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Introduction

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Abstract: The purpose and content of the book are briefly introduced, covering the 18 chapters that are presented in four parts based on regions and chronology. The terminology and classification of kilns and firing techniques in East Asia are discussed in order to clarify choices for terminology in the various chapters (a unification of terms and names is provided in a glossary at the end of the book). In other words, the introduction summarizes the history of research on kiln classification in China, as well as in Korea and the Japanese archipelago, and presents a proposal to classify East Asian kilns according to a unified standard (without imposing this standard on the authors), as an attempt to create standard terminology over this wide region for future research.

Keywords: Kilns in East Asia, research history, regions, terminology, classification, overview

1.1. About this book

The beginning of ceramic industry by kiln firing in East Asia is often accompanied by pottery mass production, increasing social complexity, and social interaction over wide regions including the movement of potterer groups. While the globally known "flat kiln" construction is used in North China, another construction, well known as the "dragon kiln" from Chinese contexts, was later developed in South China and spread to its northern peripheries, Mongolia, the southern Russian Far East, the Korean peninsula and the Japanese archipelago including the Ryūkyū Islands, where it became the only known type of ceramics firing kiln.

This book will introduce early stages of the establishment of a kiln industry in East Asia and in particular in those regions that are peripheral to China and that experienced social and technological change of varying intensity during the spread of kiln-firing technology. Questions about "why", "how" and "where" will be answered on the one hand in smaller case studies, introducing excavations, technological studies, and on the other hand with some broader studies on historical, economic or social backgrounds as well as on the kiln technology itself. The combination of archaeological and scientific methods and the international cooperation of researchers combining ideas and methods of different research traditions are an important part of this research field, and we shall introduce some newer trends.

The 18 chapters of this book are collected in four parts, beginning with a presentation of some general ideas and methods used in East Asian kiln research in the first part, while the second part discusses the early advancement of kiln manufacture and trade in China. The third part deals with subsequent developments in the North and Northeastern continental periphery including the Korean peninsula, and the final part shows the expansion to the islands of the Japanese and Ryūkyū archipelago, closing the cycle almost two millennia after its beginning in South China (see front map).

In the general part, Tomoko Nagatomo (Chapter 2) discusses the diffusion of kiln technology from China to the Korean peninsula and further to the Japanese archipelago. These East Asian kilns, normally just vaguely described as spreading to peripheral regions, will be introduced as a genealogy of several traditions, being influenced from different times and appearing in differing types while spreading to different regions. Masa'aki Kidachi (Chapter 3) explains the importance of kilns ("flat kilns" and "climbing kilns" or *anagama* in his terminology) without ceiling construction in East Asia, their structure and its relation to the firing process. He introduces experiments and analogies from folklore studies. In an essay that sums up experiences from several interdisciplinary research projects and years of research coordination in the Nakadake Sanroku project introduced in Chapter 17, Maria Shinoto (Chapter 4) discusses different approaches to interdisciplinary research and introduces the concept of agility. This is an explicit approach to the frequent and flexible adaptation of research to new insights from the ongoing research process in order to gain better results and new perspectives in the course of a project rather than after its end. In the final chapter (Chapter 5) of this part, Johannes Sterba discusses another ubiquitous topic in kiln research: provenancing with scientific methods. He discusses several methods and introduces the common application and additional potential of a well-established combination of Neutron Activation Analysis and subsequent statistical analyses

that has been developed particularly with the problems of pottery production in mind.

The second part starts the regional discussions with a focus on China and its immediate periphery: the climbing kiln developed from the latter half of second millennium BC in the Jiangnan region. It is important in the history of the Chinese ceramics industry, and although its structure looks "primitive" at first sight, it has a structure that is superior to even the most refined "flat kiln" that is built of tiles or similar material because the heat is better kept inside the kiln chamber. Therefore, excellent ceramics like stamped hard pottery and proto-porcelain continued to be produced in this kiln type, and finally celadon was produced in these kilns. Jianming Zheng (Chapter 6) argues, while reviewing the major kiln complexes in the Jiangnan region, that the Dongtiao River Basin centering on Deqing area was outstanding in antiquity, in the size of its kiln complexes, the high firing temperatures, and the quality of its products, and occupied a highly significant position in the history of Chinese ceramics. He also points out that the steady technical basis for the emergence and development of celadon in the Han dynasty was established in this area. Michèle Demandt (Chapter 7) interprets the development of proto-porcelain in this region and time as a deliberate replacement of bronze goods by ceramic skeuomorphs in the Yue state. While replacement of raw materials is often interpreted as a necessity caused by inaccessibility of the original raw materials – bronze in this case – the Yue case is different and leads to a better understanding of the social role of ceramics in Chinese society. This proto-porcelain had been increasingly exported during the Western Han period and is nowadays discovered in burials in the Shandong area and in elite burials in the Lelang commandery on the Korean peninsula.

On the other hand, the "flat kiln" is used in North China, and Yūsuke Mukai (Chapter 8) describes its development, discussing how craftspeople began to divide into groups working for pottery kilns and those working for roof-tile kilns. The firing chamber of flat kilns is easy to widen and enlarge, which is appropriate for firing goods used in architecture like tiles and roof tiles. As the kiln shape and structure that were perfected during the Han period continued to be used for centuries without major changes mainly in northern China, the influence of roof-tile production technology and kiln structure had widely spread to East Asia. He presents the important view of a history of kiln technology in China that differs from the history of porcelain- and celadon-producing kilns. Daisuke Nakamura (Chapter 9) finishes the second part with a paper on the use of kiln-fired pottery in long-distance trade around the Yellow Sea and the East China Sea during the period from the third century BC to the third century AD. He discusses a potential value change in pottery and concludes as follows: The first widespread distribution was of large containers for transport, produced in the Liaodong and Shandong peninsulas. However, after the development of proto-celadon in the Jiangnan region, medium-sized long-necked jars were exported to other regions from the Han Dynasty onwards. In short, the wide distribution of pottery changed from pottery for transport to high-quality ceramics as trade goods. In addition to the rising value of ceramic itself, it seems to have been highly valued for drinking and spread to the high strata of societies.

In the course of the following centuries, the flat kiln spread to the north and was used in the steppe. Introducing the few examples yet known, Isao Usuki (Chapter 10) covers North Asia, especially the kilns of the Xiongnu empire from the end of the Western Han to the beginning of the Eastern Han period. These kilns were presumed to have emerged under the influence of kilns in the northern rim of the Han Dynasty. Among them, the Khustyn Bulag site that Usuki shows is of particular significance as this is the location of the first kilns whose detailed structure is known north of the Han Dynasty territory. Irina Zhushchikhovskaya (Chapter 12) describes the situation in the Primor'e region further to the East from earliest firing devices in prehistoric times, potential relations to the Korean peninsula in the first half of the first millennium AD to fully developed kilns of the Bohai period and later, covering a period between the first millennium BC and the thirteenth century AD. Her investigations include archeometric studies and discuss firing conditions and temperatures in flat kilns as well as climbing kilns – which both appear in this region and show interesting potential for understanding the relation to neighboring regions. Katsuhiko Kiyama (Chapter 11) picks up the period of the latter stage of Zhushchikhovskaya's paper, and finishes the discussion of North Asia with a regionally broader overview of developed flat kilns of the Khitans, introducing studies on the structure of flat kilns and the pottery produced. Based on a detailed examination of the pottery, Kiyama shows that the pottery production at Chintolgoi Castle built by Khitans was an amalgamation of pottery traditions of different origins, such as those of the Bohai and Uyghur.

The next two chapters discuss the spread of kiln technology and complex developments on the Korean peninsula. Kiln technology was introduced to the Korean peninsula during the Chinese Han period. In contrast to North Asia, kilns were introduced in order to produce pottery rather than tiles and roof tiles. It is a characteristic of pottery fired in kilns on the Korean peninsula that there is a gradual increase of firing temperature over time. The production of kiln-fired pottery starts in the Proto-Three Kingdom period (P-TKP) and stabilizes at the beginning of the Korean Three Kingdom period (KTKP). Sungjoo Lee (Chapter 13) states that the technology of kiln and potter's wheel were introduced in the early P-TKP and replaced the former, long-term and continuous ceramic technology tradition, a process that differed in each regional part of South Korea. Unlike in the Han River basin, where kilns were introduced late and different types of pottery were produced by different organizations, in the Nakdong River basin integrated production of Wajil ware (grey-colored and kiln-fired earthenware) mainly for offering in burials, and Yeonjil ware (orange-colored and mostly open-fired

earthenware) for daily use at an early stage can be observed. These aspects are the background to the regional differences in pottery production during the KTKP. Finally, Takafumi Yamamoto (Chapter 14) suggests, based on the political situation, that regional differences between the pottery styles and the borders of the kingdoms overlap each other, that the system of pottery production might have differed between these entities as well. Baekje adopted a dispersed production/urban accumulation system, while Silla adopted a centralized production/regional distribution system. It can be concluded that this distinction between the two states originated from differences in their social characteristics, political systems and ritual customs, including burial practices.

Kiln technology came to the Japanese archipelago at the end of the fourth century via the Korean peninsula; the kilns are all of the tunnel/climbing kiln type, which originated in Southeast China and is typical for East Asia. Tomoko Nagatomo (Chapter 15) describes the process by which, at first, a single line from Mahan-Baekje, preceding the emergence of the tunnel kiln type, enters the archipelago. However, only when kiln technology from Gaya was introduced again did it become established in the archipelago. The kilns are administered under the central political power that would become the Japanese state and develop constantly, diffusing all over Japan. Masa'aki Kidachi (Chapter 16) examines the structure of tunnel kilns (long chamber kiln) introduced to the Japanese archipelago as follows: During the early period in the Japanese archipelago at the end of fourth century, these tunnel kilns can be divided into a sunken or underground kiln and a semi-sunken or semi-underground kiln. The choice of sunken or semi-sunken kilns depended on the topography and geology in which the kiln was constructed. Sunken kilns are not easy to heat up but have the advantage of keeping the heat well. On the other hand, semi-sunken kilns – like surface kilns – have the advantage of being more efficient at raising temperatures while being responsive to the heat supply, which means that the temperature in the firing chamber rises and falls considerably. In the second half of the seventh century, these tunnel kilns developed the capability to draw the fire deep into the kiln with the invention of the upright flue.

Parallel to the expansion of the Ancient Japanese state to the south, the southernmost Sue kiln site center in Japan was established as one of the latest of its kind around AD 800 in today's Kagoshima prefecture. This region is particularly interesting because of its remote location and unique prehistory and historical development, in which the establishment of a Sue kiln site is of interest because of its social and political implications and its relation to the southern islands of Ryūkyū. Recently, questions and methods new to traditional Japanese Sue research have been introduced and combined with traditional methods and ideas in a larger international project, which is introduced by Naoko Nakamura (Chapter 17). This study bridges time and region to the last kiln site cluster, which is introduced by Akito Shinzato (Chapter 18), the Kamuiyaki kiln site center on Tokunoshima in the Ryūkyū Islands, a National Historic Site in Japan. Chronologically, the kilns bridge ancient Japan and the Middle Ages, displaying relations to the Korean peninsula in the North and islands south of Okinawa in the midst of vibrant international seafaring and exchange in the Middle Ages.

1.2. Terminology and transliteration

The final part of this book is a glossary that aims to unify the names and terms used in this book in such a way that the various research traditions are respected but the meaning is clear and shows the relation between the same phenomena with different names in different languages and traditions. Also, emphasis is on correct transliteration and writings in the original writing system. For Korean, Revised Romanization from South Korea is used; for Chinese, Pinyin without tone indicators; while for Japanese, Revised Hepburn is implemented with consistent declaration of long vowels like ō or ū in terminology as well as place names and personal names. Russian and Mongolian are transliterated according to the suggestions of the authors in a consistent way.

In order not to impose certain terminology on the authors, we leave the choice to the authors in their chapters, but in the glossary each term may redirect to another term that we suggest as standard. Where necessary, this entry links to the alternative entries. The editors chose terminology according to the following principles:

1. Avoid misleading translations.
2. Favor English terminology that conveys the meaning in the original language or the constitutive characteristics.
3. Avoid the application of names borrowed from one language in another cultural context.

We hope that the glossary, though short, may serve as a means to standardize terminology and naming in East Asian kiln research. Kiln terminology in a narrower sense is a complex problem because classification and terminology depend on different traditions and principles. This book cannot offer standardized terminology in that respect, but the following overview of research history and classifications in different research traditions may provide some orientation for readers.

1.3. Overview of the history of kiln construction and kiln research

1.3.1. Research history and classification of kilns in China

A History of Chinese Ceramics shows the change in pottery, kilns and their distribution from the appearance of pottery to the Qin dynasty period, resulting from accumulated research on the history of ceramics (edited by the Chinese Society of Silicates 1991). According to this book, early kilns with holes dug in the ground shifted from

side-hole (*ce kong shi*) to pit-type kilns (*tong xue shi*) (An & Zheng 1991: 5) (Fig. 1.1b), and later, the Mantou kiln (*mantou yao*), the circular kiln (*yuan yao*), and the dragon kiln (*long yao*) were developed.

Incidentally, around the 1920s Shinobu Komori was posted to China for work and investigated kilns all over China (Komori 1936). Komori classified Chinese kilns into two main categories, named in Japanese: the flat ground kiln (*hiragama*) in the north and the inclined kiln (*keishagama*) in the south. In addition, since the mixture of both types was seen in Jingdezhen (*Keitokokuchin*), it was defined as the Jingdezhen type. He changed the traditional name of Mantou kiln to the flat ground kiln (*hiragama*) and the climbing kiln in the southern area to the inclined kiln (*keishagama*), emphasizing the importance of the angle of the kiln floor. In addition, Komori argued that the southern kilns developed sequentially from the single-chamber tunnel kiln (*anagama*) to the large kiln (*ōgama*), the snake kilns (*jagama*), the double-chambered split bamboo kiln (*waritake-gama*) and the double-stokehole climbing kiln (*renbō-shiki noborigama*).

On the other hand, Zhenqun Liu focused on the flame flow in the kiln and categorized them according to a clear criterion (Liu 1982) into three categories: updraft kiln, with flame rising from the bottom to the top; semi-downdraft kiln, from the bottom to the ceiling and back to the smoke outlet near the floor; and flatdraft kiln, with flame flowing horizontally from the firebox to the firing chamber and down to the flue.

Haitang Xiong who is well versed in Japanese kilns, attempted to classify the kilns and investigate the diffusion of kilns in East Asia, including China, the Korean peninsula and the Japanese archipelago (Xiong 1995) (Fig. 1.1a). In particular, he focused on flatdraft kilns and presented a clear subdivision plan. It is important to note that this type of kiln, considered an advanced version of a flatdraft dragon kiln (type II), was classified as a semi-downdraft climbing kiln (type IV), which is different from a flatdraft kiln.

Masato Ozawa (1993) examined the updraft kiln, which Liu and Xiong did not subdivide. He focused on the passage (fire-way) length between the firebox and the firing chamber, in addition to the positional relationship between them. Ozawa divided the updraft kiln into three types (Fig. 1.1c) and introduced the semi-downdraft kiln to the four types as follows. Type A has a long fire-way that connects the firing chamber and the firebox. Type B has the firebox, dug deeply and distinguishable from the firing chamber and connected by multiple fire-ways. Type C has the firing chamber, which is located above the firebox, and the flame holes serve as the fire-ways. Type D has an integrated firebox and firing chamber and does not connect to a fire-way. After the transition from Type A to Type B and then to Type C, the emergence of Type D was shown to occur during the Western Zhou period.

Yoshiki Fukasawa attempted to classify kilns (Fukasawa 2011) from another perspective and focused on the presence or absence of an oven floor in the firing chamber that draws the flame from the firebox into the firing chamber. He categorized the updraft kiln as a kiln with oven floor. After dividing kilns with oven floor by the presence or absence of fire-way, the type with fire-way was divided by the shape of the fire-ways, and the type without fire-way was divided by the number and location of the supporting pillars for the oven floor. This classification clarified the structural problems with the oven floor. In other words, the larger the firing chamber for production of pottery and the larger the fire-way for providing heat, the more weakened the oven floor becomes. Another unique point of Fukasawa's classification is that it grouped the flatdraft dragon kiln and the semi-downdraft kiln as a kiln without oven floor, and furthermore, subdivided by the ratio of width to length: the broad-short kiln and the long-body kiln. It is quite different from division according to the flame flow (Liu 1982; Xiong 1995) or the slope of the firing chamber (Komori 1936; Ōkawa 1985). A broad-short kiln has a length equal to the width of the firing chamber, and a narrow-long kiln has a length of 2 to 16 times the width of the firing chamber. The latter was classified into two categories: round kilns that were almost flat with a firing chamber of round shape, and long-body kilns that were five or more times as long as the width of the firing chamber.

1.3.2. Classification of kilns on the Korean peninsula

The number of kilns excavated on the Korean peninsula has increased over the last few decades because of the increase in excavations associated with the development. Since the 2000s, the transition of kilns in the Baekje, Silla and Gaya regions has been studied in detail from various perspectives (e.g. Park 2001, Kim 2004, Kim 2007, Lee 2008, Zheng 2008, Choi 2010). However, while specific changes and differences between kilns of the same type within individual regions have been elucidated, because of the limiting focus on regions and time periods little attention has been paid to the differences between various regions, such as the difference between Silla and Baekje for example. Suggestions for a solution are discussed in the contributions of Chapters 13 and 14 in this book. Systematic classification of kilns covering a wide range of time and space in the Korean peninsula is scarce, and the Japanese classification of kilns has often been used, or categories based on the plan form have been proposed. Nevertheless, Lee Sungjoo has attempted to redefine the kilns of the Korean peninsula by using the Chinese classification based on the flame flow as described above (Lee 1991).

1.3.3. Classification of kilns in the Japanese islands

The terms "climbing kiln" (*noborigama*) and "flat kiln" (*hiragama*) have commonly been used for ancient kilns in the Japanese archipelago. However, Tsugio Mikami and

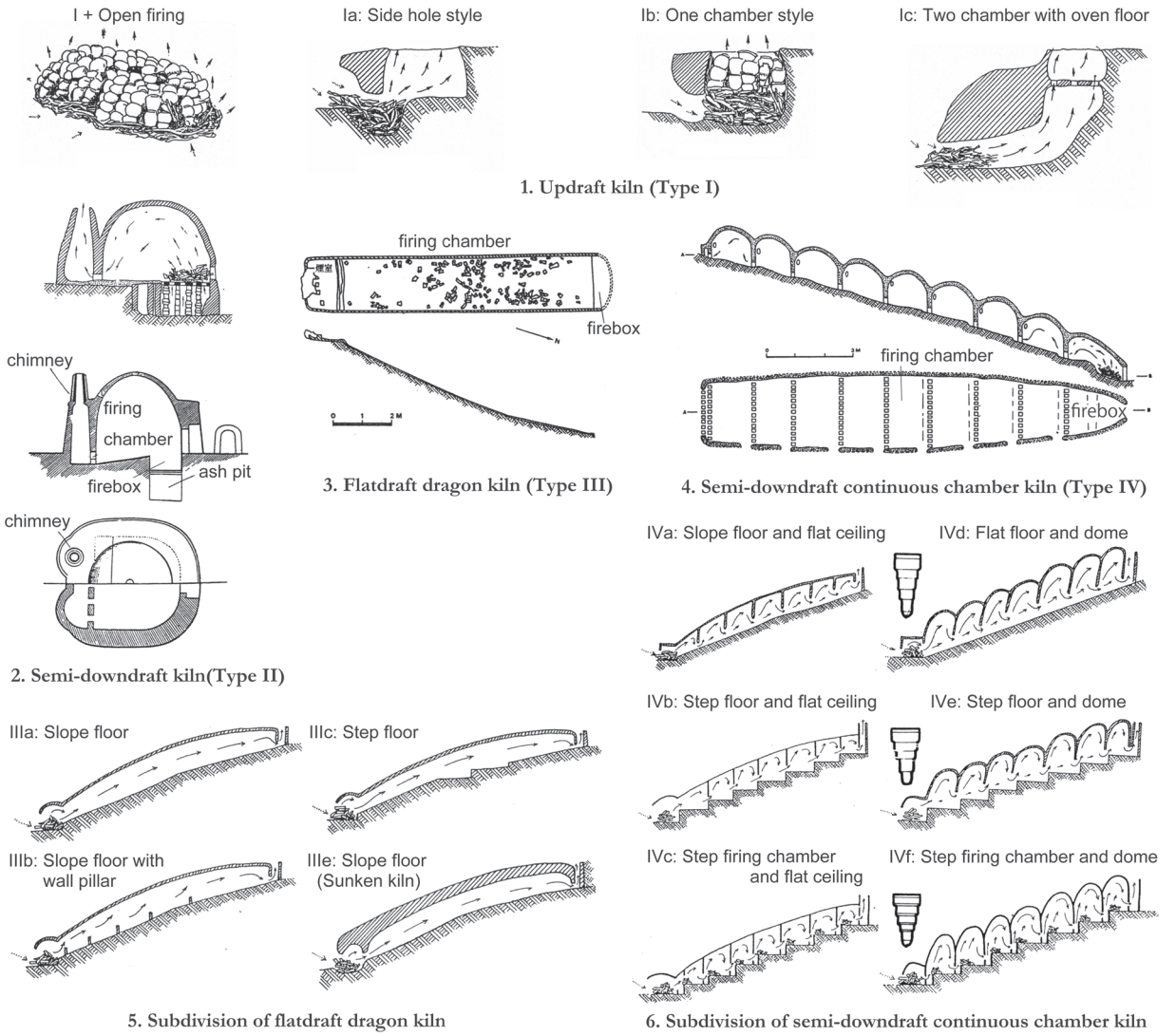

Figure 1.1. Kiln classification of previous studies.

Shōichirō Yoshida used the term "tunnel kiln" (*anagama*) instead of "climbing kiln" to avoid confusion since "climbing kiln" was used for a type of kiln with numerous connected firing chambers by ceramic researchers. Shinobu Komori, on the other hand, called a tunnel kiln one constructed underground. In addition, he included this kind of kiln as an inclined kiln (*keishagama*) which is constructed on the slope (Komori 1936).

Later, the Kiln Research Society collected information on Sue ware kilns and defined the term "tunnel kiln" (*anagama)* to distinguish them from the climbing kiln (Kiln Research Society 2004). This society supported Ōkawa's approach (Ōkawa 1985) and classified tunnel kilns into a type with wall and ceiling construction, also called "surface type" (*chijōshiki*), a type with only a ceiling construction, called "semi-sunken kiln" (*han-chikashiki*), and a type dug out completely without constructions, called "sunken kiln" (*chikashiki*). Furthermore, he divided them into several types according to the parts in their structure.

1.3.4. Classification of ancient kilns in East Asia

As described above, kilns have been classified according to the flame flow in China, and kilns in Japan have been classified according to the angle of the kiln floor and the kiln construction position (underground or surface). The differences in classification perspectives reflect the differences in kilns in each region, and neither of these classification standards is sufficient to cover all of East Asia. Therefore, the authors would like to propose classifying kilns based on the Fukasawa classification, considering the ancient kilns of China, Korea and the Japanese archipelago, using the unified criteria described below, based on an attempt offered by Nagatomo (2020) (Fig. 1.3, 1.4). After classification of kilns according to the presence or absence of the oven floor, kilns without oven floor are divided according to the definite but straightforward criteria of width and length of the firing chamber. Figure 3 shows the classification of ancient kilns in China, the Korean peninsula and Japan. Pit kilns and oven-floor kilns (updraft kiln) and kilns without oven floor

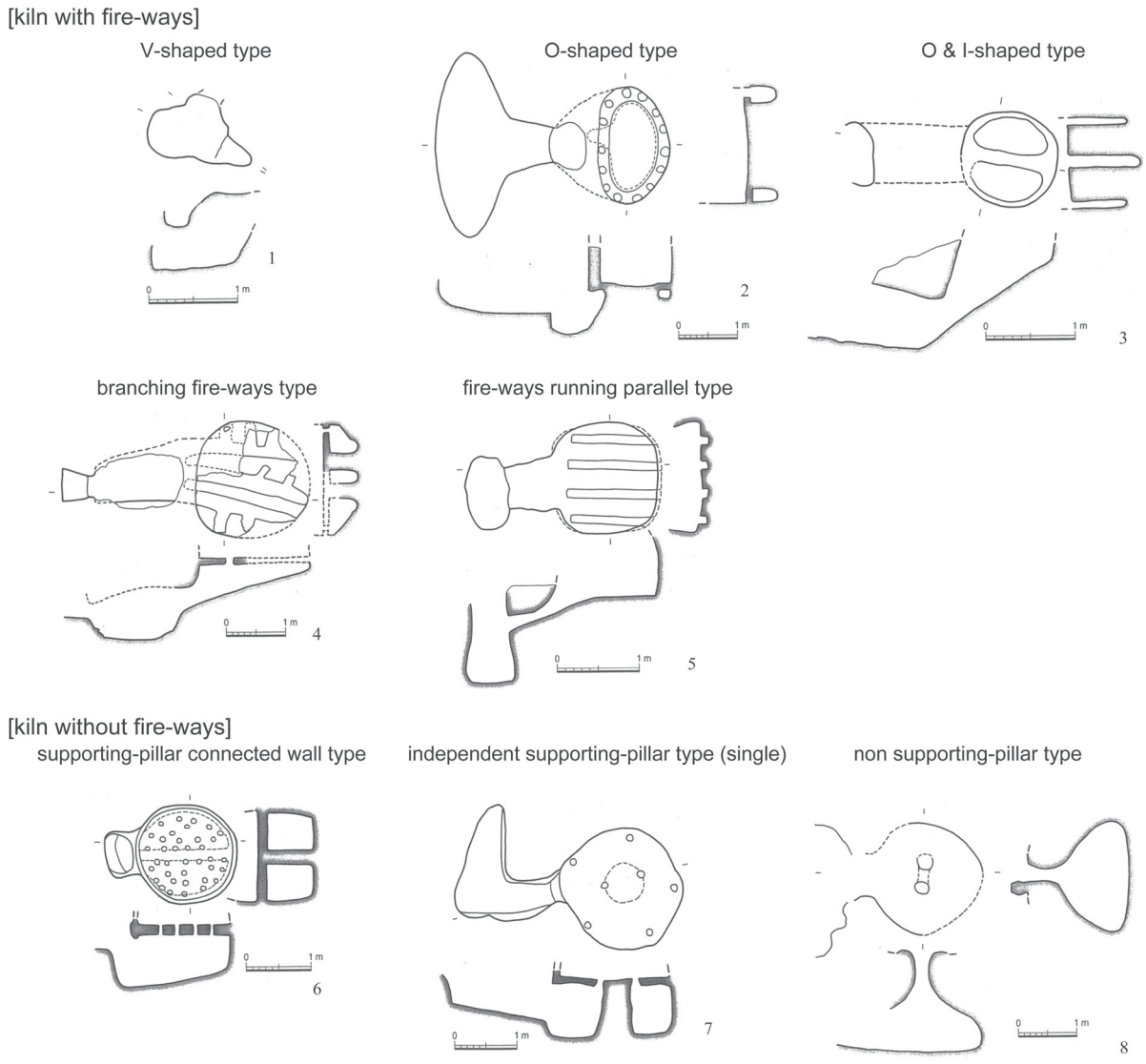

Figure 1.2. Examples of kiln with oven-floor types (after Fukasawa 2011).

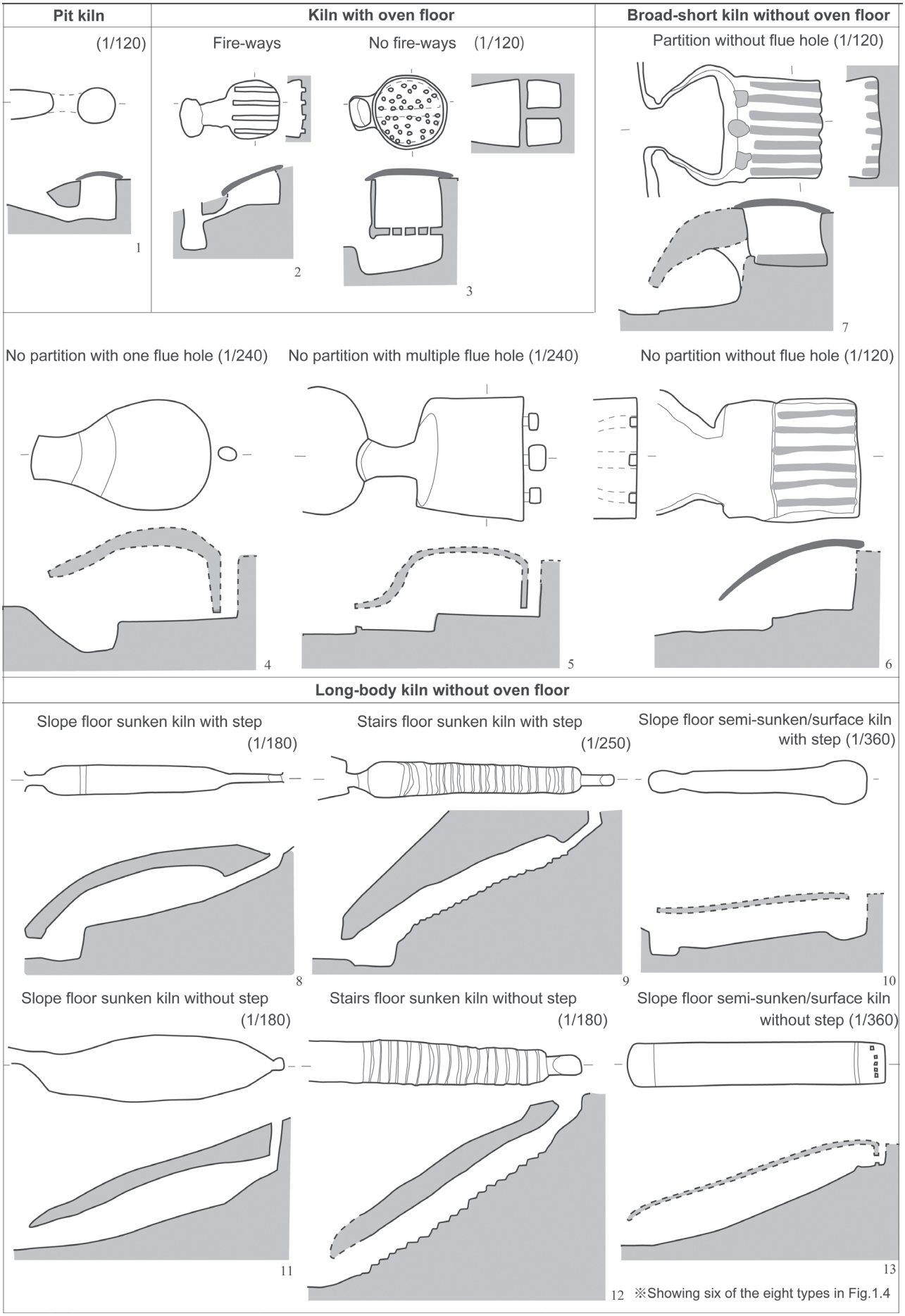

Figure 1.3. Classification of kilns (corresponds to Fig. 1.4) (Nagatomo 2020).

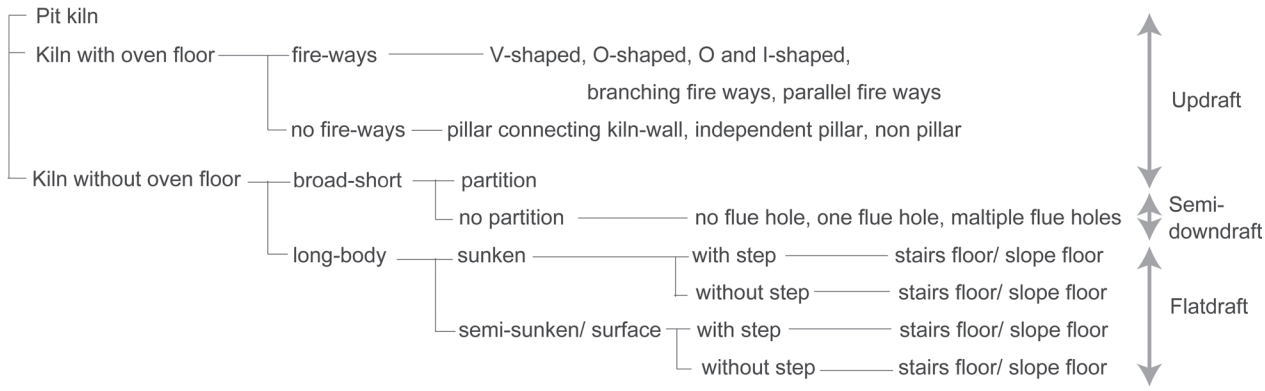

Figure 1.4. Classification of kilns in East Asia.

are broadly classified, and the kilns without oven floor are further subdivided into the broad-short kiln (flat kiln including semi-downdraft and updraft) and the long-body kiln (flatdraft dragon kiln).

Pit kiln

This type of kiln is constructed on a slope by digging a hole with an L-shaped cross-section (Fig. 1.3: 1). It is assumed that the lower horizontal hole is the stokehole and the vertical hole is the firing chamber. Fukasawa categorized this type as a round kiln among narrow-long kilns. Still, after examining the period of appearance and the structure in this paper, it has been independently categorized as a pit kiln.

Kiln with oven floor

This type corresponds to a typical updraft kiln without a fixed ceiling, which has an oven floor between the firebox and the firing chamber. Products are carried in and out of the kiln through the ceiling. The subdivisions follow Fukasawa's study (Fukasawa 2011). This type of kiln can be divided into two: a type with fire-ways (Fig. 1.3: 2) and a type without fire-ways (Fig. 1.3: 3). Furthermore, kilns with the fire-ways also are divided into three: two-way type (V-shaped, Fig. 1.2: 1) in which a single fire-way connects to a single firing chamber; ring type along with kiln-wall (O-shaped and O and I-shaped, Fig. 1.2: 2 and 3); multi-way type. Regarding the multi-way type, some have branching fire-ways (Fig. 1.2: 4), and others have fire-ways that run parallel to each other (Fig. 1.2: 5). Kilns without fire-ways are divided into the supporting-pillar connected wall type (Fig. 1.2: 6), the independent supporting-pillar type (Fig. 1.2g), and the non-supporting-pillar type (Fig. 1.2: 7). The independent supporting-pillar type has a single pillar or double pillar.

Broad-short kiln without oven floor

Basically, the space between a firing chamber and the firebox is one piece, and the length is up to twice the width of the firing chamber (Fig. 1.3). Most examples of this kind of kiln have a step between the firing chamber and the firebox. The kiln is divided into the sunken type and the semi-sunken/surface type. The latter can be subdivided according to the presence or absence of partition wall and flue (Fig. 1.3: 4–7). Those with partitions do not have a fixed ceiling (Fig. 1.3: 7), and those without partitions include kilns without a fixed ceiling (Fig. 1.3: 6). Therefore, some of the broad-short kilns without oven-floor show the flame flow from bottom to top, as in an updraft kiln. On the other hand, the flame flow in a broad-short kiln with a fixed ceiling is a semi-downdraft.

Long-body kiln without oven floor

This kind of kiln is flatdraft in flame flow (Fig. 1.3: 8–13). It is divided into the sunken type and the semi-sunken/surface type. The firing chamber and firebox are one unit, and the length is at least twice the width of the firing chamber. In addition, the presence or absence of a step between the firebox and the firing chamber can be observed, besides the presence or absence of a stairway on the floor of the firing chamber.

Although each chapter of this book uses a standard classification for the field, if the classification presented in the present chapter is kept in mind, this classification may help in understanding the structure and lineage of the kilns discussed in each case. The authors hope this will help in the reading of this book.

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