in Nara prefecture (Fujita *et al.* 1992), has traces of a mudguard having been attached to the front surface of its head, as well as cord-slippage marks on the sides of the head, suggesting that this hoe had a type IB mudguard mounted on it, secured with cords (105).

From the Late Yayoi period, the use of Kinki-type subtype V hoes and type III mudguards as a set spread, as in other areas of the Kinki region (108). A hoe head with a small hole made beside the handle hole bulge was also discovered (109). Kinki-type subtype V hoes

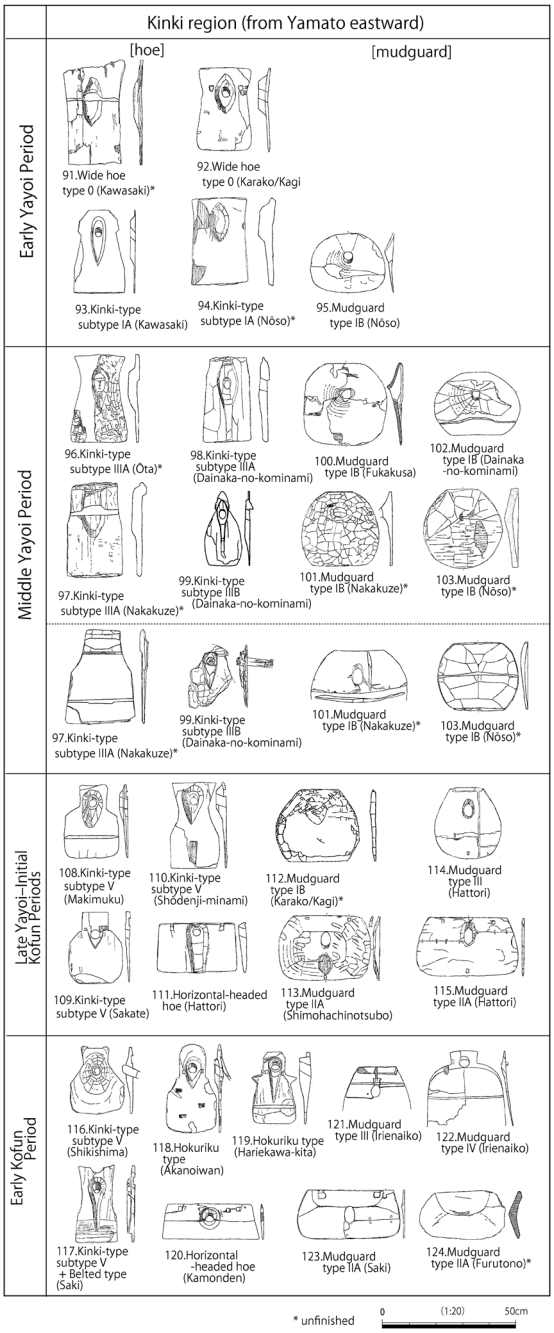


Figure 8. Excavated Examples of Wide Hoes and Mudguards by Region (3)
Note: Site name in parentheses

remained until the Kofun period, and in this regard, too, Yamato hoes were more similar to those of Yamashiro and Ōmi than to those of Kawachi and Settsu. The Kinki-type hoes disappeared around the Middle Kofun period, and after that only horizontal-headed hoes and type-IIA mudguards remained.

Although not shown in Figure 8, in the Yamato Basin, after the Late Yayoi period more examples of Kinki-type subtype IIC hoes without devices for mounting a mudguard, were excavated than those of subtypes III and IV. This indicates the possibility that dry fields that did not need a mudguard were being cultivated.

Ōmi and Yamashiro

Here we focus on sites in the areas surrounding the southern (Konan) and eastern (Kotō) parts of Lake Biwa in Ōmi and the southern Yamashiro area, for many wide hoes have been unearthed in those areas.

From the new phase of the Early Yayoi period, an unfinished example of wide hoe type 0 and an example of Kinki-type subtype IA hoe were excavated at the Kawasaki site, Shiga prefecture (*Mokki* compendium), that is located in the Kotō area (91, 93). Given the types of earthen vessels excavated at their sites, these hoes can be thought to have been adopted about the same time.

From the Middle Yayoi period, hoes of Kinki-type subtypes IIIA and IV and type IB mudguards were widely excavated. A Kinki-type subtype III hoe from the Dainaka-no-kominami site, Shiga prefecture (Kurosaki 1970), has a small indentation and horizontal groove on the upper edge of head along with a ridge, indicating that a mudguard was secured with a cord (99). At the Nakakuze site, Kyoto prefecture, several unfinished mudguards were excavated (101, 107; *Mokki* compendium), and notably, with the passage of time the bulge around the handle hoe grew lower.

In the Late Yayoi period, in addition to the regular use of Kinki-type subtype V hoes and type III mudguards (110, 114), Hokuriku type hoes were introduced. These two types of hoes and mudguards were used in a variety of combinations until the Early Kofun period. This tendency was especially conspicuous in the Ōmi region, which makes us understand that a route extending from Hokuriku to the Konan area via the coast along the Lake Biwa (or via across the Lake) was actively used at that time. The mounting of a mudguard on a Hokuriku-type hoe was secured using a wedge (118) or a cord made of bark (119).

Above we have looked at how excavated wide hoes and mudguards were used in combination by region. What is notable is that by region and period specific types of hoes and mudguards were combined as a set. The *Mokki* compendium considers mudguard type II with two holes to have been combined with horizontal-headed hoes, mudguard type III using dovetail joining to have been combined with Kinki-type subtype V hoes, and type-IV mudguards—frequently used in Hokuriku—to have been combined with Hokuriku-type

hoes. This inevitably means that all other hoes, that is, wide hoe type 0 and Kinki-type subtypes I, III, and IV hoes were paired with mudguard type I. A closer look at excavation areas, periods, and conditions, however, shows that wide hoe type 0 and Kinki-type subtype IA hoes were paired with mudguard type IA and Kinki-type subtypes IB, III, and IV hoes with mudguard type IB.

III. Mounting of Mudguard onto Wide Hoe

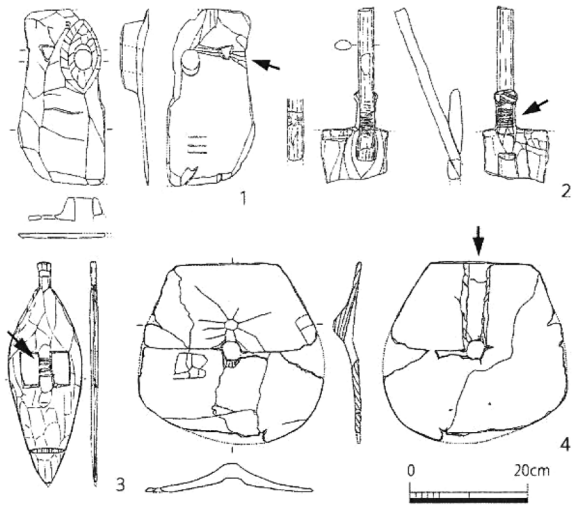
Let us now look at how a mudguard was mounted onto a wide hoe.

To show the ways of attaching a mudguard to a hoe, Kurosaki Tadashi (1988) recreated a number of types as shown in Figure 3 (2), (3), (5), and (6). To these, Uehara Mahito (1993a) added (1) and (4). The most notable of these is (1). Uehara surmises that a mudguard was attached to the wide hoe type 0 and the Kinki-type subtype IA hoe not only by tying a cord from the sides of the head, such as shown in (1), Figure 3. He also suggests that a cord or a rod was attached to a projection or ridge on the hoe head, or to triangular holes on the right and left sides of handle hole bulge, so as to form a ridge on the front surface of the head, as found on Kinki-type subtype III hoe (*Mokki* compendium). Meanwhile, Nakahara Kei (2003) assumes that the curve in cross section of the Kinki-type subtype IA hoe functioned to protect against splashing of mud, and that the projections and triangular holes played auxiliary roles in that function.

Uehara's theory can explain the meaning of the projections and triangular holes, but we are left with the question why it was necessary to take the trouble to use a cord or rod to form a ridge when it would have been easier to create a ridge by carving the wood. Nakahara's theory cannot explain how a mudguard was attached to a type 0 wide hoe and a Kinki-type subtype IB hoe, neither of which is curved in cross section. Part of the reason behind his argument is that wide hoe type 0 items have no traces on the surface of their heads of the use of a cord, such as cord-slippage marks. In the recent years, however, reports have been published about examples of wide hoe type 0 items and mudguards from the Early Yayoi period that have traces of mudguard mounting.

Figure 9-1 shows a Kinki-type subtype IA hoe unearthed at the Ikeshima-Fukumanji site in Osaka prefecture (Hirose *et al.* 2007). About a quarter of the hoe head is missing, but we can observe the triangular hole beside the handle hole bulge as well as a low ridge on the side of head. A pressure mark extends from above the handle hole to the triangular hole and around beneath the ridge on the side. This suggests that a mudguard was attached with cords running where the marks remain. Traces of cord-slippage are also observable on the lower portion of the ridge, suggesting a cord was tied about the same level as the upper edge of a mudguard.

Binding with cords was a method employed widely in the Jōmon and Yayoi periods



1. and 2. Ikeshima/Fukumanji site, Osaka prefecture (the new phase of Early Yayoi period);
3. Kitoragawa site, Osaka prefecture (the beginning of Middle Yayoi period);
4. Nishikawatsu site, Shimane prefecture (Early Yayoi period)

Note: Arrow marks indicate traces of using a mudguar

Figure 9. Hoes with Traces of Mounting

(Figure 9-2 and -3). The cord used was often made of grass or vines. The frequent use of cords for securing something to a spade, a tool that required great force when used, suggests that the material of the cord was very strong. It is usually understood that the methods most often employed for joining wooden objects in the Yayoi period was either by making a hole into which a separate part was inserted or by constructing a tenon and mortise joint. But, the cord-binding method from the previous era still had an important role to play.

An example of a mudguard with clear traces of cord binding was excavated at the Tachino site in Wakayama prefecture (Figure 10-3; Kawasaki and Tan'no 2013). This mudguard (type IA) has several depressions—which seem to have been caused by the rubbing of a cord—on the right and left sides of the upper edge. They are 8 to 10 centimeters apart, and all extend toward the handle hole. In the middle of the upper edge of the back side the mudguard also has cord-rubbing and pressure marks, apparently caused by contact with the handle.

Considering these marks and overlapping them with an example of a wide hoe type 0 unearthed at the same site, we can envision the combination of mudguard and hoe shown on the right in Figure 10. Here, the cord passes across the front of the hoe head (1); the two ends are passed to the back of the head—above the projections on the sides of the head—before being passed through the triangular holes from the back of the head (2); and the cord extends as far as the handle, where it is tied (3). (It is possible, conversely, that the starting point is where the cord is tied to the handle; from there the cord passes through the

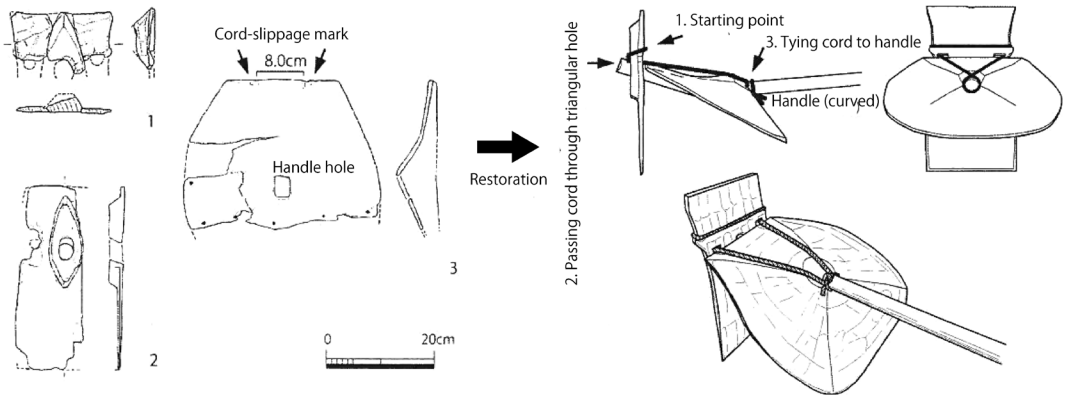


Figure 10. Excavated Mudguard from the Tachino Site and Assumption of How It Was Mounted

triangular hole and then above the projections before it is tied on the front of the head; the order of this restoration is 3→2→1.) That method can explain why hoes have triangular holes and projections on the sides of the head, as well as cord-rubbing marks on the mudguards.

Mudguard type IA was secured with right and left cords on the top surface as well as with the handle on its underside surface. When actually used in this state, the mudguard must have slipped right and left, and that was why, it is thought, several cord-slipping marks remain on the upper edge of the mudguard. Similar marks are found on an example of mudguard type IA excavated at the Nishikawatsu site in Shimane prefecture (Nakagawa 2006). We can presume that supporting the upper half of mudguard type IA using a handle was a common method of mounting.

When mudguard type IA was mounted on wide hoe type 0, however, a straight stick could not be used as a handle; a stick with a curve in the end was needed, as the side view of the reconstructed assembly shows in Figure 10. The hoe and mudguard had to be fashioned using a stick with the end sufficiently curved to make the mounting fit. Considerable technique was needed, too, to adjust the hoe to make it easy to use. The triangular holes found on the wide hoe type 0 and Kinki-type subtype IA hoe were made at the final stage of fashioning the hoe, and that was probably because it was necessary to decide exactly where to make the holes after considering the exact combination of hoe and mudguard.

IV. Specific Aspects of Mudguard Mounting

We have just observed specifically how mudguard type IA was attached to wide hoe type 0, a combination that was previously considered difficult to reproduce. Below we will look at other mounting methods for which reproductions have been made and see how they changed with time.

Changes in mudguard mounting on Kinki-type hoes

Let us first look at the chronological changes in the way mudguards were secured to various types of Kinki-type hoes (Figure 11-1 to 11-4).

In the new phase of the Early Yayoi period, the combination of Kinki-type subtype IA hoe and IA type mudguard (Figure 11-1) was the most common in the Kinki region. Here, let us look at a reproduction of a combination of mudguard and hoe using examples excavated at the Uryūdō (Horie and Nakanishi 1980; Akiyama and Kawase 2004) and Yamaga (Nakanishi and Morii 1983; Nishiguchi and Uenishi 1984) sites located near to each other.

Mounting was done using cords. (For the cord-binding method see the method described earlier for artifacts found at the Tachino site.) The Kinki-type subtype IA hoe has a head curved in cross section that served the purpose of preventing the mudguard from flipping upward. The angle of the handle hole of this hoe is closer to a right angle compared with the wide hoe type 0, whose head is not curved. The curve allowed the use of a straight handle. Generally the greater the angle of the handle hole, the wider the angle at which the blade enters the soil, making the tilling less effective. This problem is solved by curving the upper part of the hoe head as with the Kinki-type subtype IA hoe. Behind the birth of this type of hoe was likely efforts to attach a mudguard to a hoe that had a straight handle and to narrow the angle at which its blade would enter the soil.

Mudguard type IA, on the other hand, was secured to the hoe with its whole upper portion tightly attached to the handle using a cord. This way of mounting created some distance between the hoe blade and the end of the mudguard (about 25 centimeters apart as shown in Figure 11-a). Soil could easily collect in this space. If a mudguard with a handle hole located closer to its upper edge like the type IB mudguard were mounted, the force of that edge flipping upward would be stronger and make the mounting unstable. Therefore, the type IA mudguard had a wide space between its upper edge and the handle hole so that its wide upper portion would be in close contact with the handle of the Kinki-type subtype IA hoe, thus creating an adequate angle and a stable mounting.

The next most common in the Kinki region was a combination of the Kinki-type subtype-III hoe and type IB mudguard (Figure 11-2). No examples that might have been combined were excavated from adjacent sites, and so let us here reproduce the combination using examples in the Settsu and Yamashiro areas discussed earlier. The mounting method used was cord binding using a ridge on the front surface of the hoe head.

Because the distance between the upper edge and the handle hole for the type IB mudguard is short as mentioned earlier, attaching it to a hoe would have made it very unstable. The ridge on the hoe head was meant to prevent the mudguard from flipping upward. To deal with the further impact on the mudguard, a cord was apparently hitched to ridges on the side edges of hoe head.

Since the cord passed over the upper part of the hoe head, the upper half of the handle

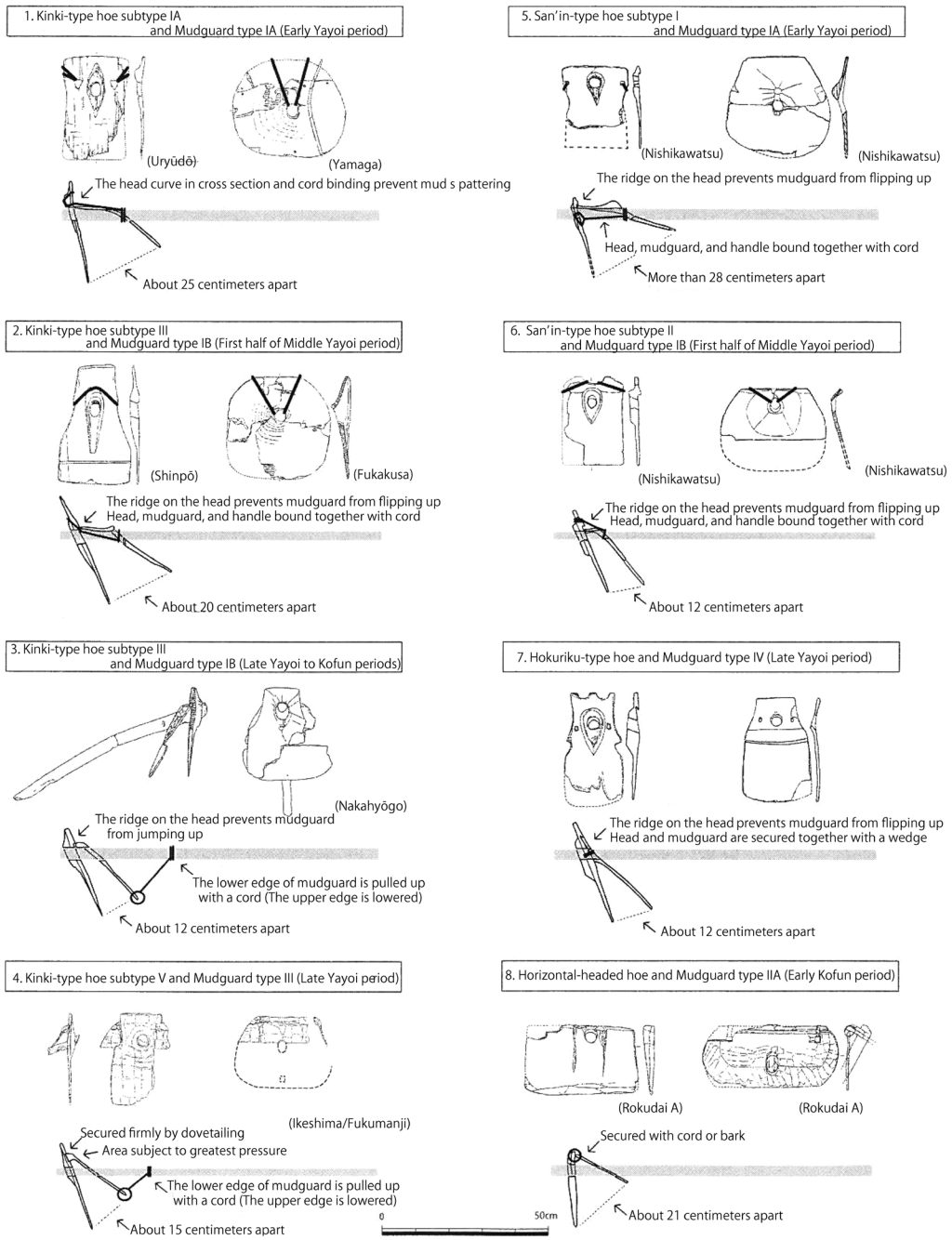


Figure 11. Assumed Ways of Securing Mudguard and Hoe Together
Note: Site name in parentheses

hole bulge, which had previously been boat-shaped was later made round. The lower half of the bulge tended to extend downward to prevent the splitting of the head. These were presumably the reasons for the transition from a boat-shaped bulge to the drop-shaped bulge that widely occurred during this period.

When mudguards began being firmly secured, it became possible to mount them on a hoe at an acute angle. The angle at which the blade touched the soil was also more acute and the distance between hoe blade and mudguard became somewhat closer compared with Figure 11-1 (about 25 centimeters). The distance in Figure 11-2 was around 20 centimeters.

Another example is also a combination of wide type III hoe and type IB mudguard dating to the Late Yayoi period. Figure 11-3 presents a hoe head, mudguard, and handle that were excavated as an assembled set at the Nakahyōgo site in Shiga prefecture (*Mokki* compendium). The hoe head does not have a ridge on its sides and so it cannot be assumed that the assembly was bound with a cord as in the previous example. But it is possible that a cord was passed through the small hole made on the lower end of the mudguard and tied to the handle to pull the edge upward, applying the principle of leverage using the ridge on the head. This prevented the mudguard from flipping upward.

The distance between hoe blade and mudguard in the case of 11-3 was very close compared with II-2, and that is because the shape of the mudguard in cross section became nearly flat. The distance measures 12 centimeters, almost the same as with the combination of the Kinki-type subtype V hoe and the type III mudguard (Figure 11-4) that was also widespread in the Late Yayoi period.

Figure 11-4 is another example of hoe head and handle and mudguard excavated as an assembled set at the Ikeshima-Fukumanji site (Inoue and Hata 2002). Here the hoe (Kinki-type subtype V) and mudguard (type III) were firmly secured by dovetailing. The top portion of the hoe head was made wider than in the previous era, so as to accommodate the dovetailing. The mudguard was nearly board-shaped and a small hole was often made at the lower end. What the function of the small hole was has been unclear, but in this case, it is assumed that a cord was used to tie the mudguard to the handle. This assumption comes from the following consideration.

There are many examples of type III mudguards that show damage (and repair). Most of the damage are narrow breaks extending horizontally from the base of the dovetail tenon or from near the handle hole. Cord binding and the utilization of a ridge were methods employed from earlier; their binding strength was loose but provided some leeway, a merit that helped to disperse the impact on the mudguard itself. When the mudguard was firmly fixed to the hoe head by dovetailing, on the other hand, the impact of strokes of the hoe was not dispersed, and the mudguard had to absorb it. The impact was easily concentrated on the slightly bent tenon area and the area around the handle hole in contact with the handle. An effective way to avoid damage would be to stabilize the lower end of the mudguard in order

to control its swinging. For that purpose, it is presumed, a small hole was made in the lower end to secure the mudguard to the handle with a cord.

The way the type III mudguard was attached to the Kinki-type subtype V hoe can be considered a most advanced form: while the two were tightly secured to each other, the abovementioned device was installed to avoid damage to the mudguard that might have been caused by that firm attachment.

Shape changes in San'in-type hoe and the birth of Hokuriku-type hoe

Next, let us look at San'in-type hoes, which developed in a distinctive way, and explore the meaning of the emergence of Hokuriku-type hoes (Figure 11-5 to -7).

The combination of the San'in-type subtype I hoe and the type IA mudguard (Figure 11-5) decreased during the Early Yayoi period, eventually replaced as a dominant combination by the San'in-type subtype II hoe and the type IB mudguard (Figure 11-6). Given that the hoe head shown in 11-5 lost its lower end below the two small holes on the sides of the handle hole and that the head is sharply constricted below the small holes, we presume that, in addition to attachment to a ridge on the head, a cord was tied to the handle from below the small holes.

In the case of 11-6, a cord was probably first hitched to both sides of the indentation in the middle of the upper edge of the hoe head and was then tied at the handle hole area from the upper part of the mudguard. This way of binding the hoe and mudguard, although there are no clear marks of it, could explain the meaning of the small holes and constrictions on the sides of the hoe head.

What should be noted here is that the distance between the hoe blade and mudguard shortened dramatically during the transition from 11-5 to 11-6, as in the case of Kinki. The distance was more than 28 centimeters for 11-5, but it was only 12 centimeters for 11-6. In the San'in region the 11-6 combination continued to be used in the Late Yayoi period and its wide use did not decline even after the Kinki-type subtype V hoe and Hokuriku-type hoes were introduced. Examples of this combination that date even to the Early Kofun period were excavated. This long continuation of use indicates that the 11-6 combination had a high functionality comparable to the Kinki-type subtype V hoe and Hokuriku-type hoes that had been brought in from outside the region.

As for the combination of Hokuriku-type hoe and type IV mudguard as shown in Figure 11-7, the mounting methods mentioned above were not used but a wedge was driven into the back side of the mudguard to secure it to the hoe head. Without widening their distance the mudguard and the hoe were secured together at an acute angle, only 12 centimeters apart between the hoe blade and the lower edge of the mudguard. By driving in a wedge, moreover, a tighter connection was achieved, as in the case of dovetailing.

As for Hokuriku-type hoes, so many were brought into the San'in region as mentioned

earlier that the previous flow of hoes from San'in to Hokuriku was reversed. It was likely that the forms of Hokuriku-type hoes were accepted as very useful in San'in as elsewhere.

The discussion above can be summed up as follows. Improvements were made to hoes and mudguards to achieve an ideal mounting in three regards: tightly securing the hoe and mudguard to each other; combining them at an acute angle, i.e., shortening the distance between hoe blade and mudguard's lower edge; and preventing breakage of the mudguard. The combinations of Kinki-type subtype V hoe and type III mudguard and of the Hokuriku-type hoe and type IV mudguard, in particular, most likely reached such a high level of perfection that they were welcomed even in the Tōkai region, which had theretofore refused the introduction of mudguards from outside, and in the San'in region, an area that had displayed great originality in hoe-making technology.

A combination that evolved in a completely different way from the above trend was that of the horizontal-headed hoe and the type IIA mudguard (Figure 11-8). The angle at which the mudguard was set to the hoe was 60 degrees and the distance from the hoe blade to the mudguard's lower edge was wide, at 21 centimeters. The handle was set nearly at a right angle to the hoe head and so the angle at which the blade touched the soil was wide, too. Since the mudguard itself was short in height, the way it was installed on this hoe was vastly different from the case of wide hoes. It is therefore difficult to assume that wide hoes and horizontal-headed hoes, although both might be equipped with mudguards, had the same functions.

V. Mudguard Functions Reconsidered

Change in types of wide hoes and mudguards

Based on the observations above, let us reconsider the functions of the mudguard below.

Figure 12 shows farming equipment from the Early Yayoi to Late Kofun periods excavated in the Kawachi area. Among hoes from that time, a mudguard was mounted on wide hoes from the Early to Late Yayoi period and on horizontal-headed hoes from the Late Yayoi to Kofun periods. There were a number of other agricultural tools from that time, including the *saguwa* (narrow-headed hoe) and *mataguwa* ("fork hoe"). A closer look at the composition of types of hoes reveals it underwent great changes during the time from the Late Yayoi to Initial Kofun periods. Kinki-type hoes, which had been the mainstream of agricultural tools until then, disappeared and were replaced by the following four main types of hoes—horizontal-headed hoe, eggplant-shape-headed and curve-handled hoe, Kinki-type subtype VI hoe without a mudguard, and spade.

Uehara Mahito (1993a) estimates that the narrow-headed hoes disappeared after the Middle Yayoi period and that eggplant-shape-headed hoes with a curved handle functioned as a substitute for them. As for wide hoes, he holds that, regardless of whether they had a

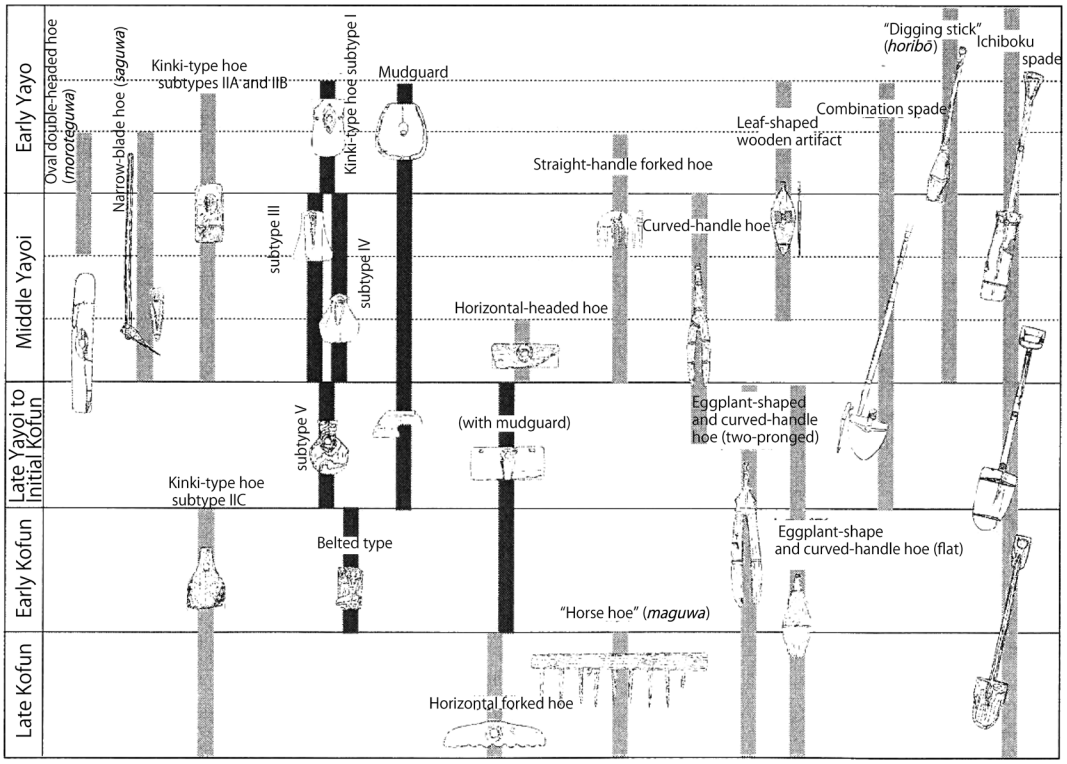


Figure 12. Changes in Farming Equipment in Kawachi Area

mudguard or not, they continued in terms of shape and function until the Middle Kofun period. Regarding horizontal-headed hoes, he focuses on whether they had a mudguard or not and denies their continuity from the Middle to Late Yayoi period.

When we focus on Kinki-type hoes, we can say that the Kinki-type subtype IIC hoe continued as a type of wide hoe without a mudguard. We may conclude they were used exclusively in dry fields. As for horizontal-headed hoes, given that a mudguard began being attached to them around that time, they probably took over a greater part of the role that had been performed by wide hoes with a mudguard. However, horizontal-headed hoes with a mudguard as illustrated in Figure 11-8, was greatly different in shape from wide hoes 11-4 and 11-6, which had evolved as the ideal hoe. It is therefore difficult to assume that all of the functions of wide hoes with mudguards were taken over by horizontal-headed hoes.

Mudguard's functions and its shape change

What are the functions of a hoe with a mudguard? When a hoe was actually used with a mudguard, what was the movement of the soil? Let us focus on these points below.

In a rice field, a layer of the soil of approximately 15 centimeters is cultivated with the hoe. The uneven or sloping parts of the bottom of the layer are leveled and the turned soil is evenly distributed so as to achieve the uniform thickness of the surface layer. This role was most likely performed by hoes with mudguards, which we presume were used to work the soil in a wet field.

When a wide hoe type 0 is mounted with a type IA mudguard (Figure 13-1), the hoe blade digs into the soil to some depth and then, as you pull the soil toward you the soil is deflected by the lower half of the mudguard and separated out to right and left. In that process considerable pressure comes to bear on the mudguard and the hoe blade. The lower half of the mudguard from the Tachino site had been broken and repaired, and the breakage was likely due to repeated impact of the soil on bumping that part.

As for the hoe blade, since the angle at which the blade strikes the soil is wide at 60 degrees, if the dislodged soil is plentiful and heavy the blade could be subject to breakage. For this reason, the soil being hoed in this case was limited to soft, wet soil. With soft soil, however, the blade might sink excessively deep and, therefore, a stopper to prevent the blade from sinking too deeply was required. Also needed was a guide to keep the hoeing depth constant. It can be assumed that the mudguard attached to the hoe functioned both as stopper and guide.

These functions improved, as shown in Figure 13-2, -3, and -4. Figure 13-2 shows the cross section of Kinki-type subtype IA hoe with a type IA mudguard. The lower half of the mudguard is set almost parallel to the bottom of the surface layer of the soil, suggesting that the mudguard functioned more properly as a guide for plowing the soil at a constant depth. This function became even more effective when a flat mudguard was attached (Figure 13-3 and -4). As shall be discussed later, a mudguard was also mounted on a horizontal-headed hoe in parallel with the bottom of hoed soil. These features tell us that the two major functions performed by the mudguards mounted on different types of hoes were to prevent the hoe blade from sinking too deeply into the soil and to hoe the soil at a constant depth.

Noting the changes illustrated from Figure 13-1 to -4, we can see that, as the angle at which the hoe blade strikes the soil grew acuter vis-à-vis the handle, the depth of the soil cultivated became gradually shallower. The soil cultivated with a hoe was deflected by the mudguard and separated out to right and left, but if amount of soil dislodged was great, it would make the hoe heavy and be harder to use properly. If the soil was moved to a more shallow depth and the amount of soil moved was smaller it became possible to evenly divide the soil to right and left while hoeing.

As for the horizontal-headed hoe, although the angle of its blade is wide at 60 degrees, it was made to scrape soil shallowly by shortening the height of the head. In other words, by mounting a mudguard on a very wide, horizontal head a field could be cultivated over a broader area, hoeing a shallow layer of the soil and distributing it evenly.

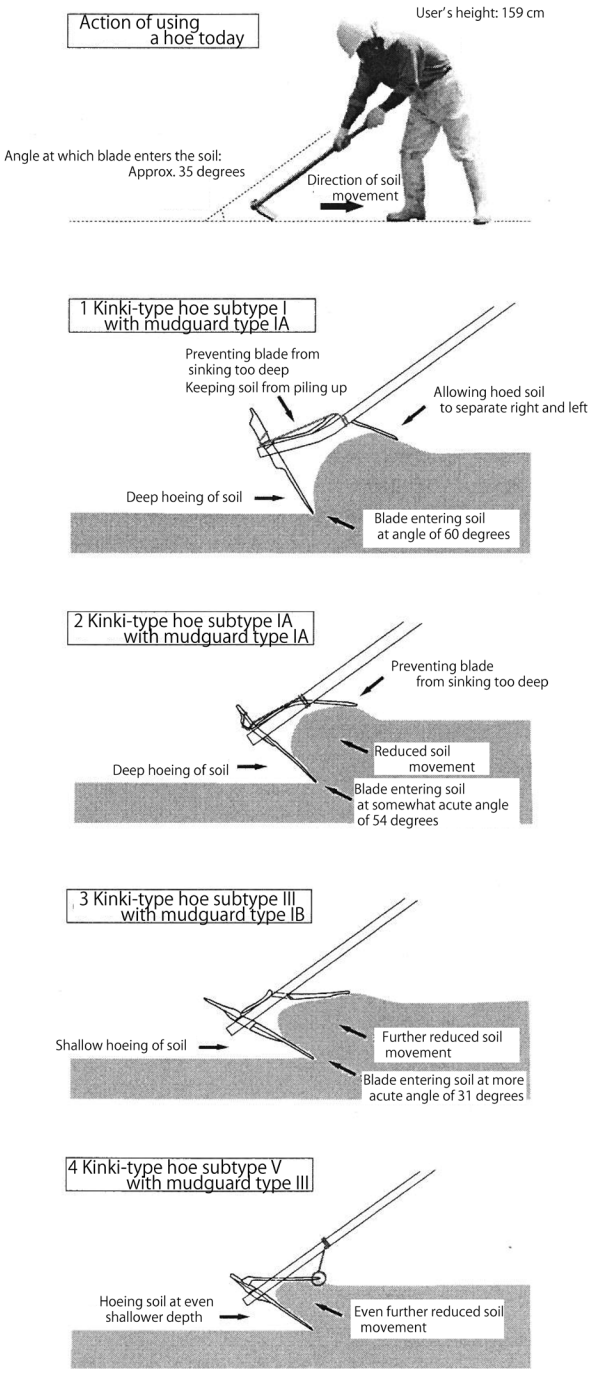


Figure 13. Assumed Ways of Using Mudguard-mounted Hoes

Why, then, did hoes not have a very wide blade from the outset? The answer to that question can be found in the hoe with a protruding belt (belted type hoe), another advanced form of hoe. As mentioned earlier (see part I), the hoe of this type had an iron blade mounted into a ridge near the lower edge of wooden hoe head. Since the mudguard, too, was mounted, this hoe was presumably used in pulling action toward the user, like the other hoes discussed here. When the soil to be cultivated was high in viscosity, it was probably easier to till with an iron blade. Conversely, in order to till the soil with a breakable wooden blade it was necessary to keep the blade edge narrow to concentrate impact. For that reason, it is assumed, hoes could not have the very wide head that the horizontal-headed hoe later did.

That physical shape is another indication that a major function of hoes was to level the uneven bottom surface of the cultivated layer of soil. Bearing this function in mind, let us focus on when the horizontal-headed hoes with mudguards appeared.

During the Late Yayoi period, in the central Kawachi area there appeared, as shown in Figure 12, horizontal-headed hoes with a mudguard along with eggplant-shaped and curve-handled hoes with traces of an iron blade having been attached. In the Setouchi area, exactly the same thing occurred in the latter half of the Middle Yayoi period. It is suggested that the appearance of eggplant-shape and curve-handled hoes with an iron blade attached was closely related to the disappearance of wide hoes with mudguards.

We can presume, in other words, that the function of leveling the uneven bottom surface of the cultivated layer of soil—a function [needed for rice farming] performed by hoes with mudguards—was taken over by the eggplant-shaped and curve-handled hoes with an iron blade while the other function, that of evenly distributing cultivated soil, was taken over by horizontal-headed hoes with mudguards. To specially perform this latter function, the head of the horizontal-headed hoes was most likely made very short and wide.

VI. Conclusion

In the above discussion focusing on examples of mudguards mounted on hoes (wide hoes) from the Yayoi and Kofun periods, we have reconstructed specific mounting methods using different types of excavated examples and considered the functions of mudguards. We can sum up the discussion as follows:

First, all hoes could be paired with a specific mudguard. By dividing hoes with devices for installing a mudguard into eleven types and mudguards into six types, we can reconstruct their combinations.

Second, the way of combining wide hoe type 0 with mudguard type IA has previously been ambiguous, but by closely observing excavated examples, we can reconstruct how the two were bound together with a cord. This suggests that from the time hoes and mudguards appeared it was essential to bind them firmly.

Third, looking at changes in the form of mounting mudguards over time, we find that improvements were made to achieve ideal mounting in three ways: tightly securing the hoe and mudguard to each other, shortening the distance between the lower edges of the hoe blade and mudguard; and preventing breakage of the mudguard.

Fourth, hoes with a mudguard used in wet fields, are thought to have functioned to scrape the surface layer of the soil and evenly distribute it. The mudguard itself must have had various functions such as preventing the hoe blade from sinking too deeply and serving as a guide for cultivating the soil at an even depth.

And fifth, in the central Kawachi area during the period between the Late Yayoi period and the Initial Kofun period, the functions of hoes with mudguards were presumably taken over by the eggplant-shaped-head and curve-handled hoes with an iron head attached to the wooden head's lower edge as well as by horizontal-headed hoes with a mudguard.

In this article our discussion has focused on mudguards excavated at Yayoi- and Kofun-period sites and the hoes on which they were mounted. We have found that mudguards were not used merely to avoid the spattering of mud as previously thought; they played an important part in cultivating wet fields.

There remain a number of issues to solve to get a better understanding of hoes and mudguards, including: there not being many excavated examples of iron blades (whose appearance is considered responsible for the disappearance of wide hoes with mudguards); continuity between the Kofun period and the subsequent period; and the relationship of hoes to structural remains of rice fields.

Lastly I would like to express my deep gratitude to Kajiwara Yoshimitsu, Kawasaki Masashi, Shimohama Takako, Nakatsuji Keita, Nakahara Tomoyuki, Higami Noboru, Fukuda Sayoko, Masaoka Tomomi, Yamada Masahisa, and Yamamoto Naoto, as well as members of the Shutsudo Mokki Kenkyūkai (Society for Research on Excavated Wooden Implements), for their precious advice and suggestions.

References

Anonymous 1681–84 *Hyakushō denki* 『百姓伝記』[A Farmer's Handbook]

Akiyama Kōzō 秋山浩三 2004. Shoki nōkō shūraku toshite no Uryūdō Iseki 「初期農耕集落としての瓜生堂遺跡」 [The Uryūdō Site as an Early Farming Settlement]. *Uryūdō Iseki I: Kōsatsu, bunseki, shashin zuhan hen* 『瓜生堂遺跡 I ～考察・分析・写真図版編～』 [Uryūdō Site I: Studies, Analyses, Photographs and Plates], pp. 465–482. Osaka Center for Cultural Heritage.

Higami Noboru 樋上　昇 2008. Mokusei nōgu no kenkyū ryakushi to kuwa no denpa keiro

「木製農具の研究略史と鍬の伝播経路」 [A Brief History of Research on Wooden Farming Tools and Routes of the Spread of Hoes]. *Kikan Kōkogaku* 『季刊考古学』, No. 104, pp. 14–18. Tokyo: Yūzankaku.

Higami Noboru 樋上 昇 2010. *Mokusei-hin kara kangaeru chiiki shakai—Yayoi kara Kofun e* 『木製品から考える地域社会—弥生から古墳へ—』[Consideration of Regional Societies from the Standpoint of Wooden Artifacts: From the Yayoi to Kofun Periods]. Tokyo: Yūzankaku.

Ishikawa Yuzuha 石川ゆずは 2008. Higashi Nihon no nōkōgu: Hokuriku 「東日本の農耕具　北陸」 [Farming Tools in East Japan: Hokuriku], *Kikan Kōkogaku* 『季刊考古学』, No. 104, pp. 45–49. Tokyo: Yūzankaku.

Kaneko Hiroyuki 金子裕之 1988. Chōsa kenkyū ihō *Eburi*-gata nōgu no saikentō 「調査研究彙報『エブリ』型農具の再検討」 [Research Report: Reexamination of *Eburi*-type Hoes]. Nara National Research Institute for Cultural Properties *nenpō* (annual report), 1987.

Kawaguchi Masayuki 川口雅之 2008. Nishi Nihon no nōkōgu: Nanbu Kyūshū 「西日本の農耕具　南部九州」 [Farming Tools in West Japan: Southern Kyushu]. *Kikan Kōkogaku* 『季刊考古学』, No. 104, pp. 26–30. Tokyo: Yūzankaku.

Kondō Toshiyuki 近藤利由 1983. Shimoikeda Iseki 「下池田遺跡」 [Shimoikeda Site]. *Mokusei nōgu ni tsuite* 『木製農具について』 [Farming Tools of Wood]. Maizō Bunkazai Kenkyūkai (Buried Cultural Properties Study Group) 14th conference materials.

Kurosaki Tadashi 黒崎　直 1970. Mokusei nōkōgu no seikaku to Yayoi shakai no dōkō 「木製農耕具の性格と弥生社会の動向」 [Characteristics of Wooden Farming Tools and Trends of Yayoi Society]. *Kōkogaku Kenkyū* 『考古学研究』 16-3, pp. 21–42. Society of Archaeological Studies.

Kurosaki Tadashi 黒崎　直 1988. Nishi Nihon ni okeru Yayoi jidai nōgu no hensen to tenkai 「西日本における弥生時代農具の変遷と展開」 [Changes and Development of Yayoi-period Farming Tools in West Japan]. *Nihon ni okeru inasaku nōkō no kigen to tenkai—Shiryō-shū* 『日本における稲作農耕の起源と展開〜資料集〜』 [Origins and Development of Rice Farming in Japan]. Japanese Archaeological Association Shizuoka Convention Executive Committee and Shizuoka Archaeological Society.

Kurosaki Tadashi 黒崎　直 1991. Nihon kodai no mokusei nōkōgu no fukugen-teki kenkyū 「日本古代の木製農耕具の復元的研究」[Toward a Reconstruction of Farming Tools in Ancient Japan]. https://kaken.nii.ac.jp/ja/grant/KAKENHI-PROJECT-03610214

Kurosaki Tadashi 黒崎　直 1996. Kodai no nōgu 「古代の農具」 [Ancient Farming Tools]. *Nihon no bijutsu 2* 『日本の美術2』 No. 357. Tokyo: Shibundō.

Kurosu Akiko 黒須亜希子 2008. Nishi Nihon no nōkōgu: Kinki 「西日本の農耕具　近畿」 [Farming Tools in West Japan: Kinki]. *Kikan Kōkogaku* 『季刊考古学』, No. 104, pp. 39–44. Tokyo: Yūzankaku.

Kurosu Akiko 黒須亜希子 2015. Hiro-guwa I-shiki no seiritsu to tenkai—Setonaikai,

Kawachi wan engan-bu ni okeru Yayoi jidai zenki no yōsō 「広鍬 I 式の成立と展開—瀬戸内海・河内湾沿岸部における弥生時代前期の様相—」[Origins and Development of the Type I Wide Hoes: Aspects of the Early Yayoi Period in the Coastal Region of the Inland Sea and Osaka Bay]. *Kodaigaku Kenkyū*, No. 205, pp. 25–47. Kodaigaku Kenkyū Kai.

Masaoka Tomomi 正岡大実 2014. Yayoi jidai mokuseihin seisan no ichikakki: Sugue-hirakuwa ni fuzui suru doroyoke e no hensen o chūshin ni 「弥生時代木製品生産の一画期—直柄平鍬に付随する泥除への変遷を中心に—」 [Epoch Making in the Production of Yayoi-period Wooden Artifacts: Focus on Changes in Mudguards Attached to Straight-handled Flat Hoes]. *Yayoi Bunka Hakubutsukan kenkyū hōkoku* 『弥生文化博物館研究報告』, No. 7. Osaka Prefectural Yayoi Culture Museum.

Mochizuki Yukako 望月由佳子 2004. Shizuoka-ken shutsudo no mokuseihin no gaikan to kadai 「静岡県出土の木製品の概観と課題」 [Overview and Issues of Wooden Artifacts Excavated in Shizuoka Prefecture]. *Shizuoka-ken Maizō Bunkazai Chōsa Kenkyūjo setsuritsu 20-shūnen kinen ronbunshū* 『静岡県埋蔵文化財調査研究所設立20周年記念論文集』 [A Collection of Papers Written to Commemorate the 20th Anniversary of the Founding of Shizuoka Prefecture Research Institute for Buried Cultural Properties], pp. 313–322. Shizuoka Prefecture Research Institute for Buried Cultural Properties.

Nakagawa Ritsuko 中川律子 2008. Higashi Nihon no nōkōgu: Tōkai 「東日本の農耕具　東海」 [Farming Tools in East Japan: Tōkai]. *Kikan Kōkogaku* 『季刊考古学』, No. 104, pp. 50–54. Tokyo: Yūzankaku.

Nakagawa Yasushi 中川　寧 2002. San'in ni okeru mokusei kikōgu no hensen: Yayoi Kofun jidai ni tsuite 「山陰における木製起耕具の変遷～弥生・古墳時代について～」 [Changes in the Tools for Turning Soil in San'in: Yayoi and Kofun Periods]. *Kōkogaku Journal* 『考古学ジャーナル』, No. 486, pp. 15–19. New Science Sha.

Nakahara Kei 中原　計 2003. Mokuseihin ni okeru Yayoi jidai zenki no kakki: Hirokuwa I-shiki no seisaku katei no henka o chūshin ni 「木製品における弥生時代前期の画期～広鍬 I 式の製作工程の変化を中心に～」 [Epochal Wooden Artifacts in the Early Yayoi Period: Focus on the Production Process of Type-I Wide Hoes]. *Machikaneyama ronsō* 『待兼山論叢』, No. 37, pp. 27–49. Osaka University Graduate School of Letters.

Ōgizaki Yoshi 扇崎　由 2008. Nishi Nihon no nōkōgu: Setouchi Shikoku 「西日本の農耕具　瀬戸内・四国」 [Farming Tools in West Japan: Setouchi and Shikoku]. *Kikan Kōkogaku* 『季刊考古学』, No. 104, pp. 31–34. Tokyo: Yūzankaku.

Ōkura Nagatsune 大蔵永常 1822. *Nōgyō benriron* 『農業便利論』 [A Study of the Convenience of Farming], *Nihon nōsho zenshū* 日本農書全集, No.15.

Satō Kōji 佐藤浩司 2008. Nishi Nihon no nōkōgu: Hokubu Tōbu Kyūshū 「西日本の農耕具　北部・東部九州」 [Farming Tools in West Japan: Northern and Eastern Kyushu]. *Kikan Kōkogaku* 『季刊考古学』, No. 104, pp. 19–25. Tokyo: Yūzankaku.

Suenaga Masao 末永雅雄, Kobayashi Yukio 小林行雄, and Fujioka Kenjirō 藤岡謙二郎 1943. *Yamato Karako Yayoi-shiki iseki no kenkyū* 『大和唐古弥生式遺跡の研究』 [A

Study of the Karako Yayoi-type Site, Yamato]. Kyoto Imperial University Literature Department Archaeological Research Reports No. 16, Kyoto Imperial University.

Sugihara Sōsuke 杉原荘介 and Kanzawa Yūichi 神沢勇一 1972. Ōsaka-fu Uriwari Iseki「大阪府瓜破遺跡」[The Uriwari Site, Osaka Prefecture]. *Nihon nōkō bunka no seisei*『日本農耕文化の生成』[Formation of Japanese Agricultural Culture], dai-1-satsu honbun-hen (No. 1, Text), Edited by Japanese Archaeological Association. Tokyo: Tokyodo Shuppan.

Terasawa Kaoru 寺沢　薫 and Morioka Hideto 森岡秀人 1989. *Yayoi doki no yōshiki to Hennen: Kinki hen I*『弥生土器の様式と編年〜近畿編 I〜』[Types and Chronology of Yayoi Pottery: Kinki I], pp. 44–58. Tokyo: Mokujisha.

Tsuchiya Matasaburō 土屋又三郎 1707. *Kōka shunjū*『耕稼春秋』[Farming and Tools in Kaga Province]. *Nihon nōsho zenshū* 日本農書全集, vol. 4.

Uehara Mahito 上原真人 1993a. B nōgu「B 農具」[B Farming Tools]. *Mokki shūsei zuroku: Kinki genshi hen*『木器集成図録　近畿原始　編』[Compendium of Wooden Artifacts, Primitive-era, Kinki], pp. 29–67. Nara National Research Institute for Cultural Properties, Publication of Historical Materials No. 36.

Uehara Mahito 上原真人, Editor 1993b. *Mokki shūsei zuroku: Kinki genshi hen*『木器集成図録　近畿原始　編』[Compendium of Wooden Artifacts, Primitive-era, Kinki]. Nara National Research Institute for Cultural Properties, Publication of Historical Materials No. 36.

Yamada Masahisa 山田昌久 1994. Nōgu no keitai to kinō: Bunken shiryō to no setten (gijutsushi kara mita nōgu)「農具の形態と機能　文献資料との接点 (技術史から見た農具)」[Shapes and Functions of Farming Tools: In the Context of Document Sources (Agricultural Equipment in Technological History]. *Kodai ni okeru nōgu no hensen: Inasaku gijutsu-shi o nōgu kara miru*『古代における農具の変遷〜稲作技術史を農具から見る〜』[Changes in Ancient Farming Tools: Rice Cultivation Methods As Found in Farming Equipment]. Collected summaries of presented papers. Shizuoka Prefecture Research Institute for Buried Cultural Properties.

Cited Reports and Catalogues, by Prefecture

Aichi Prefecture

Matsubara Ryūji 松原隆治, Mori Yūichi 森　勇一, Okakmoto Naohisa 岡本直久, Higami Noboru 樋上昇, Akatsuka Jirō 赤塚次郎, Ishiguro Tatsuhito 石黒立人, and Hattori Nobuhiro 服部信博 1992. *Kachigawa Iseki IV*『勝川遺跡 IV』[The Kachigawa Site IV]. Aichi Prefecture Research Institute for Buried Cultural Properties.

Muramatsu Kazuhide 村松一秀 . 2000. *Matsukawado Iseki: Yasuka chiku hakkutsu chōsa no gaiyō*『松河戸遺跡　〜安賀地区発掘調査の概要〜』[The Matsukawado Site: Overview of the Excavation of the Yasuka Area]. Kasugai City Board of Education.

Ehime Prefecture

Ōtaki Masatsugu 大滝雅嗣 1989. *Hatchō Iseki, Nakadera-suo Iseki, Matsuki Iseki*『八町遺跡・中寺州尾遺跡・松木遺跡』[The Hatchō, Nakadera-suo, and Matsuki Sites]. Ehime

Research Center for Buried Cultural Properties.
Manabe Akifumi 真鍋昭文, Hashimoto Tomonori 橋本智紀, Koizumi Yukari 今泉ゆかり, Doi Kōichirō 土井光一郎 2000. *Agata Iseki, Yata-hattantsubo Iseki* 『阿方遺跡・矢田八反坪遺跡』[The Agata and Yata-hattantsubo Sites]. Ehime Research Center for Buried Cultural Properties.
Miyazaki Yasuyoshi 宮崎泰好 1993. *Yamagoe Kumanodai no Iseki* 『山越・久万ノ台の遺跡』[The Yamagoe and Kumanodai Sites]. Matsuyama City Board of Education and Matsuyama-shi Shōgai-gakushū Shinkō Zaidan Maizō Bunkazai Sentā [Matsuyama Municipal Foundation for Promotion of Lifelong Learning, Center for Buried Cultural Properties].
Fukui Prefecture
Shizuoka Prefecture Research Institute for Buried Cultural Properties 静岡県埋蔵文化財調査研究所 1994. Fukui-ken 「福井県」 [Fukui Prefecture]. Kodai ni okeru nōgu no hensen: Inasaku gijutsu-shi o nōgu kara miru 『古代における農具の変遷〜稲作技術史を農具から見る〜』 [Changes in Ancient Farming Tools: Rice Cultivation Methods As Found in Farming Equipment], a collection of papers presented to the symposium held in commemoration of the 10th anniversary of Shizuoka Prefecture Research Institute for Buried Cultural Properties, as well as to the 4th Conference of Higashi Nihon Maizō Bunkazai Kenkyūkai (East Japan Research Institute for Buried Cultural Properties) and the 2nd Tōkai Kōkogaku Forum. 2nd-installment (From Niigata to Mie prefectures).
Shimohama Takako 下濱貴子, Miyata Akira 宮田 明, Warashina Tetsuo 藁科哲男, and Ura Yōko 浦 蓉子 2013. *Yōkaichi-jikata Iseki 2* 『八日市地方遺跡2』 [The Yōkaichi-jikata Site 2]. Komatsu City Board of Education.
Fukuoka Prefecture
Rikitake Takuji 力武卓治 and Ōba Kōji 大庭康時 1987. *Naka Kyūhira Iseki II* 『那珂久平遺跡 II』[The Naka Kyūhira Site II]. Fukuoka City Board of Education.
Hyōgo Prefecture
Yamamoto Masakazu 山本雅和 and Chigusa Hiroshi 千種浩 1989. *Ebisu-chō Iseki, dai-1-ji hakkutsu chōsa gaihō* 『戎町遺跡 第1次発掘調査概報』[The Ebisu-chō Site, Overview Report on the 1st Excavation]. Kobe City Board of Education.
Iwata Akihiro 岩田明広 1998. Motoyama Iseki 「本山遺跡」 [The Motoyama Site], *Kōbe-shi maizō bunkazai nenpō* 『神戸市埋蔵文化財年報』[Kobe City Annual Report on Buried Cultural Properties]. Kobe City Board of Education.
Ishikawa Prefecture
Shizuoka Prefecture Research Institute for Buried Cultural Properties 静岡県埋蔵文化財調査研究所 1994. Ishikawa-ken 「石川県」 [Ishikawa Prefecture]. Kodai ni okeru nōgu no hensen: Inasaku gijutsu-shi o nōgu kara miru 『古代における農具の変遷〜稲作技術史を農具から見る〜』 [Changes in Ancient Farming Tools: Rice Cultivation Methods As Found in Farming Equipment], a collection of papers presented to the symposium held in commemoration of the 10th anniversary of Shizuoka Prefecture

Research Institute for Buried Cultural Properties, as well as to the 4th Conference of Higashi Nihon Maizō Bunkazai Kenkyūkai (East Japan Research Institute for Buried Cultural Properties) and the 2nd Tōkai Kōkogaku Forum. 2nd-installment (From Niigata to Mie prefectures).

Kagawa Prefecture

Mori Kakuya 森　格也 1997. *Kabe Kawata Iseki I*『鴨部・川田遺跡 I』 [The Kabe Kawata Site I]. Kagawa Prefectural Board of Education, Kagawa-ken Maizō Bunkazai Chōsa Sentā [Kagawa Prefectural Research Center for Buried Cultural Properties], and Ministry of Construction Shikoku Construction Bureau.

Ōkubo Tetsuya 大久保徹也 and Morishita Tomoko 森下友子 2000. *Kabe Kawata Iseki II (dai-1-bunsatsu*『鴨部・川田遺跡 II (第1分冊) 』[The Kabe Kawata Site II (1st installment]. Kagawa Prefectural Board of Education, Kagawa-ken Maizō Bunkazai Chōsa Sentā [Kagawa Prefectural Research Center for Buried Cultural Properties], and Ministry of Construction Shikoku Construction Bureau.

Nara Prefecture

Fujita Kazutaka 藤田和尊, Amako Namie 尼子奈美枝, Okuda Hisashi 奥田　尚, Wasano Kikuo 和佐野喜久生, Kanehara Masa'aki 金原正明, Yasuda Hiroyuki 安田博幸, and Kanasugi Naoko 金杉直子 1992. *Kamotsuba, dai-12-ji gaihō*『鴨都波　第12次　概報』 [Kamotsuba, 12th Summary Report]. Gose City Board of Education (Nara).

Okayama Prefecture

Yanase Akihiko 柳瀬昭彦, Takada Kyōichirō 高田恭一郎, Okamoto Hirohisa 岡本寛久, Hirai Yasuo 平井泰男, and Inoue Hiroshi 井上　弘 1996. *Hyakkengawa Haraojima Iseki 5*『百間川原尾島遺跡5』 [The Hyakkengawa Haraojima Site 5]. Ministry of Land, Infrastructure, Transport and Tourism Okayama River Office and Okayama Prefectural Board of Education.

Kojima Yoshikuni 小島義邦, Ugaki Tadamasa 宇垣匡雅, Takada Kyōichirō 高田恭一郎, Shibata Hideki 柴田英樹, Monobe Shigeki 物部茂樹, Matsuo Yoshiko 松尾佳子, Yanase Akihiko 柳瀬昭彦, Inatani Tomoko 稲谷知子, Koezuka Takayasu 肥塚隆保, and Shiraishi Jun 白石　純 2004. *Hyakkengawa Haraojima Iseki 6*『百間川原尾島遺跡6』 [The Hyakkengawa Haraojima Site 6]. Ministry of Land, Infrastructure, Transport and Tourism Okayama River Office and Okayama Prefectural Board of Education.

Ōgizaki Yoshi 扇崎　由 2005. *Minamikata (Saiseikai) Iseki, Mokki-hen*『南方（済生会）遺跡　木器編』[The Minamikata (Saiseikai) Site, Wooden Artifacts]. Okayama City Board of Education.

Osaka Prefecture

Fujisawa Kazuo 藤沢一夫, Tashiro Katsumi 田代克己, and Horie Mon'nari 堀江門也 1969. *Takatsuki-shi Ama Yayoi Iseki hakkutsu chōsa gaiyō*『高槻市安満弥生遺跡発掘調査概報』 [Overview of the Excavation of the Ama Site of Yoyoi Period in Takatsuki]. Osaka Prefectural Board of Education.

Kameshima Shigenori 亀島重則 1994. *Tainaka Iseki hakkutsu chōsa gaiyō IV*『田井中遺

跡発掘調査概要・ IV』 [Overview of the Excavation of the Tainaka Site IV]. Osaka Prefectural Board of Education.

Kameshima Shigenori 亀島重則 and Tagaya Akira 多賀谷昭 1999. *Tainaka Iseki hakkutsuchōsa gaiyō VIII* 『田井中遺跡発掘調査概要・ VIII』 [Overview of the Excavation of the Tainaka Site VIII]. Osaka Prefectural Board of Education.

Horie Mon'nari 堀江門也 and Nakanishi Yasuto 中西靖人 1980. Uryūdō Iseki 『瓜生堂遺跡』 [The Uryūdō Site]. Osaka Prefectural Board of Education and Osaka Center for Cultural Heritage.

Akiyama Kōzō 秋山浩三 and Kawase Takako 川瀬貴子 2004. *Uryūdō Iseki I (Honbun-hen)* 『瓜生堂遺跡 I —本文編—』 [The Uryūdō Site (Text)]. Osaka Center for Cultural Heritage.

Onoue Minoru 尾上　実 and Kishimoto Michiaki 岸本道昭, eds. 1983. *Wakae-kita Iseki* 『若江北遺跡』 [Wakae-kita Site] Osaka Prefectural Board of Education and Osaka Center for Cultural Heritage.

Nakanishi Yasuto 中西靖人 and Morii Sadao 森井貞雄 1983. *Yamaga Iseki (sono 2)* 『山賀遺跡（その2)』 [The Yamaga Site (2)]. Osaka Prefectural Board of Education and Osaka Center for Cultural Heritage.

Nishiguchi Yōichi 西口陽一 and Uenishi Misako 上西美佐子 1984. *Yamaga Iseki (sono 3)* 『山賀遺跡（その3)』 [The Yamaga Site (3)]. Osaka Prefectural Board of Education and Osaka Center for Cultural Heritage.

Takashima Tōru 高島　徹 and Hirose Masanobu 広瀬雅信 1980. *Kamei Jōyama* 『亀井・城山』 [The Kamei-Jōyma Area]. Osaka Prefectural Board of Education and Osaka Center for Cultural Heritage.

Takashima Tōru 高島　徹 and Hirose Masanobu 広瀬雅信, and Hata Nobuko 畑　暢子 1983. *Kamei* 『亀井』 [Kamei]. Osaka Prefectural Board of Education and Osaka Center for Cultural Heritage.

Nakanishi Yasuto 中西靖人, Kuninori Kazuo 國乘和雄, Miyazaki Taiji 宮崎泰史, Nishimura Hirofumi 西村尋文, and Kishimoto Michiaki 岸本道昭 1984. *Kamei Iseki II* 『亀井遺跡 II』 [The Kamei Site II]. Osaka Prefectural Board of Education and Osaka Center for Cultural Heritage.

Inoue Tomohiro 井上智博 and Hata Nobuko 畑　暢子 2002. Ikeshima Fukumanji Iseki 2 (Fukumanji I-ki chiku) 『池島・福万寺遺跡2 （福万寺 I 期地区)』 [The Ikeshima Fukumanji Site 2 (Fukumanji Phase-1 Area]. Osaka Center for Cultural Heritage.

Hirose Yukishige 廣瀬時習, Jinnai Nobuko 陣内暢子, Inoue Tomohiro 井上智博, and Ichimura Shintarō 市村慎太郎 2007. Ikeshima Fukumanji Iseki 3 (Ikeshima I-ki chiku) 『池島・福万寺遺跡3 （池島 I 期地区)』[The Ikeshima Fukumanji Site 3 (Ikeshima Phase-1 Area]. Osaka Center for Cultural Heritage.

Inishi Takako 井西貴子, Matsubara Naoko 松尾奈緒子, Iida Hiromitsu 飯田浩光, Maeda Toshio 前田俊雄 and Gotō Nobuyoshi 後藤信義, eds. 2011. *Ikeshima Fukumanji Iseki 13 (Ikeshima II-ki chiku 08-2 chōsaku)* 『池島・福万寺遺跡13 （池島 II 期地区08-2 調査区)』 [The Ikeshima Fukumanji Site 13 (Ikeshima Phase-II Area, 08-2 Survey

District)]. Osaka Center for Cultural Heritage.
Nishimura Ayumu 西村歩, Niki Akio 仁木昭夫, and Miki Hiroshi 三木　弘 1996. *Shimoda Iseki, dai-1-bu Honbun-hen* 『下田遺跡　第1部　本文編』 [The Shimoda Site, Part 1, Text]. Osaka Center for Cultural Heritage.
Ono Hisataka 小野久隆 and Okuno Miyako 奥野都 1978. *Ikegami Iseki, dai-4 bunsatsu no 1, 2 Mokki-hen* 『池上遺跡　第4分冊の1・2　木器編』[The Ikegami Site, 4th installment 1 and 2]. Osaka Center for Cultural Heritage.
Tashiro Katsumi 田代克己 and Okui Tetsuhide 奥井哲秀 1979. *Higashi-nara Iseki hakkutsu chōsa gaihō I* 『東奈良遺跡発掘調査概報 I』 [Summary Report on the Excavation of the Higashi-nara Site]. Higashi-nara Iseki Chōsakai [Higashi-Nara Site Excavation Committee].
Miki Hiroshi 三木　弘 1998. *Higashi-nara Iseki* 『東奈良遺跡』 [The Higashi-nara Site]. Osaka Center for Cultural Heritage.
Kurosu Akiko 黒須亜希子 and Minami Takao 南　孝雄 2008. *Nasuzukuri Iseki* 『茄子作遺跡』 [The Nasuzukuri Site]. Osaka Center for Cultural Heritage.
Miyoshi Kōichi 三好孝一, Oku Kazuyuki 奥　和之, Jinnai Nobuko 陣内暢子, Murakami Fukiko 村上富喜子, Gotō Nobuyoshi 後藤信義, Wakabayashi Sachiko 若林幸子, Ichimura Shintarō 市村慎太郎, and Saeki Hiromitsu 佐伯博光 2011. *Kisabe-minami Iseki III, Ariike Iseki, Kami-kisabe Iseki, Uenoyama Iseki* 『私部南遺跡 III・有池遺跡・上私部遺跡・上の山遺跡』 [The Kisabe-minami, Ariike, Kami-kisabe, and Uenoyama Sites]. Osaka Center for Cultural Heritage.
Tanaka Kiyomi 田中清美, Sakurai Hisayuki 櫻井久之, Kibi Noboru 吉備　登, Tagaya Akira 多賀谷　昭, and Sakagawa Kōsuke 坂川幸祐 2015. *Kami Iseki hakkutsu chōsa hōkoku V* 『加美遺跡発掘調査報告 V』 [Report on the Excavation of the Kami Site V]. Osaka City Museum Organization and Osaka Center for Cultural Heritage.
Ogura Tetsuya 小倉徹也, Watanabe Haruka 渡邉晴香, Sakurada Sayuri 櫻田小百合, Kinugawa Kazunori 絹川一徳 and Tanaka Kiyomi 田中清美, eds. 2013. Uriwari, Suminodō-yada, Yada Iseki 『瓜破・住道矢田・矢田遺跡』 [The Uriwari, Suminodō-yada, and Yada Sites]. Osaka City Museum Organization and Osaka Center for Cultural Heritage.
Imomoto Takahiro 芋本隆裕 1987a. *Kitoragawa no mokushitsu ibutsu: Dai-7-ji hakkutsu chōsa hōkokusho, dai-3-satsu* 『鬼虎川の木質遺物〜第7次発掘調査報告書　第3冊〜』 [Artifacts of Wood at Kitoragawa: Report on the 7th Excavation, 3rd installment]. Higashi-Osaka City Cultural Properties Association.
Imomoto Takahiro 芋本隆裕 1987b. *Kitoragawa no mokushitsu ibutsu: Dai-7-ji hakkutsu chōsa hōkokusho, dai-4-satsu* 『鬼虎川の木質遺物〜第7次発掘調査報告書　第3冊〜』 [Artifacts of Wood at Kitoragawa: Report on the 7th Excavation, 4th installment]. Higashi-Osaka City Cultural Properties Association.
Ueno Toshiaki 上野俊明 and Saibara Kanehiro 才原金弘 1987. *Kitoragawa Iseki dai-12-ji hakkutsu chōsa hōkoku* 『鬼虎川遺跡第12次発掘調査報告』 [Report on the 12th Excavation of the Kitoragawa Site]. Higashi-Osaka City Cultural Properties

Association and Higashi-Osaka City Board of Education.
Shimomura Harufumi 下村晴文 and Saibara Kanehiro 才原金弘 1988. *Kitoragawa Iseki chōsa gaiyō I, ibutsu-hen, mokuseihin* 『鬼虎川遺跡調査概要 I 遺物編　木製品』 [Overview of the Excavation of the Kitoragawa Site I, Artifacts—Wooden Products]. Higashi-Osaka City Cultural Properties Association.
Shimomura Harufumi 下村晴文 and Imomoto Takahiro 芋本隆裕 1996. *Miyanoshita Iseki dai-1-ji hakkutsu chōsa hōkokusho, dai-1-bunsatsu* 『宮ノ下遺跡第1次発掘調査報告書〜第1分冊〜』 [Report on the 1st Excavation of the Miyanoshita Site, 1st installment]. Higashi-Osaka City Cultural Properties Association.
Asaoka Toshio 浅岡俊夫 1998. *Sakai-shi Shimoda Iseki* 『堺市下田遺跡』 [The Shimoda Site in Sakai City]. Shimoda Iseki Chōsadan [Shimoda Site Investigation Group] and Rokkō Sanroku Iseki Chōsakai [Rokkō Sanroku Site Investigation Committee].
Masaoka Tomomi 正岡大実 ed.　2012. Ho-otoshi-kami no sokuseki: Nōgu de himotoku Yayoi shakai 『穂落とし神の足跡　〜農具でひもとく弥生社会〜』 [Traces of "Rice-Ear-Dropping" Deity: Yayoi Society As Told by Farming Tools]. 2012 summer special exhibition catalogue, Osaka Prefectural Museum of Yayoi Culture.
Shimane Prefecture
Nakagawa Yasushi 中川　寧, Editor. 2006. *Shimane-ken ni okeru Yayoi-jidai Kofun-jidai no mokuseihin shūsei* 『島根県における弥生時代・古墳時代の木製品集成』 [A Collection of Yayoi- and Kofun-period Wooden Artifacts in Shimane Prefecture]. Shimane Prefectural Board of Education Ancient Culture Center and Research Center for Buried Cultural Properties.
Shizuoka Prefecture
Anonymous 1983 *Tokubetsu-ten: Tsuchi ni ikiru—Shizuoka no kuwa* 『特別展—土に生きる-静岡の鍬』[Special Exhibition: Living on the Earth—Hoes in Shizuoka]. Shizuoka City Museum of the Toro Site.
Nakagawa Ritsuko 中川律子, Shizuoka Prefecture Research Institute for Buried Cultural Properties 静岡県埋蔵文化財調査研究所 1994. Shizuoka-ken 「静岡県」 [Shizuoka Prefecture]. *Kodai ni okeru nōgu no hensen: Inasaku gijutsu-shi o nōgu kara miru* 『古代における農具の変遷〜稲作技術史を農具から見る〜』 [Changes in Ancient Farming Tools: Rice Cultivation Methods As Found in Farming Equipment], a collection of papers presented to the symposium held in commemoration of the 10th anniversary of Shizuoka Prefecture Research Institute for Buried Cultural Properties, as well as to the 4th Conference of Higashi Nihon Maizō Bunkazai Kenkyūkai (East Japan Research Institute for Buried Cultural Properties) and the 2nd Tōkai Kōkogaku Forum. 2nd-installment (From Niigata to Mie prefectures).
Nakayama Masanori 中山正典 and Chūbachi Kenji 中鉢賢治 1994. *Sena Iseki III (Ibutsuhen I)* 『瀬名遺跡 III (遺物編 I)』 [The Sena Site III (Artifacts)]. Shizuoka Prefecture Research Institute for Buried Cultural Properties.
Wakayama Prefecture
Iba Yoshihide 井馬好英 1995. *Ōta Kuroda Iseki, dai-26-ji hakkutsu chōsa gaihō* 『太田・

黒田遺跡　第26次発掘調査概報』[The Ōta Kuroda Site, Overview Report on the 26th Excavation]. Wakayama-shi Bunka Taiiku Shinkō Jigyōdan [Wakayama City Cultural and Physical Fitness Promotion Organization].

Nakahara Tomoyuki 仲原知之 2007. *Ōta Kuroda Iseki (ken 1-ji chōsa)*『太田・黒田遺跡（県1次調査）』 [The Ōta Kuroda Site (1st prefectural investigation)]. Center for Cultural Properties, Wakayama Prefecture.

Kawasaki Masashi 川崎雅史 and Tan'no Taku 丹野　拓 2013. *Tachino Iseki*『立野遺跡』[The Tachino Site], Center for Cultural Properties, Wakayama Prefecture.

Kugai Takeshi 久貝　健, Kawasaki Masashi 川崎雅史, Fujimura Mizuho 藤村瑞穂, Iketani Katsuya 池谷勝典, Kugai Yōko 久貝洋子, Warashina Tetsuo 藁科哲男, Kidachi Masaaki 木立雅朗, Kanzaki Masaru 神崎　勝 2002. *Katada Iseki: Yayoi-jidai zenki shūraku no chōsa*『堅田遺跡　弥生時代前期集落の調査』[The Katada Site: Investigation of Early Yayoi Period Settlements]. Gobō City Board of Education.