A Potter's Story: Blue-and-White Porcelain Production Beyond the Imperial and Non-Imperial Divide in Ming-Period Jingdezhen (1368–1644)



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Abstract

This thesis questions the 'imperial' versus 'non-imperial' framework that has dominated studies of Ming-period blue-and-white porcelain production in Jingdezhen since the late nineteenth century. Originating in European collecting circles and reinforced by a predominately historical reading of textual accounts, this divide, also framed in existing scholarship as a distinction between 'official' (*guan*) and 'folk' (*min*) production and wares, projects administrative and consumption-based categories onto the material evidence of manufacture. Yet the potters who made these objects remain largely invisible, together with their knowledge and skills exercised in the act of making.

This thesis reassesses the divide by treating new archaeological and archaeomaterial evidence as independent source, rather than through historiography-oriented scholarship alone. To do so, it integrates four methods: hermeneutic reading of textual accounts, comparative analysis of archaeological features, archaeomaterial study of published compositional datasets on porcelain bodies, and ethnographic fieldwork in present-day Jingdezhen. A case study of dragon bowl manufacture brings these methods together to examine how potters navigated the technological challenges posed by unprecedentedly large vessels commissioned for the Ming imperial court.

The findings converge on a single conclusion: the imperial and non-imperial divide does not correspond to two distinct modes of production. Textual accounts show that imperial production depended on the resource networks and process specialisation rooted in local ceramic manufacture. Archaeological features across manufacturing sites show shared practices of kiln-waste reuse, pottery wheel foundation construction, and kiln modification, alongside site-specific variation that does not track the supposed divide. Compositional analysis shows that the characteristics associated with high-quality porcelain bodies apply neither exclusively to pieces classified as 'imperial' nor consistently across that category. Instead, they resulted from potters' adaptive management of locally variable raw materials. Dragon bowl manufacture confirms that the expertise on which these vessels depended was embedded in local production communities that sustained the new demands posed by imperial commissions.

On this basis, I propose an alternative framework that centres potters as agents within an integrated production system, defined by three features: material grounding in the local geological landscape, knowledge-based practice sustained by embodied expertise, and labour organised through process-specialised communities of practice. This maker-centred framework reframes what has been treated as a categorical divide as variation within a single field of production shaped by different relationships between producers, sponsors, and consumers. Beyond Jingdezhen, the thesis contributes to wider discussions of craft production and material engagement. It demonstrates the theoretical significance of embodied knowledge and practice as the operative core of making, and the methodological value of ethnographic parallel grounded in the constancy of material constraints for recovering such knowledge from the artefacts their makers produced.

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List of Abbreviations

BPM: Beijing Palace Museum 故宫博物院

IACASS: Institute of Archaeology, Chinese Academy of Social Sciences 中國社會科學院考古研究所

JCARI: Jingdezhen Ceramic Archaeological Research Institute 景德鎮市陶瓷考古研究所

JPCIRI: Jiangxi Provincial Ceramic Industry Research Institute 江西省陶瓷工業科學研究所

JPICRA: Jiangxi Provincial Institute of Cultural Relics and Archaeology 江西省文物考古研究院

NCA: National Centre for Archaeology 國家文物局考古研究中心

SAM-PKU: School of Archaeology and Museology at Peking University 北京大學考古文博學院

Time Periods of Chinese Dynasties

Dynasty	Year
Zhou	1046–256 BC
Qin	221–206 BC
Han	202 BC–AD 220
Six Dynasties Period	AD 222–589
Sui	AD 581–618
Tang	AD 618–907
Five Dynasties and Ten Kingdoms	AD 907–960
Northern Song	AD 960–1127
Southern Song	AD 1127–1279
Yuan	AD 1271–1368
Ming	AD 1368–1644
Qing	AD 1644–1912

Ming-Period Chronology

Period	Year
Hongwu 洪武	AD 1368–1398
Jianwen 建文	AD 1399–1402
Yongle 永樂	AD 1403–1424
Hongxi 洪熙	AD 1424–1425
Xuande 宣德	AD 1426–1435
Zhengtong 正統	AD 1436–1449
Jingtai 景泰	AD 1450–1457
Tianshun 天順	AD 1457–1464
Chenghua 成化	AD 1465–1487
Hongzhi 弘治	AD 1488–1505
Zhengde 正德	AD 1506–1521
Jiajing 嘉靖	AD 1522–1566
Longqing 隆慶	AD 1567–1572
Wanli 萬曆	AD 1573–1620
Taichang 泰昌	AD 1620
Tianqi 天啟	AD 1621–1627
Chongzhen 崇禎	AD 1628–1644

Chapter 1 Introduction

1.1 Research background

1.1.1 Jingdezhen blue-and-white porcelain and the 'imperial' versus 'non-imperial' framework

By the Ming period, Jingdezhen, a small town in Fuliang County, Raozhou Prefecture in Jiangxi Province, had become the world's foremost centre of porcelain production (Figure 1-1). Of its varied products, blue-and-white porcelain—a high-fired ceramic with underglaze cobalt decoration and translucent glaze—was among the type of material most widely circulated across overland and maritime networks in the early modern world. Extensive research has been conducted on how Ming blue-and-white wares were physically and conceptually transformed as they moved across geographical and cultural boundaries (e.g., Carswell, 2000; Finlay, 2010; Pierson, 2013; Marchand, 2020). Less thoroughly explored, however, is how these same objects came to be categorised and valued within the divide of 'imperial' versus 'non-imperial' porcelain, an interpretive framework that has proved profoundly influential from the nineteenth century to the present day.

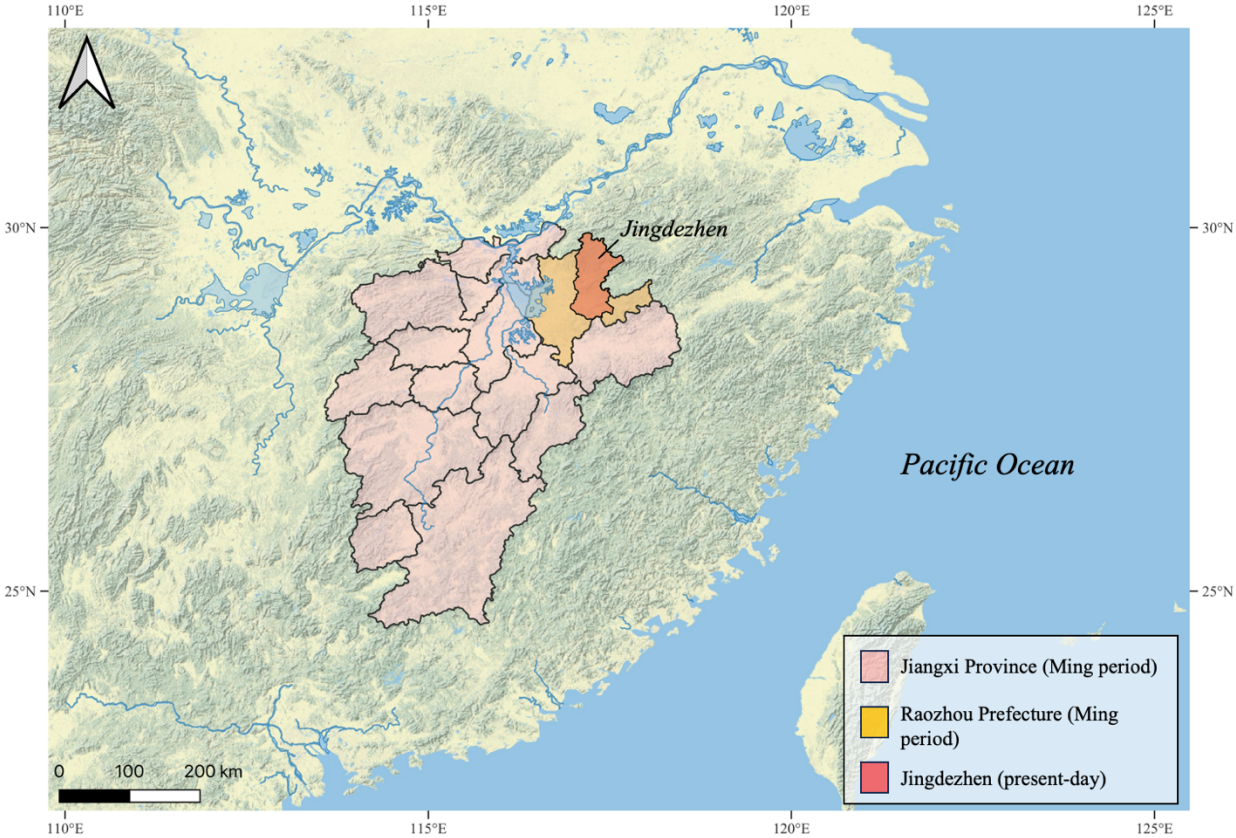


Figure 1-1: Jingdezhen within the Ming-period administrative and geographic landscape. Boundaries of Jiangxi Province and Raozhou Prefecture are derived from the China Historical Geographic Information System (CHGIS, version 6).[1]

The framework first emerged in European collecting circles from the late nineteenth century, when pieces acquired through military plunder of the imperial palace in Beijing entered Western markets and could be distinguished from the export wares that had long circulated through commercial trade (Pierson, 2010, 2017). These pieces were understood as imperial porcelain used by the emperors of the Ming and Qing periods, representing a standard of 'imperial quality' (*ibid.*). To categorise and appraise such pieces, European collectors and scholars drew extensively on Chinese historical texts, which traced the provenance of these imperial wares to Jingdezhen, provided detailed descriptions of their appearance, and assessed their production quality, aesthetics, and monetary value as superior to those of export wares (e.g., Bluett, 1933; Garner, 1954; Hobson, 1978; Brankston, 1982). The resulting classification criteria rested on subjective assessments of production characteristics (such as body, glaze, and finishing) as well as stylistic features (such as shape and decoration). Although some scholars have challenged these classification methods and their reliance on textual accounts (e.g., Pope, 1956; Lion-Goldschmidt, 1978), such critiques remain rare. The characteristics identified in these imperial wares thus became the benchmark against which all other Jingdezhen products were measured, and what fell outside it became, by default, 'non-imperial' porcelain. When at a later point certain sub-sets of non-imperial wares such as 'export porcelain' or 'armorial porcelain' received attention, they were classified by shape and decoration relative to other pieces within the same category, rather than being compared with imperial wares in ways that might have questioned the divide itself (e.g., Le Corbeiller, 1974; Jörg, 1982; Rinaldi, 1989; Curtis, 2006).

1.1.2 From imperial porcelain to imperial production: the Yuyaochang site

As local scholarship in Jingdezhen developed further, the focus on so-called imperial porcelain remained. In 1973, following infrastructure construction in the city centre, archaeological surveys and excavations began at Pearl Hill (珠山), where numerous sherds of imperial porcelain identical to pieces housed in the imperial palace collection had already been exposed

[1] The administration boundary of Jiangxi Province underwent minor changes over the course of the Ming-period. The boundary shown here corresponds to the mid-sixteenth century. As Ming-period boundary data for Jingdezhen is not yet available in the CHGIS database, the present-day municipal boundary is used for reference.

(Liu, 1993). Local potters had collected such sherds for the purpose of imitation since the early twentieth century, as imperial porcelain carried high monetary value in antique markets—a value largely promoted by European, and especially British, collectors (Brankston, 1939).

Over the subsequent fifty years of archaeological fieldwork at Pearl Hill, today known as the Yuyaochang site, the excavated porcelain sherds were studied in comparison with the Ming imperial court collection, now housed in the Palace Museum, Beijing (BPM *et al*., 2015a; 2015b; 2016; 2017; 2018; 2019). The principal aim was to establish period-specific characteristics for each reign by matching excavated sherds, datable through stratigraphic evidence, with pieces in the imperial palace collection through comparison of stylistic features and reign-period inscriptions. In this approach, the imperial palace collection served as both the basis on which imperial porcelain was defined and the reference against which excavated materials were identified as such, so that archaeological materials could only confirm or refine, not challenge, the existing classification framework.

Even more problematic is the interpretation of the site itself, which came to be identified as the location of the *Yuqi chang* 御器廠 (Imperial Porcelain Workshop), a government institution established during the Ming period for the dedicated production of imperial porcelain. When such porcelain was excavated at Pearl Hill, the site was understood as the physical manifestation of this historical concept. In existing scholarship, which remains predominantly historical in orientation, the organisation of imperial production in Jingdezhen has been understood primarily through textual accounts of state administration of production costs and labour (e.g., Jiang, 1959; Medley, 1966; Dillon, 1976; Liang, 2004; Wang, 2010; Arai, 2018), and findings at Yuyaochang have been interpreted within this textual framework rather than as an independent source of evidence (e.g., Liu, 1989; Wang, 2011; Qin *et al*., 2017; Jiang, 2020a; Gao and Qin, 2024). The conflation of the historical institution with the archaeological site has obscured the possibility that manufacture at this location extended beyond what the current understanding of imperial production encompasses.

1.1.3 Rethinking the imperial versus non-imperial divide from a maker-centred perspective

Current classification and interpretation of imperial porcelain and production have a direct consequence for how porcelain and production falling outside this category are understood. The category of ‘non-imperial’ has never been defined on its own terms but only residually, as

whatever falls outside the 'imperial.' This negative definition has left the category without stable criteria. As the following discussion of its production- and consumption-based meaning shows, the divide proves unstable from either perspective, and the categories are increasingly recognised as interconnected rather than distinct.

From a production perspective, 'imperial' denotes state-sponsored manufacture overseen by government administration. In this regard, the term is often used interchangeably with 'official' (*guan* 官), which refers to the government institutions and appointed officials responsible for production supervision, though the levels and specifics of such supervision may have varied considerably across different periods (Wang, 2004a; 2004b, pp. 11–21). When imperial production is defined by administrative oversight, non-imperial production is understood as what was organised and conducted by the 'people' (*min* 民), whose production is often rendered in current scholarship as folk production—that is, potters in Jingdezhen producing for household use or for exchange for their subsistence, whether by selling their products or their labour. The fluidity between official production (*guanyao* 官窯) and folk production (*minyao* 民窯) is already evident in historical scholarship's reading of the primary textual accounts, which describe skilled potters moving between *guan* and *min* production and carrying manufacturing knowledge and technique with them (e.g., Liang, 1991; Fang, 2002; Wang, 2010, pp. 136–138; Gerritsen, 2020, pp. 175–194; Hu, 2024).[2]

From a consumption perspective, 'imperial' refers in its narrowest sense to porcelain destined for the emperors' personal use (*yu* 御), and in a broader sense to wares ordered by the emperors that could subsequently be gifted, redistributed, or change hands through other channels. In current scholarship, imperial porcelain is identified in terms not substantially different from those established by European collectors in the late nineteenth and twentieth centuries, relying largely on stylistic features and subjective assessments of production characteristics (e.g., Liu, 1989, 1993; Geng, 1993; Lu, 2007; Quan, 2009; Li, 2012; Jiang, 2020a). What has been labelled 'non-imperial' porcelain, by contrast, encompasses a heterogeneous range of materials recovered beyond imperial contexts, including shipwrecks, ports, hoards, and burials linked to

[2] The character *yao* 窯, although commonly translated as 'kiln', is frequently used in Chinese historical texts to refer not only to the physical kiln structure but also to the wares produced in it, and by extension ceramic production more broadly. Throughout this thesis, *yao* is translated according to its specific usage in each textual or scholarly context.

trade or to individuals without direct imperial connections (e.g., Huang, 1986; Chen, 2017; Peng, 2018). In practice, scholars have tended to associate such materials with freer brushwork, decoration motifs drawn from vernacular culture, and what is judged to be inferior production quality—in short, whatever imperial porcelain is not. Yet even from a consumption perspective, the boundary between imperial and non-imperial porcelain has been blurred by recent findings, which suggest that the same objects or designs could serve multiple functions across different consumption contexts (e.g., Xiang, 2018; Liu, 2020; Wang, 2025), or that the same raw materials could be drawn on for both imperial and other production (e.g., Xu *et al*., 2025).

These production- and consumption-based definitions of 'imperial' and 'non-imperial' have been conflated in the interpretation of archaeological evidence. Ming-period blue-and-white porcelain manufacturing sites in Jingdezhen have been classified as either imperial or non-imperial. These classifications rest not on how production was organised but on the consumption contexts projected onto the unearthed sherds. Recent discoveries of imperial porcelain at non-imperial sites, and of non-imperial porcelain at Yuyaochang, expose the limits of this binary framework (e.g., JCARI *et al*., 2020; JPICRA *et al.*, 2024b; BPM *et al*., 2024b). These overlaps are not simple anomalies but evidence that the imperial versus non-imperial divide is a conceptual construction imposed on what were, in practice, far more entangled processes of manufacture than the current framework allows.

This entanglement points to a deeper problem. Because classification of Jingdezhen porcelain has been seen through administrative and consumption lenses, the people who actually made these objects have remained largely invisible. Even where studies have addressed how porcelain was made, their treatment of it remains organised around wares produced under 'imperial patronage' or 'official control' versus those made for broader domestic and overseas markets (e.g., Medley, 2001, pp. 192–239; Kerr and Wood, 2004, pp. 184–239), a framing that stays within the imperial versus non-imperial divide. On neither side of this divide have Jingdezhen potters been fully examined as agents of production. Their technological practices have been reconstructed, but not the initiatives, constraints, and production choices that shaped the very objects that scholars have subsequently sorted into opposing categories. Gerritsen's (2020) work on Jingdezhen blue-and-white has begun to address this gap, redirecting attention from the taxonomic distinctions between different manufacturing sites and product categories to the knowledge and expertise that circulated between them.

This thesis takes up this task by proposing an alternative framework, one that moves beyond the divide to understand Jingdezhen's porcelain manufacture as an integrated system and to recover the role of potters within it. Where existing scholarship has shown overlaps across the divide, whether in raw materials, labour, or consumption, it draws on new archaeological and archaeomaterial evidence of production to show that the interconnection is systematic, extending across the manufacturing strategies and practices through which porcelain was made. As the analysis will show, this system was materially grounded, knowledge-based, and organised through process-specialised communities of practice that transcended administrative and consumption-based boundaries.

1.2 Research questions

To reassess the imperial and non-imperial divide through the material evidence of porcelain manufacture, including both museum objects and new discoveries from recent excavations in Jingdezhen, this thesis is organised around three research questions.

First, to what extent, if at all, can the imperial versus non-imperial divide be sustained when applied to the production of Ming-period blue-and-white porcelain in Jingdezhen? This question examines the framework identified in Section 1.1 against the material evidence. It also reassesses the historical texts on which previous archaeological interpretations of porcelain manufacture in Jingdezhen have relied, texts that have centred predominantly on imperial production. If a meaningful distinction between imperial and non-imperial production existed, it should be observable in the processes through which porcelain was made, or in the characteristics of the finished wares. This question asks whether such distinctions can in fact be identified, and if so, whether they correspond to differences in intended consumers or in the degree of administrative oversight.

Second, what does the material evidence of porcelain production show when examined independently of the imperial versus non-imperial framework? Rather than beginning from consumption-derived categories and working backwards to production, this question takes the direct material evidence of Ming-period Jingdezhen blue-and-white porcelain production, including archaeological features at manufacturing sites, the compositional properties of porcelain bodies, and production traces preserved on finished wares as its starting point. It asks what patterns, variations, and traditions emerge across Jingdezhen's porcelain production when

the evidence is read on its own terms, and what these suggest about how potters made production choices and responded to different demands.

Third, if the binary framework cannot adequately account for the material evidence, what alternative interpretive approach can better address the complexity of porcelain production in Jingdezhen? This question builds on the findings of the first two. Where the first tests the existing framework and the second examines the evidence afresh, the third asks what kind of framework is needed to account for the entanglement of practices across supposed imperial and non-imperial boundaries. It also asks how such a framework can make visible potters as conscious agents within manufacture. Although this question arises from the Jingdezhen case, it engages with a broader problem in the study of craft production and material engagement—how to recover the embodied knowledge and decision-making processes of practitioners whose expertise was exercised in the act of making.

1.3 Theoretical frameworks

To address these questions, this thesis draws on three interrelated theoretical frameworks: *technological choice*, *cultural technology*, and *communities of practice*. Together, they provide a means of examining blue-and-white porcelain production in Jingdezhen from the perspective of the potters who carried it out, rather than from the administrative or consumption categories that have structured existing scholarship.

1.3.1 Technological choice

The concept of *technological choice*, introduced by Lemonnier (1986), understands the attributes of artefacts as outcomes of choices made by their makers. In the case of ceramics, potters determine the properties of finished wares through their choice of raw materials, forming techniques, decoration, and firing conditions (Santacreu, 2014, p. 53). These choices are not purely technical but are shaped by a range of environmental, material, socioeconomic, and functional constraints (Rice, 2015, p. 324). Because any given piece of porcelain is the product of a specific sequence of such choices, decisions at one stage of that sequence can also alter the possibilities available at subsequent stages (Schiffer and Skibo, 1997; Sillar and Tite, 2000; Schiffer, 2004). Applied to Jingdezhen, this concept allows the material evidence of porcelain production to be read not as a reflection of administrative or consumption categories, but as a record of decisions made by potters responding to material, economic, and social

conditions that cut across the imperial and non-imperial divide. If distinctions between so-called imperial and non-imperial production are attributable to differences in technological choice, those differences should be identifiable in the production sequence and the finished products. If they are not, the distinction rests not on how porcelain was made but on how it was subsequently categorised and valued.

1.3.2 Cultural technology

Technological choices do not occur in isolation. Lemonnier (1986, p. 180) further argues that the material aspect of technologies is closely related to the characteristics of the societies which developed them. The production of artefacts therefore needs to be understood within the system of cultural technology—not as the use of tools and techniques alone, but as techniques exercised by human actors in specific social contexts, which in turn shape those actors through the processes of making (Lemonnier, 1986; Bray, 1999). This concept has been developed further by various scholars along divergent but interlinked paths, two of which deserve particular notice.

The first concerns the relationship between maker and material. Gosden and Malafouris (2015), through the framework of Process Archaeology, shift attention from what artefacts are to how they come into being. Where technological choice treats production as a sequence of decisions, Process Archaeology foregrounds the ongoing interaction between makers and their materials—the ways in which potters respond to the properties and behaviour of clay, glaze, and decorating pigments, and the ways in which those materials in turn constrain and redirect the makers' actions (*ibid.*). As this perspective draws attention to the improvisatory and responsive dimensions of craft practice, it is helpful to recover the dimension of production which attends to the practical, embodied knowledge and skills through which potters made porcelain, beyond the prescribed sequence of how porcelain was supposed to be made.

The second path concerns the social embeddedness of technology itself. Ingold (2000) argues that in practice, technical relations are embedded in social relations and can only be understood within that relational matrix. The technical is not a separate domain but one aspect of the social. Pollard and Gosden (2023, p. 10) develop this position for archaeology, arguing that all social relations involve making, using, and exchanging material things, and that the skills involved in producing objects are inseparable from the skills of building and sustaining relations with

people. They also challenge progress-based narratives in the history of technology—the assumption that technological development follows an inevitable trajectory from simple to complex, or that the quality of products can be scaled along a single axis of advancement (Pollard and Gosden, 2023, pp. 3–4, 22). This challenge is directly relevant to the study of Jingdezhen porcelain, where the distinction between imperial and non-imperial has long carried an implicit hierarchy of 'quality' that has rarely been questioned on technological grounds. This thesis takes up that challenge, examining whether the supposed quality distinction holds when tested against the compositional and technological evidence of production itself.

1.3.3 Communities of practice

Finally, this thesis applies the framework of *communities of practice* to understand the potters themselves as a community constituted through shared engagement in production, whether they worked individually or in groups. Despite divergences in how the concept has been theorised (for a summary, see Cox, 2005), its core premise offers a productive way of centring potters even where individual voices are absent from surviving textual and material records. Knowledge and skill, the premise holds, are developed and transmitted through sustained mutual engagement in a shared practice—a process that can leave material traces in production sites and finished products. The framework foregrounds potters as active participants in developing and transmitting knowledge, rather than as passive workers within imperial or non-imperial production. In this thesis, the framework is applied by identifying shared material knowledge and production practices among Ming-period Jingdezhen potters, using archaeological, archaeomaterial, and ethnographic evidence to trace the community that these shared practices constitute.

1.4 Methods and materials

To address the research questions posed above within the framework just outlined, this thesis draws on four complementary methods: historiographical analysis of textual sources, comparative analysis of archaeological features, archaeomaterial study of porcelain bodies, and ethnographic fieldwork. As established in Section 1.1, existing classifications of Jingdezhen blue-and-white porcelain rest on a conflation of production- and consumption-based definitions, in which administrative categories and consumption contexts have been projected onto the material evidence of manufacture without independent verification. Disentangling these requires methods capable of examining evidence from production on its own terms. Each

method and its associated materials addresses a dimension of porcelain production that the others cannot capture independently.

1.4.1 Historiographical research

While previous scholarship has benefited from significant compilations that collect, collate, and annotate the extensive textual accounts of Jingdezhen porcelain production (Feng, 2000; Kerr and Wood, 2004, pp. 12–39; Xiong and Xiong, 2006; Chen and Yu, 2013; Chen, 2015), these works rarely analyse sources from the perspectives of authorship or readership. The agendas of their authors, their intended audiences, social positions, and knowledge sources all shaped the technical knowledge these texts recorded and how their authors perceived the relationship between imperial and non-imperial production.

This thesis therefore examines textual accounts of porcelain production in Ming-period Jingdezhen following Schrag's (2021) critical reading framework, which evaluates texts through four dimensions: *agenda* (identifying the specific need the text addressed and its intended audience), *credibility* (assessing potential factual inaccuracies), *nuance* (examining which information and arguments the author chose to present), and *context* (understanding the full background of events and subjects described). The four dimensions provide a structured approach to reading these texts critically—an approach that is particularly necessary for a study that seeks to re-examine how textual accounts have shaped interpretation of material evidence. A critical reading also recovers what the material records cannot show, the administrative organisation and detailed arrangements of production that the archaeological evidence does not preserve, while remaining alert to the institutional agenda through which the texts recorded them.

1.4.2 Comparative analysis of archaeological features

As discussed in Section 1.1.2, Ming-period blue-and-white porcelain manufacturing sites in Jingdezhen have been classified as either imperial or non-imperial on the basis of the consumption contexts projected onto their unearthed sherds, rather than on the basis of how production was conducted at these sites. To assess whether this classification corresponds to observable differences in production, Chapter 3 conducts a comparative analysis of production features across four Ming-period manufacturing sites: Yuyaochang, Guanyinge, Luomaqiao, and Hutian. These four were selected from a broader survey of thirty-nine sites identified as

containing evidence of Ming-period blue-and-white porcelain production, on the basis of documentation quality and the range of production evidence preserved. The comparison examines four categories of production features (walls, evidence for the use of pottery wheels, kilns, and kiln waste deposits) that represent different stages of porcelain manufacture from spatial organisation and forming to firing and post-firing disposal. For each category, construction methods, materials, scale, and stratigraphic sequences are compared across sites, drawing on published excavation reports. This analysis can inform differences in construction investment, production priorities, and disposal practices, but it does not claim to reconstruct how production was organised or administered. Chapter 3 also addresses the limits of feature analysis, given that many similarities across sites reflect common practical responses to shared manufacturing requirements rather than distinctive production traditions.

1.4.3 Archaeomaterial research

This thesis conducts an archaeomaterial study of Ming-period Jingdezhen blue-and-white porcelain bodies to test whether the binary classification of imperial and non-imperial porcelain reflects actual production differences (Chapter 4). The study analyses published compositional datasets, taking raw material selection and paste preparation as indicators of technological practice. It shifts the basis of comparison from visual and stylistic judgement to measurable material properties, providing an independent means of assessing whether currently classified 'imperial' and 'non-imperial' wares are technologically distinct.

Beyond porcelain bodies, existing quality-based classification criteria for 'imperial' and 'non-imperial' porcelain include other visual characteristics concerning cobalt pigment colouring effects and glaze. The mechanisms that produce these characteristics are complex and multifactorial, which deserve dedicated research beyond the scope of this thesis. The provenance of cobalt ores for Ming-period blue-and-white porcelain has been extensively studied (e.g., Wen *et al.*, 2007; Wen and Pollard, 2016; Matin and Pollard, 2017; Jiang *et al.*, 2020), but the colouring effect of cobalt pigment results from an interplay between the elemental composition and crystal structure of pigment particles, the size and distribution of those particles, the density of surrounding anorthite crystals, and the colour of the overlying glaze itself (Pinto *et al.*, 2020). Glazes present further complications as open systems whose measured composition changes during firing through interaction with the body and decoration pigments (Wen *et al.*, 2007; Pradell and Molera, 2020). The visual effect of a glaze can also

depend on differences in kiln operation, or even post-depositional alteration (Freestone, 2001; Coutinho *et al.*, 2022). The study of porcelain bodies thus serves as a necessary starting point for reconsidering existing classification criteria for finished products, while full investigation of these domains is identified as a direction for future research.

1.4.4 Ethnographic research

To understand the technological knowledge and choices of Jingdezhen potters, ethnographic fieldwork was conducted in Jingdezhen across two periods, from April to May 2023 and from April to June 2024. The fieldwork was approved by the Central University Research Ethics Committee (ethics reference R84820/RE001). The fieldwork comprised two phases. The first was an exploratory study of all stages of blue-and-white porcelain production, structured by a *chaîne opératoire* (production-sequence) approach. The *chaîne opératoire* is a conceptual tool that organises all phases involved in the manufacture of ceramics, relating the materials, techniques, and knowledge that potters bring to each stage of the production process (Santacreu, 2014, pp. 49–55). Applied as a fieldwork methodology, it orders and compares the multiple technical choices made by potters across the entire process, making explicit how decisions at one stage constrain or enable choices at subsequent stages. Through direct observation and semi-structured interviews, the author attends in particular to this interconnectedness, which is rarely documented in published ethnographic works that tend to focus on specific techniques within individual stages (e.g., Fang, 2002; Chen, 2004; Bai, 2005; Zheng, 2022). These insights informed the second phase: the development of a case study of dragon bowl production (Chapter 5), with particular attention to raw material selection, paste preparation, and forming processes.

The use of ethnographic evidence to interpret past production carries well-recognised methodological risks, including playing down historical contingency and masking cultural specificities (Gosselain, 2016). The strength of any ethnographic comparison, however, depends not on surface similarities between past and present but on relational analogies grounded in demonstrable structural connections between the cases compared (Wylie, 1985; Hamilakis, 2016). As Roux (2017) and Lyons and David (2019) argue, when such connections are carefully specified and their boundaries made explicit, ethnographic research remains essential for interpreting material evidence, such as production traces, forming marks, and raw material choices, that textual and archaeological sources alone cannot fully explain. This thesis

adopts that principle: ethnographic evidence is drawn upon where the physical properties of raw materials and the technical demands of porcelain production provide the relational basis for comparison, while the different social and economic conditions under which modern and Ming-period potters worked define the limits of what such comparisons can claim. These limits are addressed in Chapter 5 (Section 5.2.1) and the methodological contribution as a whole is further discussed in Chapter 6 (Section 6.2).

Beyond Chapter 5, published ethnographic data and the author's own documentation are drawn upon also elsewhere in this thesis. In these instances, ethnographic evidence serves as illustration, providing concrete examples of how certain mechanisms or practices may have operated. Where ethnographic evidence is used to inform historical processes, the basis for comparison is made explicit and differences between past and present conditions are addressed.

1.5 Thesis structure and chronological scope

This thesis examines Ming-period blue-and-white porcelain production in Jingdezhen across four chronological periods: early Ming (Hongwu to Xuande, 1368–1435), mid-Ming (Zhengtong to Zhengde, 1435–1521), late Ming (Jiajing to Wanli, 1521–1620), and the post-1620s (Taichang to Chongzhen, 1620–1644). These divisions are established in the first instance from the stylistic periodisation of blue-and-white porcelain in existing scholarship (e.g., Lion-Goldschmidt, 1978; Geng, 1993) and refined against the production activities recovered from dated manufacturing sites examined in this thesis (for relevant discussions, see Wang, 2015; Gao and Li, 2020; Gao and Qin, 2024). They also broadly align with shifts in political stability and socio-economic conditions that shaped the circumstances under which porcelain was produced (detailed discussion see Chapter 2), though the periodisation adopted here is derived from the material evidence itself.

The thesis is organised into seven chapters. Following this introduction, Chapter 2 examines textual accounts of porcelain production in Ming-period Jingdezhen. Through a critical reading of historical sources, it argues that an administrative gazetteer of porcelain production, though framed around a division between 'official' (*guan*) and 'folk' (*min*) production, itself records their interdependence through shared materials, labour, and outsourced commissions. Examining this source alongside official histories and production treatises, this chapter attends to the broad picture of local manufacture and argues that official and folk production were not

two connected systems but a single integrated one on which the manufacture of imperial porcelain depended.

Chapter 3 turns to the archaeological evidence. If imperial production was integral to local ceramic manufacture, as Chapter 2 argues, the question follows whether the two can be distinguished through the evidence that survives at manufacturing sites. Chapter 3 addresses this through a comparative analysis of production features across four Ming-period manufacturing sites (Yuyaochang, Guanyinge, Luomaqiao, and Hutian) examining walls, evidence for the use of pottery wheels, kilns, and kiln waste deposits. The chapter argues that shared production practices are observable across sites, alongside site-specific variation. This variation does not correspond to the imperial and non-imperial classification, but reflects differences in construction investment and production priorities.

Chapter 4 shifts from production features to the finished products themselves. Where Chapter 3 examines whether manufacturing sites can be distinguished through the archaeological evidence of production, Chapter 4 asks whether the products classified as ‘imperial’ and ‘non-imperial’ are technologically distinct in body compositions. The chapter argues that the commonly accepted criteria for high-quality porcelain bodies neither apply exclusively to currently classified ‘imperial’ porcelain, nor to all pieces within this category. Achieving such characteristics required potters to manage the instability and variability in locally sourced materials through adaptive strategies grounded in accumulated knowledge, and resulted from negotiation between specific production and consumption demands.

Chapter 5 explores the knowledge and the skills that underpinned these adaptive strategies through a case study of dragon bowl production. Combining ethnographic fieldwork with analysis of the textual accounts and material evidence, it examines how potters navigated the specific technological challenges posed by large-sized dragon bowls, from balancing conflicting raw material properties to managing the interdependence of decisions across successive production stages. The chapter argues that the technical expertise and material resources accounting for the success of these vessels were not exclusive to the Imperial Porcelain Workshop but were embedded in local ceramic traditions and production communities.

Chapter 6 integrates the findings of the preceding chapters into a broader discussion. It reassesses the imperial versus non-imperial divide from the three perspectives through which it has been constructed—administrative oversight, archaeological fieldwork, and object classification. Furthermore, it proposes an alternative framework that centres potters as agents within an integrated production system. Drawing on parallels between past and present porcelain production in Jingdezhen, the chapter argues that the constancy of material constraints provides a basis for recovering potters' decisions, while the different social worlds in which those decisions were made define the limits of such comparison. On this basis, it reframes Jingdezhen's porcelain production as materially grounded, knowledge-based, and organised through process-specialised communities of practice that transcended administrative and consumption-based boundaries.

Chapter 7 draws together the findings of the thesis and considers their broader implications. It concludes that the imperial and non-imperial divide does not correspond to two distinct modes of production, and considers what the alternative framework proposed in Chapter 6 contributes to wider discussions of technological knowledge, embodied practice, and the recovery of practitioners' decisions from the material records. It also identifies directions for future research.

Chapter 2 Shifting the Imperial Focus: Local Porcelain Production Organisation Reflected in Textual Accounts

Textual accounts of Jingdezhen porcelain have profoundly influenced scholarly understanding of local ceramic production during the Ming period. As will be demonstrated, the organisation of porcelain production fulfilling imperial commissions was the primary concern of different levels of government administration. This administrative focus positioned local porcelain manufacturing activities in Jingdezhen, organised by potters outside direct oversight of government officials, in a subsidiary role to imperial production. This framing obscures the complex reality of how imperial production was dependent upon, rather than merely assisted by, Jingdezhen's local porcelain manufacture.

While previous compilations have collected, collated, and annotated the extensive textual accounts of Jingdezhen porcelain production (Feng, 2000; Xiong and Xiong, 2006; Chen and Yu, 2013; Chen, 2015), these works apply traditional methods of Chinese historiography without systematically interrogating the sources from the perspectives of authorship and readership. It is precisely these overlooked aspects that shape the knowledge of porcelain production they convey, and that have consequently shaped how scholars have understood and interpreted the material evidence. The following analysis applies Schrag's (2021) critical reading framework, as outlined in Section 1.4.1, examining three genres of textual accounts—official histories, local gazetteers, and treatises on porcelain production—through the dimensions of *agenda*, *credibility*, *nuance*, and *context*. These dimensions provide a structured means of foregrounding the relationship between a text's circumstances of production and the kind of knowledge it can reliably provide about porcelain manufacture. Texts are selected from previous compilations of textual accounts of Jingdezhen porcelain (Feng, 2000; Xiong and Xiong, 2006), whose collation and annotation works are referenced alongside the present author's own interpretation of the original texts. Selection criteria prioritise texts that provide information on production organisation, particularly with regard to raw material and labour resource management. Having examined the diverse perspectives represented in these historical texts in Section 2.1, Section 2.2 establishes the socio-economic context of the Ming period in which porcelain production operated. Sections 2.3 and 2.4 then discuss how imperial production was organised in ways that relied on the resource networks and process specialisation rooted in Jingdezhen's local ceramic manufacture throughout the Ming period.

2.1 Porcelain production reflected in textual accounts

2.1.1 Official histories

In Chinese historiography, the term 'official' historical texts refers to texts written or compiled by government officials appointed by the emperor, a concept in contrast to 'private' historical texts written by individuals spontaneously (Wilkinson, 1998, pp. 489–494). During their compilation of official histories, the officials in charge of this work referred to documents that recorded the decisions and actions of the emperor in the conduct of government business, in order to provide references for his successors to better govern the country (Yang, 1961; Wilkinson, 1998).

In terms of Schrag's (2021) framework, the dimension of *agenda* is particularly salient for this genre: their purpose of providing precedents and references for governing fundamentally constrained which aspects of porcelain manufacture they recorded. As the following analysis demonstrates, porcelain production in Jingdezhen entered official histories primarily as a matter of imperial orders and fiscal expenditure. Questions of *nuance* (what these compilers chose to include or leave out) and *context* (what surrounding circumstances their entries preserve or omit) further show how the administrative framing of these records has shaped subsequent scholarly understanding of Jingdezhen's production history.

Within this writing genre, textual accounts concerning porcelain production can be found mainly in three official historical works of the Ming period: the *Ming shilu* 明實錄 (Veritable Records of the Ming Period), *Ming huidian* 明會典 (Collected Statutes of the Great Ming), and *Mingshi* 明史 (History of the Ming Period). These records primarily document porcelain production ordered by the emperor, providing significant references for understanding how imperial production was organised in different reign periods. Whereas Jingdezhen—a town on the lowest rank in the administrative hierarchy of the Ming period—was rarely mentioned in official histories, it received significant attention from both the administration of Jiangxi Province and the emperors specifically for its association with porcelain production.

Ming shilu 明實錄

The *Ming shilu* 明實錄 (Veritable Records of the Ming Period) collectively refers to thirteen historical works that were compiled throughout the Ming period and have survived to the

present day.[3] The records for each imperial reign period were compiled by officials of the Hanlin Academy (*Hanlin yuan* 翰林院) during the succeeding reign period (Wu, 1987, p.493). These scholars primarily relied on documents preserved in the archives of different government institutions that recorded communications with the emperor, and their meticulous efforts in copying these official documents and organising them chronologically have been acknowledged by later historians (Yang, 1961; Wilkinson, 1998, p.497).

Prior to the Jiajing period, readership of these records was strictly limited to the officials involved in their compilation and the emperor himself (Qian, 2010). Upon completion of the *Ming shilu*, all manuscripts created during the compilation process were destroyed, with only two copies preserved—one kept by the emperor and another archived within the imperial court (*ibid*.). However, beginning in the Jiajing period, the emperor permitted officials working at the Hanlin Academy to make copies of the records from previous imperial reigns for their personal reference (*ibid.*). These personal copies subsequently circulated among officials and eventually beyond the confines of the imperial court. According to Qian's (2010) research on the distributions of *Ming shilu* copies, many were found in the collections of literati elites during the sixteenth and seventeenth centuries. Consequently, the actual readership would expand in the final decades of the Ming period, from the emperor to a broader group of government officials within the court and presumably to literati elites outside the court. Although all volumes of the veritable records stored in the Ming court were destroyed during the Qianlong period (1711–1799), many copies made during the late Ming period remain available today for scholarly reference (*ibid.*).

The *Ming shilu* contains reports on imperial orders regarding porcelain production during the Ming period. However, the surviving records are likely to be incomplete, preserving only records from the reigns of Emperor Xuanzong 宣宗 (1399–1435; Xuande reign, r. 1426–1435), Emperor Yingzong 英宗 (1427–1464; Zhengtong and Tianshun reigns, r. 1436–1449, 1457–1464), and Emperor Xianzong 憲宗 (1447–1487; Chenghua reign, r. 1465–1487) (Table 2-1). Additionally, the *Ming shilu* includes imperial edicts to cease or reduce ongoing porcelain production, which indirectly indicates the existence of prior production orders that have been lost to history (Table 2-2).

[3] The *Ming shilu* referenced in this thesis is the 1963 reprinted edition collated by Huang Zhangjian 黃彰健. When discussing textual accounts of individual reign periods, the specific text within the compilation is cited.

Table 2-1: Imperial orders for porcelain production recorded across the *Ming shilu* collection (1963 reprinted edition, collated by Huang Zhangjian 黃彰建)

No.	Emperor	Reign period	Order date	Place of production	Reference
1	Xuanzong 宣宗 (1399–1435)	Xuande	1425	Raozhou Prefecture	*Ming Xuanzong shilu*, volume 9, p. 226
2			1425	Ci Zhou	
3	Yingzong 英宗 (1427–1464)	Zhengtong	1444	Raozhou Prefecture	*Ming Yingzong shilu*, volume 116, pp. 2807–2808
4	Xianzong 憲宗 (1447–1487)	Chenghua	1485	Jingdezhen	*Ming Xianzong shilu*, volume 263, p. 5303

Table 2-2: Imperial edicts to cease or reduce porcelain production recorded across the *Ming shilu* collection (1963 reprinted edition, collated by Huang Zhangjian 黃彰建)

No.	Emperor	Reign period	Order date	Place of production	Reference
1	Xuanzong 宣宗 (1399–1435)	Xuande	1428	Raozhou Prefecture	*Ming Xuanzong shilu*, volume 70, p. 1898
2	Yingzong 英宗 (1427–1464)	Tianshun	1464	Raozhou Prefecture, Chuzhou Prefecture	*Ming Xianzong shilu*, volume 1, p. 42
3	Xiaozong 孝宗 (1470–1505)	Hongzhi	1490	Jiangxi Province	*Ming Xiaozong shilu*, volume 45, p. 1183
4			1503	Jingdezhen	*Ming Xiaozong shilu*, volume 201, p. 4542
5	Shenzong 神宗 (1563–1620)	Wanli	1583	Unspecified	*Ming shenzong shilu*, volume 147, p. 3451
6			1585	Unspecified	*Ming shenzong shilu*, volume 172, p. 3969

Among the records of imperial orders preserved in the *Ming shilu*, Jingdezhen is mentioned twice as a production place. Other named locations include Ci Zhou, Chuzhou Prefecture, Raozhou Prefecture, and Jiangxi Province, representing different levels of administrative jurisdiction.[4] Notably, one record concerning Jingdezhen states that tax revenue was collected from Raozhou Prefecture to support imperial production there, implying prefectural or even provincial involvement in its administration (*Ming Xianzong shilu*, volume 263, p. 5303). This

[4] The administrative hierarchy of the Ming Period is (from highest to lowest): central government, province, prefecture, zhou (also known as subprefecture), county, town. Ci Zhou (*Cizhou* 磁州) was governed by Zhangde Prefecture (*Zhangde fu* 彰德府) under the jurisdiction of He'nan Province (*He'nan sheng* 河南省). Chuzhou Prefecture (*Chuzhou fu* 處州府) was under the governance of Zhejiang Province (*Zhejiang sheng* 浙江省). Raozhou Prefecture (*Raozhou fu* 饒州府) was under the governance of Jiangxi Province (*Jiangxi sheng* 江西省). See Hucker, 1978, pp. 33–43; Guo and Jin, 2017.

suggests that references to Raozhou Prefecture or Jiangxi Province may also have pertained to imperial production in Jingdezhen. The involvement of prefectural and provincial administration in Jingdezhen's imperial production is discussed further in Section 2.3.

Furthermore, the *Ming shilu* shows that Jingdezhen received attention from both the provincial administration of Jiangxi Province and the emperor during the Jiajing period, attesting to the scale and significance of local porcelain production. In 1540, Grand Coordinator of Jiangxi Province (*Jiangxi xunfu* 江西巡撫) Wang Wei 王暐 (1485–?) reported to the emperor that many potters in Jingdezhen had lost their subsistence due to severe floodings (*Ming Shizong shilu*, volume 240, p. 5862).[5] He requested the appointment of an official to Fuliang County to assist with relocating potters and resume porcelain production, a request that the emperor approved (*ibid.*). That such a request reached the emperor suggests how closely Jingdezhen's porcelain production workforce was tied to imperial interests. It is questionable whether comparable intervention would have been made for ordinary agricultural communities.

Ming huidian 明會典

While the *Ming shilu* documented the emperor's communications with various government officials and institutions, the structures, functions, and regulations of these institutions were recorded in the *Ming huidian* 明會典 (Collected Statutes of the Great Ming).

During the Hongzhi period, Emperor Xiaozong 孝宗 (1470–1505; Hongzhi reign, r. 1488–1505) ordered court officials to compile the *Ming huidian* based on contemporary administrative statues, providing detailed description of government institutions and their functions that served as a handbook to officials to follow the regulations (*Ming Xiaozong shilu*, volume 123, pp. 2715–2716). The compilation also included references to previous regulations that were no longer enforced at the time (*ibid.*). The first edition of the *Ming huidian* was printed in 1511 (Shang, 1993). Subsequently, both Emperor Shizong 世宗 (1507–1567; Jiajing reign, r. 1522–1566) and Emperor Shenzong 神宗 (1563–1620; Wanli reign, r. 1573–1620) ordered supplementary entries to update the texts with revised regulations and newly

[5] From 1430, Grand Coordinator (*xunfu* 巡撫) was sent out as delegates from the central government to coordinate and supervise provincial-level agencies. See Hucker, 1985, p. 255.

established institutions during the Jiajing and Wanli periods respectively (*ibid.*). The later Wanli version, printed in 1587, is the edition commonly referred to today (Yuan, 2011).

Regarding imperial porcelain orders (Table 2-3), the *Ming huidian* names several production locations, including Yizhen County, Raozhou Prefecture, Henan Province, Zhending Prefecture, Ningguo Prefecture, the imperial capital Beijing, and Jiangxi Province.[6] Although Jingdezhen is not mentioned by name, references to Raozhou Prefecture and Jiangxi Province likely concern production there, as the *Ming shilu* records similarly suggest.

Table 2-3: Imperial orders for porcelain production recorded in the *Ming huidian* (Wanli edition, 1587)

No.	Emperor	Reign period	Order date	Use	Place of production	Reference
1	Taizu 太祖 (1328–1398)	Hongwu	1393	For wine storage at the Court of Imperial Entertainments	Yizhen County	Volume 194, p. 9797
2	Xuanzong 宣宗 (1399–1435)	Xuande	1432	For use by the Directorate for Palace Delicacies	Raozhou Prefecture	Volume 194, pp. 9800–9801
3				For use by the Court of Imperial Entertainments		
4			1425–1435	For use by the Court of Imperial Entertainments	Henan Province, Zhending Prefecture	Volume 194, pp. 9798–9799
5	Yingzong 英宗 (1427–1464)	Zhengtong	1436	Inner Storehouse for Transport and Storage	Raozhou Prefecture	Volume 194, p. 9801
6	Daizong 代宗 (1428–1457)	Jingtai	1453	For use by the Court of Imperial Entertainments	Raozhou Prefecture	
7	Yingzong 英宗 (1427–1464)	Tianshun	1459	Unspecified	Beijing	Volume 194, p. 9797
8				For use by the Court of Imperial Entertainments	Raozhou Prefecture	Volume 194, p. 9801
9	Xianzong 憲宗 (1447–1487)	Chenghua	1467	For use by the Court of Imperial Entertainments	Raozhou Prefecture	Volume 194, p. 9801
10	Xiaozong 孝宗 (1470–1505)	Hongzhi	1505	Unspecified	Raozhou Prefecture	Volume 194, p. 9802
11				For use by the Court of Imperial Entertainments	Raozhou Prefecture	
12	Shizong 世宗 (1507–1567)	Jiajing	1527	For use by the Court of Imperial Entertainments	Ningguo Prefecture	Volume 194, p. 9798
13				For use by the Court of Imperial Entertainments (Nanjing)		

[6] Yizhen County (*Yizhen xian* 儀真縣) was under the governance of Yangzhou Prefecture (*Yangzhou fu* 揚州府), Southern Directly Administered Region *(Nanzhili* 南直隸). Henan Province (*Henan sheng* 河南省) was one of the highest-ranked local governments in Ming-period administrative structure. Zhending Prefecture (*Zhending fu* 真定府) was governed by Northern Directly Administered Region (*Beizhili* 北直隸). Ningguo Prefecture (*Ningguo fu* 寧國府) was governed by Southern Directly Administered Region (*Nanzhili* 南直隸).

14			1552	For use at the imperial palace (kitchens, wine cellars, gardens)	Beijing	Volume 194, p. 9797
15	Muzong 穆宗 (1537–1572)	Longqing	1571	Unspecified	Beijing	Volume 194, p. 9797
16	Shenzong 神宗 (1563–1620)	Wanli	1581	Unspecified	Jiangxi Province	Volume 194, p. 9802
17			1572–1620	Unspecified		Volume 194, p. 9802
18				Unspecified		Volume 194, pp. 9802–9803
19				Unspecified		Volume 194, p. 9803

Compared to the *Ming shilu* records, the *Ming huidian* sometimes specifies in detail the institutions for which the emperors ordered porcelain. Three institutions are named: the Court of Imperial Entertainments (*Guanglu si* 光祿寺), the Directorate for Palace Delicacies (*Shangshan jian* 尚膳監), and the Inner Storehouse for Transport and Storage (*Nei chengyun ku* 內承運庫). The Directorate for Palace Delicacies was one of twelve major directorates (*jian* 監) through which palace eunuchs were organised during the Ming period, and was responsible for the emperors' daily meals, including the preparation, cooking, and serving of cuisine (Hucker, 1985, p. 410). Its mention in this context suggests that the porcelain ordered may have been intended for food storage and service. The Court of Imperial Entertainments, by contrast, served a broader function as the central government agency responsible for catering to the imperial household, court officials, and imperial banquets honouring foreign envoys and other dignitaries (Hucker, 1985, p. 288).[7] The mention of the Inner Storehouse for Transport and Storage, one of numerous palace storehouses (*neiku* 內庫) located within the imperial palaces in Beijing and Nanjing (Su, 2015), further suggests that some porcelain may have been distributed beyond the imperial palaces.[8]

Mingshi 明史

Other than the *Ming shilu* and the *Ming huidian*, records on porcelain production of the Ming period are also kept in the *Mingshi* 明史 (History of the Ming Period) that was compiled during the succeeding Qing period. The Institute of Ming History (*Mingshi guan* 明史館) began compiling the *Mingshi* in 1645 (Li, 1933). In 1739, the imperial publishing house *Wuying dian* 武英殿 created printing blocks for the final manuscript, enabling wider circulation beyond the imperial court (*ibid.*). Unlike handwritten copies of the *Ming shilu*, the printed *Mingshi* reached

[7] In the Ming Period, this institution was set up in the two imperial centres, Beijing and Nanjing. If unspecified, the Court of Imperial Entertainments refers to the one in Beijing.
[8] If unspecified, the Inner Storehouse for Transport and Storage refers to the one in Beijing.

a broader audience, and the *Wuying dian* edition remains the standard reference today (Wilkinson, 1998, p. 880).

While scholars debate how Qing officials' political views and Confucian beliefs influenced their interpretation and selection of Ming historical events in the *Mingshi* (e.g., Wilson, 1994), such bias is less evident in porcelain production records. These entries appear chronologically under the section 'Ceramic Manufacture' (*shaozao* 燒造) of 'Monograph on Food and Commodity' (the *Shihuo zhi* 食貨志), simply documenting imperial porcelain orders by reign period (see Table 3-4). The straightforward nature of these records suggests little motivation for intentional distortion. However, the *Ming shilu*, *Ming huidian*, and *Mingshi* show notable discrepancies in their records of imperial orders, suggesting different material sources and ways of compilation. These discrepancies show the importance of Schrag's (2021) dimension of *context*: reading any single official history in isolation risks taking its account as complete, when each work preserves a different, and partial, record of the same events.

In the *Mingshi*, Jingdezhen appears once as a production place for ceramics made on commission for Emperor Xianzong, for which he appointed a eunuch to supervise the production of 'porcelain for imperial use' (*yuyong ciqi* 御用瓷器) (*Mingshi*, volume 82, p. 3373). An identical record appears in the *Ming shilu* (see record no.4 in Table 2-1), suggesting that the *Ming shilu* served as a source for the compilers of the *Mingshi*. Notably, the *Mingshi* records that Emperor Shizong appointed a government official as the superintendent of the 'Imperial Porcelain Workshop' (*Yuqi chang* 御器廠) (*Mingshi*, volume 82, p. 3374). In the *Mingshi*'s 'Monograph on Geography' (*Dili zhi* 地理志), this institution is mentioned under the entry of Fuliang County as located in Jingdezhen, noting its establishment for imperial production (*Mingshi*, volume 43, p. 1731). While other production locations for imperial porcelain are mentioned in the *Mingshi* (Table 2-4), Jingdezhen is the only one where a dedicated institution was established.

Table 2-4: Imperial orders for porcelain production recorded in the *Mingshi* (*Wuying dian* edition, 1739)

No.	Emperor	Reign Period	Order date	Place of production	Reference
1	Xuanzong 宣宗 (1399–1435)	Xuande	1425–1435	Raozhou Prefecture	Volume 82, pp. 3372–3373
2				Ci Zhou	Volume 82, p. 3373
3			1436–1449	Unspecified	*ibid.*

4	Yingzong 英宗 (1427–1464)	Zhengtong		Raozhou Prefecture	*ibid.*
5	Xianzong 憲宗 (1447–1487)	Chenghua	1465–1487	Jingdezhen	*ibid.*
6	Xiaozong 孝宗 (1470–1505)	Hongzhi	1488–1505	Unspecified	*ibid.*
7	Shizong 世宗 (1507–1567)	Jiajing	1536	Unspecified	*ibid.*
8			1557	Jiangxi Province	Volume 82, pp. 3373–3374
9	Muzong 穆宗 (1537–1572)	Longqing	1567–1572	Jiangxi Province	Volume 82, p. 3374
10	Shenzong 神宗 (1563–1620)	Wanli	1590	Unspecified	*ibid.*
11			1573–1620	Unspecified	*ibid.*

2.1.2 Local gazetteers and the *Taoshu* 陶書

Local gazetteers differ from official histories in both their authorship and focus. Here, 'local' stands for a smaller administrative unit, in contrast to official histories that cover the entire state. Compiled by scholars and officials on their own initiative, local gazetteers reflect different personal interests in documenting local regions. Following the writing tradition developed in the Southern Song period, Ming local gazetteers cover a variety of topics such as geography, customs, local products, and historical events (Hargett, 1996). Based on the scope of the administrative unit covered, these gazetteers range from provincial gazetteer (*shengzhi* 省志 or *tongzhi* 通志), prefectural gazetteer (*fuzhi* 府志), to district gazetteer (*xianzhi* 縣誌) (Zurndorfer, 1995, p.187).

Examining local gazetteers through Schrag's (2021) framework highlights how the shift in authorship and administrative scope produces a different set of *agendas*, and correspondingly different perspectives on porcelain production. As the case of the *Taoshu* demonstrates, an author's administrative position could impose an agenda that closely mirrors that of official histories, framing local manufacture in relation to imperial production. At the same time, the nuance of what local gazetteers record, such as geological information and local produce, opens a broader view of porcelain production than official histories provide.

The local gazetteers concerning Jingdezhen mainly include provincial gazetteers of Jiangxi Province, prefectural gazetteers of Raozhou Prefecture, and district gazetteers of Fuliang County (for a complete list, see Xie, 2001). They contain geological and hydrological information regarding Jingdezhen and its vicinity that help contextualise potters' choices of raw materials and production sites. These gazetteers' records on local manufacturing activities

and trading business also cover broader aspects of porcelain production in Jingdezhen, in contrast to official histories that primarily focus on porcelain production for 'imperial use'. As the perspectives on porcelain production provided in local gazetteers are still shaped by the aims of their compilers, some works nonetheless retain an imperial focus. This is evident in the *Jiangxi sheng dazhi* 江西省大志 (Gazetteer of Jiangxi Province) compiled by Wang Zongmu 王宗沐 (1524–1592) when he was in office as Vice Administration Commissioner of Jiangxi Province (*Jiangxi canzheng* 江西参政) (for research on Wang Zongmu's biography, see (Qiu, 2004).[9]

Notably, the *Jiangxi sheng dazhi* places strong emphasis on the fiscal administration of Jiangxi Province, providing detailed information on the tax and labour requisition systems that cannot be found in other gazetteers of this region or official histories (Shi, 2013).Wang Zongmu dedicated an entire volume, the *Taoshu* 陶書 (Book of Ceramics), to documenting the resource management of raw materials and labour at the Imperial Porcelain Workshop (the nature of this institution is discussed in Section 2.3). The *Taoshu* cited in this thesis is the Wanli edition, supplemented by Lu Wan'gai 陸萬垓 (1533–1599), Grand Coordinator of Jiangxi Province, and published in 1597, rather than Wang Zongmu's original Jiajing compilation. As the fuller of the two texts, the Wanli edition incorporates Wang's account together with additions made through the Longqing and Wanli periods, thus documenting the organisation of imperial production across the late-Ming period this thesis examines. Wang's original edition is consulted where a claim is specific to the Jiajing period, and any discrepancy between the two editions is noted when relevant (for a collation of the two editions, see Chen, 2012).

In the epilogue of the *Taoshu*, Wang Zongmu states his intention for the work to serve as a reference for future superintendents of the Workshop, helping them balance between fulfilling imperial commissions and managing their impact on the local potters (Wang and Lu, 1597, pp. 908–914). Wang expresses concern that the manufacture of massive quantities of porcelain requested by the imperial court had become a heavy burden on potters who were obliged to serve as corvée labourers and thus required to cover their own subsistence, exposing them to famine (*ibid.*). This administrative purpose fundamentally shapes the *Taoshu*'s perspective on local porcelain manufacture, as the *Taoshu* draws a clear distinction between production

[9] Vice administration commissioner (*Canzheng* 參政) is the second executive post in Ming provincial administration, subordinate to Grand Coordinator (*Xunfu* 巡撫). See Hucker, 1985, p. 517.

organised by the 'official' (*guan* 官) and that by the 'people' (*min* 民), positioning the latter in a subsidiary role assisting the fulfilment of imperial porcelain orders (Wang and Lu, 1597, pp. 847–848).

Here, the category of *min* denotes potters from local ceramic production communities, who were regarded by the administrators of imperial production as a workforce on which the Workshop could draw, as discussed in Section 2.3. But this subsidiary framing is administrative, not a description of two separate systems of production. As current scholarship shows in the reading of the *Taoshu*, the same text documents at length how imperial commissions depended on *min* manufacture (e.g., Arai, 2018; Gerritsen, 2020, pp. 175–194; Hu, 2024). The Workshop enlisted or recruited its workforce from local ceramic communities and, when imperial demand exceeded its capacity, distributed orders to be fired in kilns run by the 'people' (*ibid*.). The skilled potters the Workshop relied on were thus not a distinct body of labour, but participants in Jingdezhen's local porcelain manufacture, drawn into imperial commissions as demand required and returning to other work as it eased. What the *Taoshu* frames as a division between *guan* and *min* is better understood as an administrative ordering imposed on a single, locally rooted production system, on which imperial manufacture depended. Sections 2.3 and 2.4 develop this dependence through the *Taoshu*'s own records of workforce recruitment, outsourced commissions, shared resource networks, and a division of labour based on process specialisation.

The *Taoshu* also asserts a technological supremacy of production at the Imperial Porcelain Workshop over products made in kilns run by the 'people', on the grounds of the Workshop's substantial investment of time and material resources in imperial production (Wang and Lu, 1597, p. 844). For instance, it records that when a kiln was loaded at the Workshop, the wares were separated from the flames by rows of empty saggars, and the kiln was sealed under a layer of mud to maintain a reducing atmosphere and prevent cracks and air vents (Wang and Lu, 1597, pp. 843–844; also noted by Gerritsen, 2020, p. 146). Beyond the Workshop, this protective sealing was omitted and more wares were loaded, shielded from the flames only by a row of coarser pieces (*ibid*.). The *Taoshu* thus attributes the purity of imperial wares to this difference in firing (*ibid*.).

Such assertion raises questions of *credibility.* The compilers' administrative position disposed them to justify the Workshop's resource expenditure, and their claim that this expenditure yielded technically superior wares need not reflect any real advantage of imperial over non-imperial production. As Gerritsen (2020, p. 187) points out, these procedural distinctions may be more idealised than actual, an account intended to safeguard the reputation of imperial quality and to deliver precisely the kind of goods listed on the imperial demand. This claim of technological distinction was nonetheless taken up by those arguing for the superior quality and technical expertise of imperial production, and is evaluated against the material evidence in Chapters 3, 4 and 5.

2.1.3 Treatises on porcelain production

Beyond official histories and local gazetteers, a separate category of sources narrows its lens specifically to porcelain manufacturing. These treatises were written by figures as varied as Confucian scholars, government officials, foreign Jesuits, and local Jingdezhen literati, and their backgrounds shaped not only what they wrote but how they gathered information, whether from historical texts, personal observation, or direct accounts from potters. The resulting perspectives stand apart from sources driven by administrative purposes that constrained their attentiveness to the knowledge and experience of the potters themselves. In terms of Schrag's (2021) framework, the diversity of authors in this category means that the dimensions of *agenda* and *nuance* vary considerably from one treatise to the next. For these treatises, *context* is also essential. The circumstances under which each author gained access to production knowledge, whether through scholarly observation, administrative apprenticeship, or conversations with converts, directly affected the reliability and scope of their accounts.

Taoshan 陶埏

One much-consulted text is the *Taoshan* 陶埏 (The Making of Ceramics) from the *Tiangong kaiwu* 天工開物 (The Works of Heaven and the Inceptions of Things), first published in 1637. This encyclopaedia covers various technologies of agriculture, metallurgy, textile making, and porcelain production (Pan, 2008, pp. 1–33). The *Tiangong kaiwu* was written by Song Yingxing 宋应星 (1587–1666), a teacher at the Confucian school in Fenyi County, Jiangxi Province (for Song's biography, see Schäfer, 2011, pp. 28–39). As a Confucian scholar, Song was influenced by Ming philosopher Wang Yangming 王陽明 (1472–1529), who urged fellow scholars to

focus on ‘investigating things’ (*gewu* 格物) and ‘extending knowledge’ (*zhizhi* 致知) (Lee, 1987).

Following Wang Yangming’s call, Song argued that such ‘knowledge’ (*zhi* 知) could only be obtained through translating the tacit knowledge embedded in commoners’ daily practices into explicit and objective principles (Song, 1933, p. 52). The *Tiangong kaiwu* thus exemplifies this approach, presenting technological knowledge of various craft industries gained through his personal observation (Schäfer, 2011, pp.115–120). As the *Taoshan* contains numerous empirical accounts of porcelain making, accompanied by illustrations depicting actual production processes, scholars have argued that Song Yingxing gained his knowledge through direct observation of ceramic manufacture in Jingdezhen (Pan, 2008, pp. 14–15; Schäfer, 2011, p. 133).

In comparison to official histories and local gazetteers, the *Taoshan* fundamentally shifts focus from administrative concerns to technological processes, although its coverage of porcelain production is relatively concise as part of an encyclopaedic text surveying multiple industries. It does not address the costs, labour organisation, or the distinction between imperial and non-imperial production that feature in the sources discussed above. Song structures his accounts of porcelain production in Jingdezhen by dividing it into sequential stages, including clay preparation, forming, underglaze painting, glazing, and firing (Song, 1637, pp. 138–140). Notably, within the forming stage, he distinguishes between vessels requiring throwing techniques (*yuanqi* 圓器) and those requiring moulding processes (*yinqi* 印器) (Song, 1637, p. 139). This division indicates process specialisation that is discussed in greater detail in Section 2.4.

Taoye tushuo 陶冶圖說

While Song Yingxing approached porcelain production as a Confucian scholar interested in technological processes, the next treatise emerged from a very different perspective of a government official who mastered the potters’ skills in order to better supervise the manufacture of imperial porcelain. This was the *Taoye tushuo* 陶冶圖說 (Illustrated Manual of Ceramic Production) written by Tang Ying 唐英 (1682–1756), overseer of imperial

porcelain production during the Yongzheng (1723–1735) and Qianlong (1736–1796) periods.[10]

Tang Ying's writing was intended to satisfy Emperor Qianlong 乾隆 (1711–1799; Qianlong reign, r. 1735–1796)'s curiosity about porcelain production. According to Chen's (2023) research on the *Taoye tushuo*'s compilation process, Qianlong first commanded three court painters to create a twenty-leaf album depicting porcelain production in 1740. These paintings were subsequently sent to Tang Ying, who three years later composed a treatise describing the natural landscape and production processes illustrated in the commissioned works (Chen, 2023, pp. 77–78). This treatise, together with the twenty paintings, became known as the *Taoye tushuo*. Drawing on a personal apprenticeship with Jingdezhen potters from 1728 to 1731 (Chen, 2023, p. 73), Tang Ying was able to provide detailed explanations of raw material terminology and production techniques that serve as valuable references for interpreting the other historical accounts discussed throughout this thesis.

Like the *Taoshan*, Tang Ying's account follows the general porcelain production process from raw material processing to firing, with additional stages covering the packaging of finished products and ceremonies worshipping the kiln deity (Tang, 1743, pp. 953–954). He identifies producer groups who approached the same production stage in different ways, such as potters working with distinct forming techniques, including throwing (*lapi* 拉坯), moulding (*yinpi* 印坯), and slab building (*xiang* 鑲) (Tang, 1743, pp. 955–956). This record echoes Song Yingxing's account of process specialisation and raises the possibility that certain knowledge and expertise were developed and shared within particular producer communities. Tang also extends his view beyond potters themselves, noting the supporting roles of those who sourced and prepared cobalt blue pigments and of carpenters who installed and maintained the pottery wheels (Tang, 1743, pp. 955–956). This draws attention to the broader networks of labour and supply that made porcelain production in Jingdezhen possible.

D'Entrecolles's letters

Besides Chinese writers, porcelain production in Jingdezhen also attracted the attention of foreign visitors to China. By the seventeenth century, European potters were already attempting

[10] Tang Ying wrote several essays on his administration of imperial porcelain production. For a brief summary of these essays, see Kerr and Wood, 2004, p. 27.

to replicate the hard-paste porcelain imported from Jingdezhen in large quantities, and understanding its manufacturing secrets remained a primary concern for European visitors throughout the seventeenth and eighteenth centuries (Gerritsen and McDowall, 2012; Pollard, 2015). Among the accounts left by foreign travellers, two letters written in 1712 and 1722 by the French Jesuit Father François Xavier d'Entrecolles (1664–1741) provide first-hand records of porcelain production in Jingdezhen at the time.[11] These letters remain rare sources documenting not only raw material recipes and production processes, but also the daily lives of Jingdezhen potters at work.

According to Yu's (2017) research on d'Entrecolles's biography and his contemporary letters to the French Catholic Church, the Jesuit arrived in China in 1699 and spent time in Jiangxi Province, including Jingdezhen. During his time in Jingdezhen, he collected information on porcelain production from his personal observation and recorded the knowledge shared by the local people in Jingdezhen (d'Entrecolles, 1712, p. 51). He also consulted written sources, mentioning a book on the 'history of Fuliang' (*ibid.*), presumably referring to the *Fuliang xianzhi* 浮梁縣志 (Gazetteer of Fuliang County) compiled in 1682. According to d'Entrecolles himself, his purpose in compiling these observations into two letters was to help Europeans to better understand the production technology behind Jingdezhen porcelain that had become popular in European markets, including raw materials, recipes for body pastes and glazes, and other manufacturing techniques (*ibid.*).

Beyond documenting raw materials, recipes for porcelain bodies, glazes, and decoration pigments, and production processes, d'Entrecolles's letters provide individual perspectives that he acquired from his converts who worked in porcelain manufacture. For example, converts who worked mixing processed raw materials into homogeneous clay for porcelain bodies had difficulty attending church regularly as their work was extremely time-consuming (d'Entrecolles, 1712, p. 70). They were indispensable for the work as their absence would delay subsequent production stages (*ibid.*). In contrast, converts who worked as underglaze painters were less burdened (d'Entrecolles, 1712, p. 78). D'Entrecolles notes a further division in the underglaze painting stage, where one painter draws the outlines, the second paints flowers, the third depicts water and mountains, and the fourth adds animals, decreasing the time and effort

[11] Prior to d'Entrecolles, five Jesuits were sent to China by the French King Louis XIV in 1685 (Jami, 2012). One of the Jesuits, Le Comte (1655–1728) also wrote letters introducing porcelain production in China. Nevertheless, Le Comte did not specify his sources of materials, nor did he visit Jingdezhen in person (Le Comte, 1739).

required from each individual to complete a piece (d'Entrecolles, 1712, p. 78). These accounts suggest a level of task subdivision within a single production stage, which informs the discussion of workforce management in Section 2.4.

Taoshuo 陶說 and *Jingdezhen taolu* 景德鎮陶錄

While d'Entrecolles provided an outsider's perspective in the early eighteenth century, contemporary Chinese literati were also documenting Jingdezhen's porcelain production. There are two particularly influential later works, the *Taoshuo* 陶說 (Description of Chinese Pottery and Porcelain), first published in 1774, and the *Jingdezhen taolu* 景德鎮陶錄 (The History and Manufacture of Jingdezhen Porcelain, also known as the *Taolu*), first published in 1815.

Both authors of the *Taoshuo* and the *Taolu* had local connections. The *Taoshuo* was written by Zhu Yan 朱琰, a literatus who served under Grand Coordinator of Jiangxi Province Wu Shaoshi 吳紹詩 (1699–1776) (Fu, 1981).[12] The *Taolu* was authored by Lan Pu 藍浦, a Jingdezhen literatus, with support from District Magistrate of Fuliang County Liu Bing 劉丙 (Liang, 2020).[13] The *Taolu*'s preface also suggests that the original version written by Lan Pu comprised six volumes, and the extra volumes on porcelain production processes and the epilogue were added by Lan's student Zheng Tinggui 鄭廷珪 based on Lan's unfinished drafts and notes after his death (Lan and Zheng, 1815, the second preface, p. 1).

According to their respective prefaces, both the *Taoshuo* and *Taolu* aimed to provide comprehensive overviews of porcelain production from the Tang period to their time (Zhu, 1774, pp. 6–7; Lan and Zheng, 1815, second preface, p. 1). In documenting Jingdezhen porcelain production during the Ming period, both authors drew extensively from earlier historical works, including official histories, local gazetteers of Jiangxi Province, and treatises on Jingdezhen porcelain such as the *Taoye tushuo* as previously discussed. While these works provide valuable references to historical sources, especially for those whose original copies are now lost, the *Taoshuo* and *Taolu* also inherited earlier compilers' focus on imperial production.

[12] In both the Ming and Qing periods, the government position Grand Coordinator (*xunfu* 巡撫) referred to the highest ranking official in provincial administration. See Hucker, 1985, p. 255.
[13] During the Qing period, District Magistrate (*zhishi* 知事) was a government position designated to the official in charge of county administration. See Hucker, 1985, p. 155.

In Schrag's (2021) terms, this inheritance reflects the dimension of *nuance*. By drawing primarily on earlier historical works rather than direct observation, both authors reproduced the selective emphasis on imperial production that characterised their source texts. Notably, in both texts, the history of porcelain production in Ming-period Jingdezhen primarily documents imperial production rather than presenting a broader picture of local manufacturing activities (Zhu, 1774, pp. 80–92; Lan and Zheng, 1815, volume 5, pp. 4–8).

Though written during the subsequent Qing period, these accounts of imperial porcelain production of the Ming period profoundly influenced the scholarship on Jingdezhen porcelain. When foreign scholars with limited access to primary Chinese historical sources began their inquiries of Jingdezhen porcelain in the twentieth century, they consulted French, Japanese, and English translations of the *Taoshuo* and/or *Taolu*, depending on what they could lay their hands on and on their language expertise (Pope, 1956, pp. 27–33; Pierson, 2000). The resulting studies established the foundation for Chinese ceramics scholarship in foreign languages that continues to this day. In Section 2.3.1, these accounts of imperial production are carefully examined alongside the primary Chinese historical sources dating to the Ming period as previously discussed in Sections 2.1.1 and 2.1.2.

Besides quoting from historical sources, the author and editor of the *Taolu* documented the organisation of porcelain production in nineteenth-century Jingdezhen, in consultations with local potters whose names were recorded in the epilogue (Lan and Zheng, 1815, volume 10, p. 16). The key unit of this organisation was the ceramic production community (*yaohu* 窯戶), which encompassed potters who were not necessarily blood relatives (Lan and Zheng, 1815, volume 3, pp. 1–3). These communities were in turn supported by other producer groups supplying essential materials such as firewood and saggar clay (Lan and Zheng, 1815, volume 3, pp. 5–6). This organisation closely corresponds with what Tang Ying described nearly a century earlier, suggesting the network of people and material resources that sustained ceramic manufacture in Jingdezhen continued to operate across time.

In summary, different writing genres offer complementary yet distinct perspectives on Jingdezhen porcelain production. While central government officials were concerned with how imperial orders were fulfilled, authors of production treatises turned their attention to broader manufacturing practices. To understand what these sources describe requires familiarity with

the wider social context in which porcelain production in Jingdezhen operated. Three aspects of the Ming period's socio-economic development are particularly relevant: the tax system through which the state financed imperial production, the labour requisition system through which it mobilised artisans, and the trade networks through which materials and finished goods circulated.

2.2 The socio-economic context of porcelain production in Jingdezhen

2.2.1 Tax system

The Ming fiscal system was shaped fundamentally by the founding emperor Zhu Yuanzhang 朱元璋 (1328–1398; Hongwu reign, r. 1368–1398), who sought to restore an agrarian order predicated on in-kind payments to the state (Huang, 1998, p. 107; von Glahn, 2016, p. 287). In 1381, the emperor introduced the *lijia* system, organising rural society into village communities of 110 households (von Glahn, 2016, pp. 286–287). These village communities (*li* 里) served as the basic units for government administration, responsible for delivering tax payments in kind and providing labour services at the demand of different government institutions (Huang, 1998, pp. 121, 134–135). Land was taxed at roughly three percent of total yield under a two-tax system: a summer tax collected in wheat and an autumn tax collected in husked rice, with some areas assessed in silk or cotton according to local production (Huang, 1998, pp. 107, 126, 132). Land and population surveys carried out in 1387 and 1393 established permanent tax quotas that remained largely unchanged thereafter and bore increasingly little resemblance to social and economic reality over time (Huang, 1998, pp. 108, 112; von Glahn, 2016, p. 287). Under this fiscal structure, no distinction was made between imperial and local revenue, as all provincial and local officials acted simultaneously as regional treasurers of the crown (Huang, 1998, p. 107). In this regard, imperial porcelain production was financed not through a separate imperial budget but through the same tax revenue that supported all other state expenditures.

Beginning with the commutation of the Jiangnan rice tribute levy in 1436, the state gradually shifted to taxes collected in silver (von Glahn, 2016, p. 307). In some provinces this shift began well before it was formalised at the empire-wide level. In Jiangxi, provincial administrators initiated reforms to tax collection and labour requisition from the Hongzhi period onward, converting a portion of required local produce and labour service obligations into silver-based tax payments (Liang, 1963; Fan, 1982). What could be converted varied across prefectures within Jiangxi Province and changed over time (for discussion of this variation, see Lin, 2000).

These provincial reforms culminated in the Single Whip reforms (*yitiao bianfa* 一條鞭法) of the late sixteenth century, which converted numerous in-kind tax payments and labour services into silver payments on an empire-wide scale (Huang, 1998, pp. 155–158; von Glahn, 2016, p. 307). Yet tax rates remained tied to early quotas, meaning the government failed to capture revenue from the expansion of agriculture and commerce (von Glahn, 2016, p. 309). For imperial porcelain production, this meant that the fiscal resources available to finance manufacture likely remained constrained even as the scale and cost of imperial orders grew over time.

2.2.2 Labour requisition system

Central to the founding emperor's vision of social order was the registration of the population into hereditary occupational groups that provided different labour services to the state (von Glahn, 2016, p. 287). In 1369, the emperor ordered all households to be registered under specific service categories, each defined by the particular duty they were required to provide to the state, ranging from supplying soldiers for military service to providing various goods for the imperial palace (for a summary of these categories, see Wang, 1986). Among these occupational groups, artisan households (*jianghu* 匠戶) were obliged to serve in construction or craft production projects in the imperial centres, or they could be retained for local manufacturing projects within their provinces when needed (for a summary of the artisan household service system, see Liu, 2014). This arrangement provided the basic labour force for the Imperial Porcelain Workshop, as discussed in Section 2.3.2. The hereditary occupational household system gradually fell into disuse, especially following the Single Whip reforms (Hsu, 1988, pp. 138–139; von Glahn, 2016, pp. 289–290). The services that artisan households were obliged to provide could be commuted to silver payments, which allowed artisans to sell their labour on the open market rather than fulfilling service obligations in person (Hsu, 1988, pp. 138–139; Huang, 1998, pp. 118–119; von Glahn, 2016, p.290). For porcelain production in Jingdezhen, this shift meant that the Workshop could no longer rely solely on the labour requisition system to secure its workforce and increasingly needed to hire labour, as discussed in Section 2.3.

2.2.3 Trade and market

The founding emperor of the Ming imposed strict restrictions on trade. Merchants were prohibited from engaging in overseas trade from 1374, and the hereditary occupational

categories assigned to each household impeded the movement of labour (von Glahn, 2016, pp. 287, 289). Recovery began in the sixteenth century, as the growth of agricultural production and population, together with the revival of long-distance trade, fostered a pattern in which particular localities increasingly concentrated on the production of specific goods—Jingdezhen on ceramics, parts of Zhejiang on silk, and Fujian on sugar and paper (von Glahn, 2016, p. 297; Heijdra, 1998, pp. 425–426).

The revival of commercial activities transformed the conditions under which porcelain was produced and exchanged. As Brook (1998, pp. 683, 687) argues, markets (*shi* 市)—places where goods are bartered, bought, or sold—are indicators of the growth of what he terms the 'commercial economy'. A significant step in this development is the transition from trading in surplus to trading in commodities, that is, goods manufactured specifically for exchange. In the late Ming period, as reliance on silver grew following the tax reforms, producers increasingly traded through price rather than barter (Brook, 1998, p. 694). In localities such as Jingdezhen, periodic markets appeared to meet the needs of producers and consumers, connecting local manufacture to wider commercial networks (Heijdra, 1998, p. 497).

The crucial catalyst for this expansion was the influx of foreign silver from the 1530s onward, as European and Japanese traders purchased Chinese porcelains and silks with silver (von Glahn, 2016 pp. 307–309). This influx both sustained and was sustained by the manufacturing activities in Jingdezhen, where skilled potters enabled production at a scale sufficient to supply both imperial commissions and the growing demand from overseas markets.

In short, these broader developments in fiscal administration, labour organisation, and commercial activities provide the necessary context for examining how imperial porcelain production was organised in Jingdezhen, and how that organisation changed over the course of the Ming period. The following sections return to the textual accounts introduced in Section 2.1, examining them in relation to one another to understand how imperial production was dependent on the resource networks and process specialisation long established in local ceramic manufacture in Jingdezhen.

2.3 The organisation of imperial production in Jingdezhen

Central to imperial production in Jingdezhen was a government organisation known as the *Yuqi chang* (御器廠). According to both the *Mingshi* and the *Taoshu*, it was responsible for fulfilling imperial porcelain commissions throughout the Ming period (*Mingshi*, volume 82, p. 3374; Wang and Lu, 1597, p. 813). However, before it came to function as the Imperial Porcelain Workshop—the role most scholarly works have attributed to it—the name *Yuqi chang* designated an imperial depot where porcelains were collected and stored before being dispatched to the imperial centres. The shift in function behind this shared name thus reflects a transformation in the ways Jingdezhen potters delivered imperial commissions, which this section sets out to examine.

2.3.1 Establishment of the Imperial Porcelain Workshop

Scholarly opinions regarding the date and process of establishment of the Imperial Porcelain Workshop in Jingdezhen vary considerably, with two main views predominating. The first view, based on records from the *Jingdezhen taolu*, holds that the Workshop was established in 1369, the second year of the Hongwu period (e.g., Bushell, 1910; Lion-Goldschmidt, 1978; Liu, 1996; SAM-PKU, 2007; Quan, 2009). The second, drawing on the *Taoshuo*, holds that it was established in 1402, the thirty-fifth year of the same reign (e.g., Feng, 1985; Ma and Wang, 1993; Ding, 2013).

Upon closer examination, however, both claims oversimplify the original sources. The *Taolu* records that to a complex (referred to as *chang* 廠) was set up in Jingdezhen in 1369 to 'produce porcelain for the emperor' (*zhitao gongshang* 制陶供上) (Lan and Zheng, 1815, volume 5, p. 4). While this *chang* has generally been interpreted as an abbreviation of *Yuqi chang*—and thus translated as the Imperial Porcelain Workshop—an alternative reading is that it refers simply to sheltered workspace, where manufacturing activities were carried out.[14] It was not until the Zhengde period that these structures were given the official designation *Yuqi chang* 御器廠, transforming them into a formal government institution with an appointed superintendent overseeing production (Lan and Zheng, 1815, volume 5, p. 6). The *Taoshuo* similarly records that imperial porcelain was being manufactured in Jingdezhen from 1402, but confirms that it was only during the Zhengde period that a formally named institution, the *Yuqi chang*, was

[14] The original meaning of *chang* 廠 is 'a place that shelters from wind and rain'; see Xu (1994, p. 323). In a production context, it can be rendered as 'sheltered workspace'.

established with appointed officials in charge (Zhu, 1774, p. 86).[15] Taken together, both the *Taolu* and the *Taoshuo* suggest that the Imperial Porcelain Workshop as an official institution was not established until the Zhengde period, even though production activities for imperial orders in Jingdezhen had begun no later than 1402.

As discussed previously, both authors of the *Taoshuo* and *Taolu* drew from local gazetteers of Jiangxi Province and Fuliang County to provide an overview of porcelain production in Jingdezhen during the Ming period. In fact, the establishment of the Imperial Porcelain Workshop during the Zhengde period was documented in the *Taoshu* from the *Jiangxi sheng dazhi* (Wang and Lu, 1597, p. 813). First published in 1560, it was likely the original source for the later accounts found in both the *Taoshuo* and *Taolu*.

Nevertheless, an institution bearing the same name—*Yuqi chang*—existed elsewhere before the Imperial Porcelain Workshop was established in Jingdezhen. As Medley (1966) and Wang (2011) pointed out, the earliest record of the *Yuqi chang* appears in the *Raozhou fuzhi* 饒州府志 (Prefectural Gazetteer of Raozhou Prefecture), published in 1511. There, the *Yuqi chang* referred to a depot set up adjacent to the administrative office of Poyang County during the Xuande period (Chen, 1511, volume 2, p. 151). It served to store porcelain supplied by varies counties within Raozhou Prefecture as part of their tribute obligations to the central government, with a palace eunuch appointed by the emperor responsible for selecting which pieces would be transported to the imperial palace (*ibid.*). It is therefore reasonable to suggest that sometime after 1511, when the Imperial Porcelain Workshop was established in Jingdezhen, this depot was relocated to Jingdezhen and became integrated within the Workshop.

This assumption is corroborated by the *Taoshu*, which provides a detailed description of the Imperial Porcelain Workshop's spatial arrangement. Along the central axis of the complex stood a formal reception hall, to the left of which were administrative offices occupied by the Workshop's superintendent and subordinate officials, who were responsible for managing the entire cycle of porcelain production for the emperor, from procuring raw materials and recruiting skilled potters and labourers to overseeing the production process and selecting pieces for delivery (Wang and Lu, 1597, pp. 816, 828–832). Arranged on both sides of this

[15] A contradiction does appear within the *Taoshuo* itself: the Imperial Porcelain Workshop is listed under the Hongwu-period events, yet the same text, under the Zhengde-period events, documents the formal establishment of the Workshop in Jingdezhen.

central axis were production area and depots for storing finished wares—serving the same function as the depot previously set up in Poyang County (Wang and Lu, 1597, p. 816). In this regard, the various textual accounts drawn from local gazetteers, the *Taoshu*, and the *Taolu* in fact offer rather consistent documentation of imperial production in Jingdezhen: while manufacturing activities had begun as early as the Hongwu period, the establishment of the Imperial Porcelain Workshop during the Zhengde period formalised production by placing it under the supervision of appointed government officials within a dedicated institutional complex.

2.3.2 Development of imperial porcelain production in Jingdezhen over time

Imperial production prior to the establishment of the Imperial Porcelain Workshop, 1368–1511

While there are no textual accounts providing detailed information about the organisation of imperial porcelain production in Jingdezhen before the establishment of the Imperial Porcelain Workshop, inscriptions on archaeological ceramics offer insights into how the local workforce was organised within a workshop structure under the oversight of the Fuliang County Magistrate.

Seven early-Ming porcelain roof tiles discovered within or in the vicinity of the Yuyaochang site in Jingdezhen bear inscriptions that yield information on production organisation (Table 2-5). These roof tiles have porcelain bodies and are glazed with black colour on one side (for an example, see Figure 2-1). In addition to those excavated from Jingdezhen, identical roof tiles were found only in the palace located in present-day Fengyang County, Anhui Province, which served as the first imperial palace of the Ming emperor from 1369 to 1375 (Ji and Liu, 2022). This distribution suggests that these roof tiles were architectural ceramics manufactured specifically for imperial palace construction.



Figure 2-1: Porcelain roof tile. See record no. 1 in Table 2-5 for the full inscription. Source: Jingdezhen Imperial Kiln Institute, 2019, p. 207.

As shown in Table 2-5, the inscriptions on the unglazed side follow a consistent format. The texts begins with an identifier, likely indicating which architectural component the tile was intended for. It then specifies the individuals involved in the production, including the overseer (*jiangong* 監工), the *jia* chief (*jiashou* 甲首), the master potter (*zuotou* 作头), the glazer (*jiaoce* 澆色), and the kiln firer (*fenghuo* 風火). Finally, the inscription notes the names of different precincts under Fuliang County administration.

Table 2-5: Inscriptions on porcelain roof tiles excavated from Yuyaochang, manufactured for imperial palace construction (c. 1369–1371)

Note*:* '/' indicates information not preserved on the tile. 'Identifier' refers to characters likely designating the architectural component for which the tile was intended. 'Precinct name' refers to precincts (*du* 都) under the administration of Fuliang County.

No.	Identifier	Overseer	*Jia* chief	Master potter	Glazer	Kiln firer	Precinct name	Reference
1	Shouzi sanhao 壽字三號	Zhao Wanchu 趙萬初	Wu Changxiu 吳昌秀	Pan Cheng 潘成	Fan Daoming 凡道名	Fang Nan 方南	Lower Lian Precinct 下連都	Liu, 1996, p. 18
2	/						Lower Changyuan Precinct 下長遠都	Liu, 1996, p. 19

3	/	/	/	/		Xu 徐	Renshou Precinct 仁壽都	Jiang, 2018, p. 31
4	Wanzi 萬字	Zhao Wanchu 趙萬初	Wu Changxiu 吳昌秀	Pan Cheng 潘成		Zhan Gao 占高	Upper Yi Precinct 上義都	Jiang, 2018, p. 74
5	Wanzi sanhao 萬字三號			/		Fang Nan 方南	Changning Precinct 長寧都	SAM-PKU, 2007, p. 42
6	/			/			Shang Xibu Precinct 尚西部都	JPICRA *et al*., 2024b, p. 44
7	Shouzi sanhao 壽字三號			Pan Cheng 潘成			Upper Changyuan Precinct 上長遠都	

Notably, the inscriptions referencing an 'overseer' and '*jia* chief' (i.e., chief of one of ten sections) suggest that the workforce for tile production was drawn from village communities. While every 110 households formed one village community (*li* 里) under county administration, each community was further divided into ten sections (*jia* 甲), each led by a *jia* chief (*jiashou* 甲首) (Huang, 1998, pp. 134–135; Li, 2010). Each year, one section was obligated to fulfil any labour service demanded by the government on behalf of the entire community, while the remaining sections were required only to pay regular taxes (*ibid.*). In this case, the inscription naming Wu Changxiu 吳昌秀 as *jia* chief indicates that these tiles were produced by people from the households under his supervision as part of their mandatory service obligations. The production process as a whole was administered by the Magistrate of Fuliang County, Zhao Wanchu 趙萬初, whose name appears with the title 'overseer' on the tiles.[16]

Moreover, the remaining inscriptions suggest that tile production was organised in a hierarchical arrangement, with two potters allocated to the tasks of glazing (*jiaoce* 澆色) and firing (*fenghuo* 風火), and one master potter who coordinated both process. The recurrence of the same names (the master potter 潘成, the glazer Fan Daoming 凡道名, and the kiln firer Fang Nan 方南) across several tile inscriptions further suggests that these tiles were manufactured together in the same workshop. Meanwhile, the absence of any potter's name associated with the forming process indicates that the tile bodies may have been pre-manufactured elsewhere before being sent to Jingdezhen workshops for glazing and firing. This

[16] According to Liu's (1996) research on Zhao Wanchu's biography, he served as the county magistrate from 1369 to 1371.

division of production processes explains why the tile inscriptions consistently identify the same potters for glazing and firing while also referencing place names other than Jingdezhen within Fuliang County. These place names likely designate the locations where the unglazed tile bodies were initially produced before being transported to Jingdezhen's workshops for glazing and firing.

Beyond the government-organised production, one record from the *Ming huidian* shows an alternative approach for acquiring imperial porcelain. In 1432, Emperor Xuanzong 宣宗 (1399–1435; Xuande reign, r. 1426–1435) commissioned 443,500 pieces of porcelain to be made in Raozhou Prefecture of Jiangxi Province (*Ming huidian*, volume 91, pp. 9800–9801). While no detailed documentation survives on how these extensive quantities of porcelain were produced, Arai (2018, pp. 109–111) argues that the order was at least partially fulfilled through local potters in subordinate counties of Raozhou Prefecture. This is supported by a contemporary record from the *Ming shilu*, which states that a local resident in Fuliang County delivered approximately 50,000 porcelain pieces to the imperial palace and received reimbursement for production costs (*Ming Xuanzong shilu*, volume 22, p. 549). As Arai (2018) notes, using state revenue to acquire imperial porcelain from local potters was a common practice dating back to the Song period. Although government officials responsible for procurement may have also specified vessel forms or decoration styles, likely at the request of the emperors (for discussion of such case, see Xie, 2010), they were not responsible for organising and overseeing the production process itself, as the County Magistrate and *jia* chief did in the case of tile production.

Imperial production after the establishment of the Imperial Porcelain Workshop, 1511–1644

After its establishment in Jingdezhen, the Imperial Porcelain Workshop functioned simultaneously as a manufacturing centre where potters worked and as an administrative institution where an appointed superintendent and their subordinates were responsible not only for overseeing production but for securing the raw materials and workforce required to fulfil imperial demands (Wang and Lu, 1597, pp. 816, 828–832). Drawing on the accounts of the *Taoshu*, this section examines how the Workshop's operational regulations and the officials' procurement methods fundamentally shaped the organisation of imperial production.

Raw materials

The *Taoshu* identifies two procurement methods for essential materials required for porcelain bodies, glazes, and cobalt pigment for underglaze decoration. Most materials were acquired by purchasing pre-processed raw materials from trade markets. For example, the *Taoshu* describes how 'brick-shaped earth ' (*duntu* 不土) was sourced and transported from neighbouring Yungan and Wuyuan Counties (Wang and Lu, 1597, p. 818).[17] The *Yugan xianzhi* 余乾縣誌 (Gazetteer of Yugan County) confirms this account, listing *duntu* as a local product exported to Jingdezhen (Lü, 1684, p. 171). Although the *Taoshuo* offers limited details about *duntu*, the *Taoye tushuo* provides more extensive technical information. According to the *Taoye tushuo*, this porcelain body material originated from quarried mountain stones (Tang, 1743, p. 954). After extraction, these stones underwent a processing sequence: they were pulverised into powder using water-powered trip hammers, then purified through water levigation to remove impurities, and finally compressed into brick-shaped blocks—a form locally referred to as *dun* 不 in the Jingdezhen dialect *(ibid.*). Therefore, the 'brick-shaped earth' acquired for the Imperial Porcelain Workshop represented not raw quarried stone but a refined intermediate product. This procurement method likely developed in response to increasing silver circulation and expanding regional trade networks since the late fifteenth century. For materials like 'brick-shaped earth', the *Taoshu* records how transportation distance influenced the monetary value for different earth sources (Wang and Lu, 1597, p. 818), indicating one factor that shaped market valuation.

Alternatively, raw materials such as cobalt pigments could be allocated from government depots under the charge of the Jiangxi Provincial Administration (*Buzheng si* 布政司) to the Imperial Porcelain Workshop when the superintendent petitioned for specific quantities, as documented in the *Taoshu* (Wang and Lu, 1597, p. 832). These cobalt pigments were first assigned to government depots from the palace storehouses in Nanjing and Beijing by the Ministry of Works (*Gongbu* 工部), and then distributed to local authorities, including the Jiangxi Provincial Administration (Su, 2015). Although these cobalt pigments originated as tributes from foreign countries or domestic regions within China (Jiang *et al.*, 2020), they were never incorporated into the Ming period's regular local produce collection system. Local

[17] The term *tu* 土 is translated as 'earth' to distinguish it from *ni* 泥, translated as 'clay'. As detailed examination of textual accounts of raw material nature and terminology in Chapter 4 (Section 4.1.1) will demonstrate, *tu* refers to intermediate products that have undergone initial processing, while *ni* denotes the final clay paste ready for body making.

gazetteers from cobalt source regions, including *the Ruizhou fuzhi* 瑞州府志 (Gazetteer of Ruizhou Prefecture) and *Le'an xianzhi* 樂安縣誌 (Gazetteer of Le'an County), classify cobalt merely as a 'local product' (*wuchan* 物產) rather than as produce for mandatory collection (*na* 納) (Tao, 1628, p. 1557; Fang, 1684, p. 12). Had cobalt pigments been subject to the regular collection system, these gazetteers would have documented precise quotas required from local village communities, with monetary values converted to silver as part of each county's tax contribution to the state (Ding, 2021).

Production costs for imperial commissions were not reimbursed but had to be estimated by the superintendent and allocated from Jiangxi Province's tax revenue by the Provincial Administration Commissioner (*buzhengshi* 布政使), following the same allocation process used for cobalt (Wang and Lu, 1597, pp. 823–824). This financing arrangement required a significant degree of standardisation in production, understood here as a deliberate reduction in dimensional variability within each vessel type. The *Taoshu*'s detailed inventories, which meticulously specify dimension measurements and raw material quantities required for fifty-five vessel types, reflect this concern (Wang and Lu, 1597, pp. 835–839). Without uniform vessel dimensions, estimating accurate material quantities and costs would have been difficult and resulted in raw material shortage or waste. Assessing the extent to which such standardisation was achieved in practice would require systematic dimensional analysis of excavated vessels, which falls outside the scope of this thesis. Nevertheless, the demand for reduced product variability by the superintendent was likely fulfilled through potters' fine motor skills developed during process specialisation, which is discussed further in Section 2.4.

Workforce

The *Taoshuo* identifies four methods of workforce recruitment for the Imperial Porcelain Workshop. The first was to enlist potters from registered artisan households under the administration of the Ministry of Works. These artisans were required to work on construction or craft production projects in the imperial centre, Nanjing, on a rotational basis of one to five years (the *Ming huidian* 明會典, volume 189, pp. 9558–9566). However, as recorded in the *Taoshu*, potters registered under artisan households of Jiangxi Province who were otherwise obliged to serve in Nanjing could be retained in Jingdezhen to work at the Imperial Porcelain Workshop (Wang and Lu, 1597, p. 851). These potters were also required to cover their own

subsistence (*zibei gongshi* 自備工食), and likely made a living by taking on extra work outside the Workshop or through the support of other members of their households.

The second method was to enlist potters from local ceramic production communities in Fuliang County. These ceramic production communities (*yaohu* 窯戶) comprised potters who were not necessarily blood-related. While *yao* 窯 literally means 'kilns' in Chinese, *yaohu* 窯戶 does not refer solely to those who operated kilns, but to those working in ceramic production more generally. The number of ceramic production communities was sometimes recorded in local gazetteers as a measure of production capacity, representing a form of local knowledge for provincial, prefectural, or county administrations (for examples of such records, see Hu, 2024). According to the *Taoshu*, for the purpose of enlisting potters, the government defined each ceramic production community by the number of kilns it operated, with one kiln constituting one community (Wang and Lu, 1597, p. 852). How labour was organised within each community, whether it comprised a single workshop, several workshops, or potters working from their own households, is not specified in the available textual accounts regarding Ming-period Jingdezhen. In 1529, for every three kilns in use, one potter was enlisted to work in the Imperial Porcelain Workshop (*ibid*.). If kilns ceased operation after the survey was completed, the potters associated with those kilns were released from this obligation (*ibid.*). Nevertheless, the author of the *Taoshu* criticised this approach, noting that these enlisted potters suffered from a severe imbalance between their extensive workload and complete lack of compensation (Wang and Lu, 1597, pp. 852–853).[18]

The third method was to recruit potters who excelled at particular production processes, such as underglaze painting, dragon carving, or firing large-size vessels (Wang and Lu, 1597, pp. 851–852). This method was recorded only in the Wanli edition, not in Wang's original text, and is thus likely a development after the Jiajing period (Wang and Lu, 1597, pp. 853–854; collated by Chen, 2012). Unlike potters from registered artisan households or those enlisted from ceramic production households, these recruits received a daily wage in exchange for their skills and labour (Wang and Lu, 1597, pp. 853–854). For instance, underglaze painters with superior skills (*gaoshou* 高手) were paid more than those with intermediate proficiency (*zhongshou* 中

[18] The Jiajing-period workforce arrangements set out in this section are drawn from the Wanli edition. They appear first in Wang Zongmu's original text, and are not among the revisions Chen (2012) attributes to Lu Wan'gai. The developments extending into the Longqing and Wanli periods, noted below, belong to Lu's later additions.

手) (Wang and Lu, 1597, p. 854). If imperial orders were urgent, the wages could increase further (*ibid.*). While the *Taoshu* did not specify how such skills were assessed, this account indicates that the superintendent or master potters overseeing particular production processes had a working knowledge of relative skill levels, or that a general consensus existed among potters' groups regarding who were the most proficient.

In addition to potters, other workers involved in porcelain production, documented as general labourers (*shanggongfu* 上工夫) and sand and earth carriers (*shatufu* 砂土夫), were enlisted through village communities of counties under the administration of Raozhou Prefecture (Wang and Lu, 1597, pp. 822–828). The same method had been used for tile production in Jingdezhen before the establishment of the Imperial Porcelain Workshop. As with the first two methods, enlisting potters from artisan households and local ceramic production communities, this approach relied on compulsory labour duties assigned by government administration. By contrast, the third method of recruiting skilled potters was based on paid employment, affording potters greater freedom in deciding whether to accept the work.

Notably, after the reforms to the tax collection and labour requisition systems began during the Hongzhi period, potters registered under artisan households could either commute their duties through monetary payment or skilled potters as substitutes to complete their tasks (this phenomenon is widely noted, see Hsu, 1988; Liu, 2014; Gerritse, pp. 179–180;Hu, 2024). This arrangement also created greater opportunities for the Imperial Porcelain Workshop to recruit skilled potters. Well before the Single Whip Reform extended such commutation to a state-wide scale in the late sixteenth century, potters registered under artisan households in Jiangxi Province were already required to pay silver in lieu of their rotational labour service at Nanjing (Wang and Lu, 1597, p. 852). This created a double burden—because they were retained at the Imperial Porcelain Workshop and therefore could not travel to Nanjing to serve, they were obliged both to perform corvée labour at the Workshop and to pay the levy commuting the Nanjing service they were prevented from rendering. A Workshop superintendent reported this hardship to the Ministry of Works in 1529, and the additional payment was rescinded some twenty years later (Wang and Lu, 1597, p. 853).

After recruitment, potters were assigned to different workshop compounds within the Imperial Porcelain Workshop. Each sub-workshop (*zuo* 作) was designated for specific tasks: firing

(*fenghuo yao* 風火窯), overglaze enamel firing (*se yao* 色窯), big bowl forming (*dawan zuo* 大碗作), dish forming (*die zuo* 碟作), plate forming (*pan zuo* 盤作), vessel moulding (*yin zuo* 印作), win cup forming (*zhong zuo* 鐘作), dragon carving (*zhuilong zuo* 錐龍作), underglaze painting (*hua zuo* 畫作), inscription writing (*xiezi zuo* 寫字作), overglaze painting (*se zuo* 色作), and saggar making (*xia zuo* 匣作) (Wang and Lu, 1597, pp. 854–855). Within each sub-workshop, master potters (*tou* 頭) oversaw the production process, while others potters (*jiang* 匠) who worked under them (*ibid.*).

This production arrangements described here mirror those seen in tile inscriptions (see Section 2.3.2), albeit with a more diverse and complex range of tasks. This division of tasks also allowed the superintendent to estimate the total workforce required for imperial commissions, as the production of a single vessel was now broken down into discrete stages, each with its own labour demands. However, most workforce recruitment methods of the Imperial Porcelain Workshop could not ensure that potters possessed the skills required for certain tasks such as painting, moulding, or carving. The lack of documentation regarding training processes raises the question of whether recruited potters were assigned tasks on the basis of pre-existing skills, or whether they were expected to acquire the necessary competencies after assignment. The available textual accounts suggest only that the Workshop pursued multiple ways to secure a sufficient workforce for porcelain production, drawing on the labour requisition system that operated from central government down to local county administration. Where shortfalls in experienced potters occurred, these could be supplemented through targeted recruiting in areas of particular demand.

Outsourced imperial orders

Beyond manufacturing activities within the Workshop, the *Taoshu* also documents an alternative method for acquiring imperial porcelain. When imperial orders needed to be delivered within a limited timeframe and the order volume exceeded the production capacity of the Imperial Porcelain Workshop, the surplus was assigned to local ceramic production communities within Jingdezhen (Wang and Lu, 1597, pp. 839–840, 847–848). While the *Taoshu* records that these communities received compensation for their production costs of imperial orders from the superintendent of the Workshop, the author also notes that many complained that the compensation was never sufficient and reluctant to fulfil the orders (Wang and Lu, 1597, p. 839). As a result, they always delayed production until the final deadline

imposed by the superintendent and delivered products with defects such as body deformation or blurry decoration (Wang and Lu, 1597, p. 848).

In summary, while the establishment of the Imperial Porcelain Workshop marked a greater formalisation of imperial porcelain production in Jingdezhen, the underlying organisation of production remained broadly consistent throughout the Ming period, encompassing both government-administered manufacturing and outsourced commissions to potters within local ceramic communities (Table 2-6). Following the Workshop's establishment, however, a key development can be identified. The superintendent undertook direct administration of production costs in terms of raw materials and workforce, with more accurate estimation of these costs enabled by the standardisation of vessel forms and the organisation of sub-workshops that divided the manufacture of certain vessel types into discrete stages. This development drew upon the resource networks and process specialisation rooted in Jingdezhen's local ceramic production, as is discussed further in Section 2.4.

Table 2-6: Organisation of imperial production before and after the establishment of the Imperial Porcelain Workshop (compiled from textual accounts discussed in Sections 2.3.1 and 2.3.2)

<table>
<tr><th></th><th>1368–1511</th><th>1511–1644</th></tr>
<tr><td colspan="3">I. Government-administered imperial production</td></tr>
<tr><td>Overseer</td><td>Fuliang County Magistrate</td><td>Superintendent of the Imperial Porcelain Workshop</td></tr>
<tr><td>Production location</td><td>Yuyaochang identified; others unknown</td><td>Imperial Porcelain Workshop</td></tr>
<tr><td rowspan="2">Raw material procurement</td><td rowspan="2">Unknown</td><td>Local resource networks</td></tr>
<tr><td>Allocation from central and provincial authorities</td></tr>
<tr><td rowspan="4">Workforce recruitment</td><td rowspan="4">Potters from village communities of Fuliang County (obligatory)</td><td>Potters from registered artisan households (obligatory)</td></tr>
<tr><td>Potters from active ceramic production communities (obligatory)</td></tr>
<tr><td>Potters based on daily-wage payment (voluntary)</td></tr>
<tr><td>Labourers and clay carriers from village communities of counties subordinate to Raozhou Prefecture (obligatory)</td></tr>
<tr><td>Labour division</td><td>Forming, glazing, firing</td><td>Twelve sub-workshops encompassing forming, painting, inscription writing, and firing</td></tr>
<tr><td>Product standardisation</td><td>Unknown</td><td>Fifty-five vessel forms</td></tr>
<tr><td colspan="3">II. Imperial commissions outsourced to ceramic production communities</td></tr>
</table>

2.4 Resource networks and process specialisation in Jingdezhen's local ceramic manufacture

2.4.1 Raw material procurement and local resource procurement networks

As discussed above, the Imperial Porcelain Workshop's primary method for acquiring raw materials was purchasing pre-processed materials through trade networks connecting Jingdezhen with source sites in adjacent counties. In addition to the sources from Yungan and Wuyuan Counties documented in the *Taoshu* (Wang and Lu, 1597, p. 818), the *Taoshan* identifies another source in Qimen County (Song, 1637, p. 138), suggesting the diverse raw material options available to Jingdezhen potters.

This practice of direct acquisition from raw material suppliers, the sellers who quarried, processed, and traded prepared body materials, was common in Jingdezhen's local porcelain production, dating at least to the Southern Song period. Archaeological excavations at Hutian have yielded numerous inscribed sherds from strata dated to twelfth and thirteenth centuries (JPICRA *et al.*, 2007, pp. 436–438). These sherds, comprising the inner bottoms of bowls or dishes, bear carved inscriptions that identify suppliers. For instance, one bowl sherd is inscribed 'The yellow clay from Ling Xiaoqi's son' (*Lingxiaoqi zi huangni* 凌小七子黄泥) (see Figure 2-2), while another displays 'Xiao Yuan's yellow clay workshop' (*xiaoyuan huangnichang* 小元黄泥厂) (JPICRA *et al.*, 2007, p. 436). These inscriptions suggest potters may have carved them to track material sources during firing tests, or that the suppliers provided pre-inscribed pieces to demonstrate the quality of finished porcelains made with their materials. These markings indicate that suppliers were identified by name and their materials judged on the clay quality, pointing to a competitive supply trade in which potters could source prepared materials of known and demonstrable performance. The term *chang* 廠, literally meaning 'sheltered space', here likely refers to a workshop for processing yellow clay, suggesting that raw material procurement and processing had itself become a specialised activity within local ceramic manufacture, carried out by suppliers who prepared and sold body materials to potters.



Figure 2-2: Bowl sherd (left). The sherd was excavated from the Hutian Site (registration no. 99H·T11②:200). Source: JPICRA *et al.*, 2007, p. 436.

2.4.2 Process specialisation and division of labour

As conceptualised by Flad and Hruby (2007, p. 3), scholarly discussion on specialisation can be understood as a continuum, with product specialisation (production for non-kin consumption with no dependence on exchange) as a more encompassing category and producer specialisation (specialists carry out only their craft to earn their subsistence) as a more restricted subset within it. In the case of Jingdezhen, while no evidence suggests that raw material suppliers or potters who excelled at particular production techniques necessarily derived their livelihood exclusively from these activities, they developed knowledge and skills that enabled specialisation in particular production processes and gave rise to differentiated roles within Jingdezhen's broader ceramic production communities.

For example, the *Taoshan* explicitly distinguishes between throwing and moulding techniques within the forming stage. As shown in the *Taoshan*'s text and accompanying illustration (Figure 2-3), throwing involved centring clay on a rotating wheel, then skilfully drawing it upward to create vessel walls of uniform thickness (Song, 1637, p. 139, 145). Moulding, by contrast, covers a more complex sequence (Figure 2-4): creating moulds (typically in two or several parts) with coarser clay, preparing slabs with refined clay, pressing these slabs into the moulds, removing partially dried pieces from the moulds, and finally joining these components together using diluted clay slip as an adhesive (Song, 1637, p. 139). Since the *Taoshan* documented that

moulded vessels constituted merely ten percent of Jingdezhen's total porcelain production volume (*ibid.*), the moulding technique was likely practiced and mastered by considerably fewer potters. This process specialisation of moulding is further corroborated by the organisation of the Imperial Porcelain Workshop, where vessel moulding was designated as a distinct specialised workshop, while other forming workshops were divided according to vessel types.

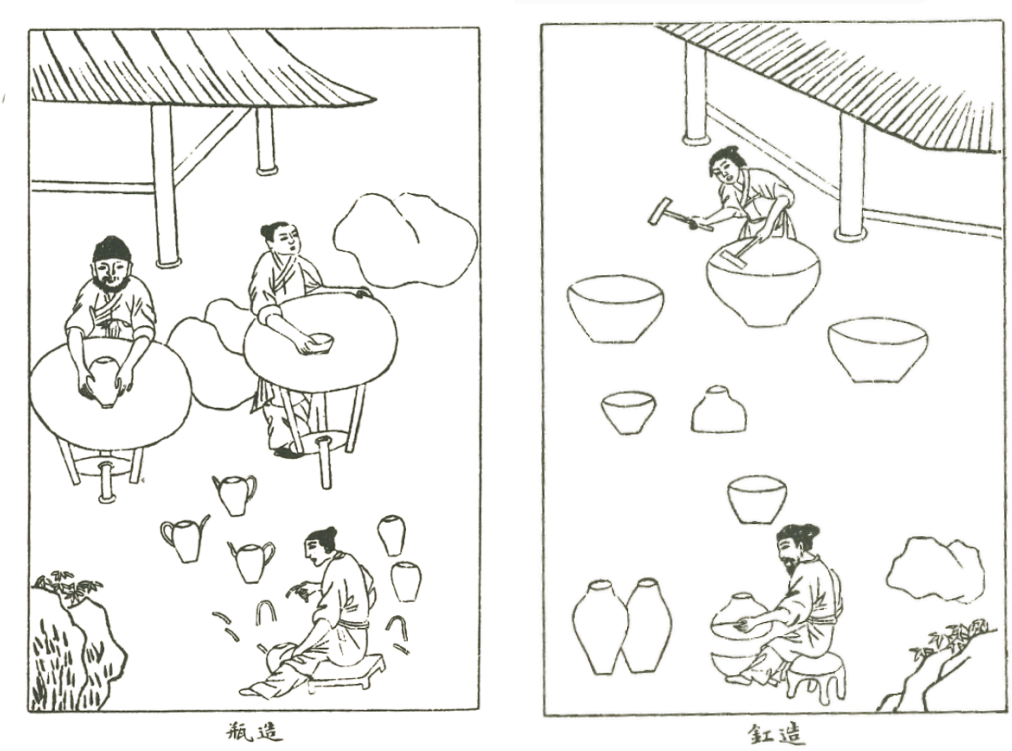


Figure 2-3 (left): Throwing process. Two potters depicted in the back row were throwing porcelain bodies of round ewers using double-wheel devices. The caption in the original image reads *zaoping* 造瓶 (making vases) Source: Song, 1637, p. 145.

Figure 2-4 (right): Moulding process. The potter depicted in the back was using a paddle-shaped tool to press slabs into the mould, while the one in the front was seaming the two moulded vessel parts. The caption in the original image reads *zaoping* 造缸 (making large bowls) Source: Song, 1637, p. 148.

While Rice (2015, p. 541) associates process specialisation with prescriptive technologies—where artisans are assigned specific tasks and possess little knowledge of the full production sequence—the process specialisation evident in Jingdezhen's local production does not always conform to this model. For instance, mould making required holistic knowledge ranging from clay body properties to firing principles, as noted in the *Taoye tushuo*. Potters who made moulds had fired pieces in mind, calculating precise dimensional modifications to account for

the shrinkage and deformation that firing would introduce (Tang, 1743, p. 955). Mould making thus demanded knowledge of stages the mould maker did not perform. To size a mould correctly, the potter had to anticipate how the clay body would behave in firing. The expertise was defined not by the single task but by the cross-stage understanding the task required.

In comparison to throwing, which was a relatively simple technique, the *Taoye tushuo* notes that Jingdezhen had no more than two or three renowned specialists in mould making, which speaks to the considerable time and personal experience required to master the craft (*ibid.*). As fewer potters possessed the expertise that such techniques demanded, certain production processes became specialisations in their own right. This concentration of skill, however, could also result in the division of production into sub-tasks for potters with different skill sets, rather than a unified process mastered by one individual. In this respect, the outcome aligns with Rice's prescriptive arrangement, even if the underlying logic differs. In Rice's model, the division of production into sub-tasks implies that individual artisans possess limited understanding of the full sequence. Yet in Jingdezhen, the very expertise that made certain potters indispensable to process specialisation rested on integrated knowledge spanning multiple stages. The outcome of divided labour may appear similar, but the knowledge structure underpinning it is fundamentally different. This is a claim the present chapter can only begin to establish from the demanding specialisations visible in the textual accounts. As the material evidence examined in Chapters 4 and 5 will show, potters' production knowledge was developed in the practice of responding to variable materials rather than held as codifiable procedure, and this knowledge could become the basis for adapting a technique from one stage to another. In that case, specialisation in a certain production stage or method could deepen rather than narrow what a practitioner knew.

The varying skill levels of potters account for how labour was divided within the Imperial Porcelain Workshop. As Gerritsen (2020, pp. 182–183) points out, not all tasks assigned to the sub-workshops required high levels of expertise. For instance, potters in the saggar-making workshop needed only to form roughly potted bowls and did not have to possess knowledge of porcelain clay properties. Potters who threw larger vessels, such as big bowls and plates, were also required to possess greater skill than those producing cups and dishes (*ibid.*). In this regard, she further argues that the division of labour within the Workshop functioned more as a coping mechanism to manage the mixed labour sources, whereby potters of differing abilities could be assigned to suitable roles, and unskilled workers could be trained easily to carry out simpler

tasks (*ibid.*). The deepening of knowledge discussed here therefore applies to the skilled specialisms on which the system depended, such as mould making and the forming of large vessels, not to the auxiliary tasks that could be carried out with little training. While a smaller number of specialists gained their expertise that required knowledge spanning multiple stages, a larger body of workers performed tasks that could be leaned on the job.

Under this mode of organisation, the Imperial Porcelain Workshop was strongly reliant on specialist potters. Even if their tasks were confined to certain stages, such as making moulds, the specialisation required an integrated understanding of the entire process, encompassing raw materials, forming, and firing effects. Without accurately shaped moulds, whether for moulding or trimming thrown vessels, the uniform vessel forms demanded by the superintendent would have been unachievable, let alone the accurate estimation of production costs. This dependency on specialist potters also shaped the Workshop's recruiting strategy. As potters registered under artisan households were permitted to commute their obligatory service into monetary payments, the superintendent could redirect these funds toward hiring the experienced specialists the Workshop required. Simultaneously, the expertise of these specialists reduced the overall skill threshold for tasks that could be fulfilled by other workforce secured through compulsory enlistment from local ceramic production communities and village communities. For instance, once a mould had been made by a specialised potter, others working in the moulding workshop did not need to possess the full knowledge of a master potter, as the mould itself standardised the form that would otherwise have depended on individual skill.

Despite the substantial number of over three hundred potters working at the Imperial Porcelain Workshop (Wang and Lu, 1597, p. 851), this represents only a modest fraction of Jingdezhen's total workforce in porcelain production during the sixteenth century. As examined in Section 2.1.1, the *Ming shilu* preserves a report submitted in 1540 by Grand Coordinator of Jiangxi Province Wang Wei 王暐 (1485–?) (*Ming Shizong shilu*, volume 240, p. 5862). In this official communication, Wang reported that severe flooding had deprived more than 100,000 workers engaged in local porcelain production of their livelihoods and requested the appointment of an official to Fuliang County to assist with relocating potters and resume production, a request that the emperor approved (*ibid.*). This record attests to the extraordinary scale of the local ceramic manufacture, which provided essential resources for imperial production—both the expertise that specialist potters possessed and the sufficient workforce that sustained the division of labour at the Workshop.

This chapter has examined how imperial porcelain production in Jingdezhen was supported by the Ming period's state infrastructure: how it drew on Jiangxi Province's tax revenues to finance production costs, utilised workforce recruited from the labour requisition system, and was administered by appointed officials to ensure timely delivery of imperial orders. This state-sponsored production did not operate in isolation. On the contrary, it was fundamentally dependent upon Jingdezhen's existing resource networks and process specialisation, and thus remained inseparable from the broader local ceramic manufacture. These insights from textual accounts, and the limits of what such accounts can capture about how production was actually carried out, necessitate a re-examination of archaeological evidence from Jingdezhen that scholars have traditionally categorised as 'imperial' or 'non-imperial', a task undertaken in the subsequent chapter.

Chapter 3 Blurring the Imperial Boundary: Porcelain Production Practices Reconstructed from Archaeological Evidence

Through analysis of historical accounts, Chapter 2 has shown that imperial porcelain production in Jingdezhen was an integral part of local ceramic manufacture. This raises the question of whether sites currently classified as imperial and non-imperial can be distinguished through the archaeological evidence of production, or whether they shared more commonalities than differences in how porcelain was made. As discussed in Chapter 1, however, these sites are classified not by how production was conducted but by the consumption contexts projected onto their unearthed sherds. The Yuyaochang site, in particular, has been identified as an imperial site where the Ming-period Imperial Porcelain Workshop was located (for a summary of existing scholarship, see Jiang, 2020b), while other sites became 'non-imperial' since their excavated objects were largely found at overseas shipwrecks or urban settlements without direct imperial consumption associations (Gao, 2021, pp. 8–18). This classification has shaped the interpretation of individual archaeological features at each site, from boundary walls to kiln waste deposits.

To assess whether the current imperial and non-imperial classification of these sites corresponds to observable differences in how production was conducted, this chapter conducts a comparative analysis of production features across four Ming-period porcelain manufacturing sites in Jingdezhen, drawing on published excavation reports. Throughout this chapter, 'site' refers to a discrete archaeological locale identified through excavation or survey, following the designations used in published reports. Section 3.1 provides an overview of the archaeological evidence for Ming-period blue-and-white porcelain production across Jingdezhen. From this overview, Section 3.2 selects four manufacturing sites (Yuyaochang, Guanyinge, Luomaqiao, and Hutian) on the basis of documentation quality and the range of production evidence preserved. Section 3.3 then compares construction methods, materials, scale, and stratigraphic sequences across four categories of production features: walls, evidence for the use of pottery wheels, kilns, and kiln waste deposits. These categories represent different stages of porcelain manufacture, from spatial organisation and forming to firing and post-firing disposal. Together, these aspects of production features constitute what this chapter terms *production practices*—the recurring choices through which potters organised space, formed vessels, fired kilns, and disposed of waste. The comparison assesses whether the direct

archaeological evidence shows distinct differences corresponding to the current imperial and non-imperial classification of these sites. Section 3.4 draws together the findings.

At the same time, this chapter acknowledges the limits of feature analysis. As will be demonstrated, structural features and deposits can inform production technologies, construction choices, and disposal practices, but they do not tell us how production was organised or administered. Much of what emerges reflects common practical responses to shared manufacturing requirements, such as recycling kiln waste for construction, stabilising a pottery wheel shaft, or modifying kiln structures to improve heat distribution. These responses were found across Jingdezhen's manufacturing sites and, more broadly, in ceramic production in general. Identifying what is site-specific therefore requires careful comparison, and even then, the evidence speaks more directly to differences in construction investment and production priorities than to the administrative arrangements specified in textual accounts.

3.1 An overview of the archaeological evidence for Ming-period blue-and-white porcelain production

So far, thirty-nine sites in present-day Jingdezhen have been identified as containing archaeological evidence of Ming-period blue-and-white porcelain production through research activities led by institutes such as the Jingdezhen Ceramic Archaeological Research Institute and the Jiangxi Provincial Institute of Cultural Relics and Archaeology (Figures 3-1, 3-2). These activities have included surveys involving surface collection and/or test pit excavation, rescue excavations conducted prior to urban development, and planned excavations guided by specific research questions with comprehensive stratigraphic records and detailed documentation. However, the quality of data recording varies across these categories, particularly for rescue excavations where time and budget is often constrained.

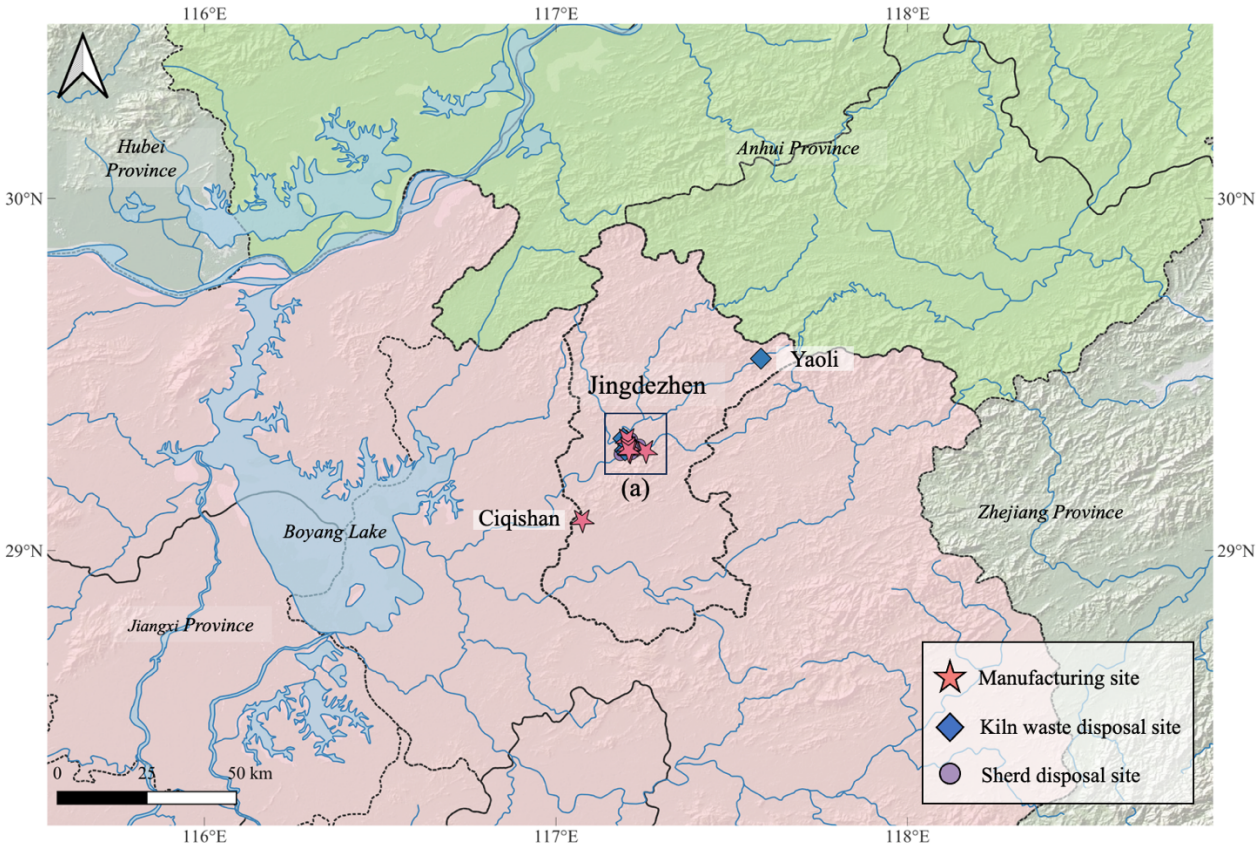


Figure 3-1: Distribution of archaeological sites in Jingdezhen. Geographic coordinates for site locations are given in Table A3-2, Appendix A.

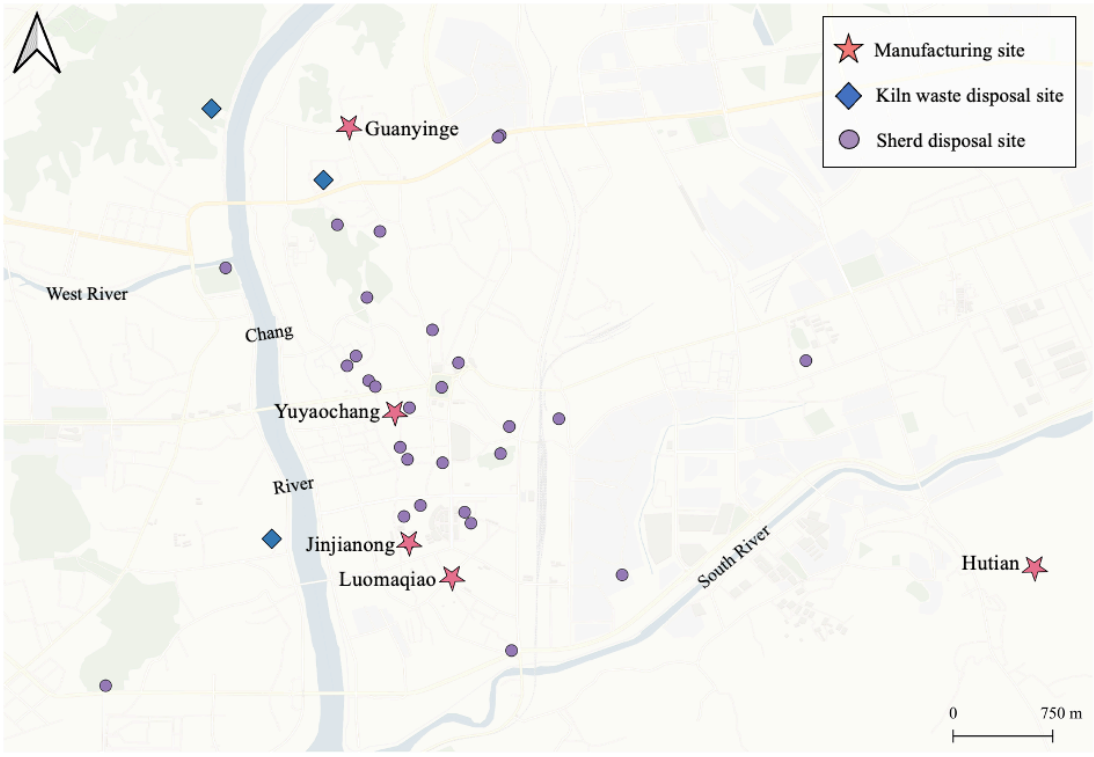


Figure 3-2: Distribution of archaeological sites in cluster (a) (see Figure 3-1). Manufacturing site names are labelled. Geographic coordinates for site locations are given in Table A3-2, Appendix A.

Based on the types of archaeological remains recovered, these sites can be divided into manufacturing sites, kiln waste disposal sites, and sherd disposal sites. Manufacturing sites have yielded significant evidence of production features—such as clay refining pools, pottery wheels, kilns, and production tools. While Song *et al*. (2023) argue that the presence of at least one permanent feature—such as a clay refining pool or a pottery wheel—confirms the presence of a workshop, this chapter uses more neutral terms such as 'manufacturing site' and 'production area' when analysing production features, following Costin's (2001) critique of the indiscriminate use of 'workshop' in archaeological research. Costin (2001, p. 296) argues that this term implies large-scale production at non-household locations conducted by non-kin potters, and insists that these are organisational characteristics that must be demonstrated through archaeological evidence rather than assumed. Although the analysis of historical accounts in Chapter 2 indicates the presence of specialised workshops and ceramic production communities in Ming-period Jingdezhen, such social organisational contexts cannot be inferred from the currently published archaeological materials alone. What can be compared are the production features themselves, and it is on this basis that the present chapter proceeds.

Beyond manufacturing sites, kiln waste disposal sites have yielded porcelain sherds and kiln furniture, suggesting that such debris was disposed after firing, although the disposal location may not have been the original production area due to the lack of preserved production features. In contrast, sherd disposal sites are those where only porcelain fragments are found, which may have been deposited following either production or consumption activities. Table A-1 (Appendix A) lists the category attributed to each site.

These classifications are made on the basis of published documentation, and reclassification remains a possibility should future publications disclose additional evidence of production features. This provisionality is particularly worth underlining for Yaoli, which the present study classifies as a kiln waste disposal site because no production features have been published (Table A-1). Yet Yaoli lies close to viable sources for porcelain body raw materials, and the compositional characteristics of Ming-period wares discovered at the site, as discussed in Chapter 4, are consistent with the use of locally available materials rather than debris transported from elsewhere. This observation does not establish that forming and firing took

place at Yaoli, which the absence of published production features leaves undetermined, but it indicates that the disposal-site classification reflects the current state of publication rather than a settled interpretation. Where Yaoli samples are compared with those from other sites in Chapter 4, this qualification should be borne in mind.

3.2 Selected manufacturing sites

Among the six manufacturing sites identified (Table 3-1), four have been selected for comparative analysis: Yuyaochang, Guanyinge, Luomaqiao, and Hutian. Two criteria guided this selection. First, sites must have undergone at least one planned excavation resulting in either a full excavation report or detailed preliminary reports, ensuring that the archaeological evidence is comprehensively documented. Second, sites must preserve evidence of more than one category of production feature, such as walls, evidence for the use of pottery wheels, kilns, or kiln waste deposits, to enable comparison across different stages of porcelain manufacture. Jinjianong is excluded because its findings are only briefly mentioned in survey records, and Ciqishan, although excavation uncovered an early-Ming kiln, lacks documentation of other production features. Together, the four selected sites also provide chronological coverage across the Ming period, with Guanyinge specifically dated to the middle–late periods. Detailed documentation of archaeological research for each site is provided in Appendices D–G.

Table 3-1: Available evidence from blue-and-white porcelain manufacturing sites in Jingdezhen

Site Name	Period	Archaeological research type(s)	Publication status	Walls	Pottery wheels	Kilns	Kiln waste deposits	Selected for analysis
Ciqishan (瓷器山)	Early Ming	Planned excavation	One preliminary excavation report	×	×	√	√	×
Guanyinge (觀音閣)	Middle–late Ming	Survey and planned excavation	Five preliminary excavation reports	√	√	×	√	√
Yuyaochang (御窯廠)	Ming	Survey, rescue excavation, and planned excavation	Five preliminary excavation reports	√	√	√	√	√
Luomaqiao (落馬橋)	Ming	Rescue excavation and planned excavation	Two preliminary excavation reports	√	√	√	√	√
Hutian (湖田)	Ming	Survey and planned excavation	Full excavation report	√	×	√	√	√
Jinjianong (金家弄)	Ming	Rescue excavation	Survey records	Unknown		√	√	×

These four production feature categories—walls, evidence for the use of pottery wheels, kilns, and kiln waste deposits—were selected for comparative analysis because they represent different stages and aspects of porcelain manufacture while having sufficient documentation with detailed stratigraphic information across all four sites. Walls provide direct evidence of production space boundaries and infrastructure construction. Evidence for the use of pottery wheels and kilns represents two essential production stages, namely forming and firing. Kiln waste deposits, though not production features themselves, offer complementary evidence of how selection and disposal practices operated within production processes.

The following section outlines the research history of the four selected sites and examines how their current classifications have been complicated by overlapping and ambiguous consumption contexts, establishing the need for a production-centred approach grounded in the archaeological evidence recovered from these sites that is presented in Section 3.3.

3.2.1 Yuyaochang

The Yuyaochang site refers to the Yuyaochang National Archaeological Site Park (御窯廠國家考古遺址公園) (Figure 3-3). The name Yuyaochang literally means 'workshops of imperial wares', where *yao* 窯 is used in its broader sense as 'wares' rather than physical kilns. It was assigned by one of the first archaeologists to search for material evidence of the Imperial Porcelain Workshop (Liu, 1989).[19] The designation was based on the site's large quantities of ceramic items sharing identical technological and stylistic characteristics with pieces from the Ming imperial court collection now housed in the Palace Museum, Beijing (*ibid.*). Since then, the archaeological site and the historically documented Workshop have been frequently conflated in archaeological reports and broader scholarship on Jingdezhen porcelain, classifying Yuyaochang as an 'imperial' production site.

The two concepts, however, are distinct. The Imperial Porcelain Workshop denotes a government organisation established during the Zhengde period, as discussed in Chapter 2, whereas Yuyaochang designates an area of archaeological investigation that has yielded evidence of porcelain production across the Ming period. Moreover, while vessels reassembled

[19] The name Yuyaochang 御窯廠 also refers to the Qing-period institution for imperial porcelain, which current scholarship considers to have been modelled on the Ming Imperial Porcelain Workshop (Wang, 2004a; 2006).

from sherds are comparable to pieces in the Ming imperial court collection, blue-and-white porcelain sherds from primary kiln waste deposits have also been recovered that are identical to products from other 'non-imperial' production sites in terms of vessel shapes, decoration motifs, and inscriptions (SAM-PKU *et al*., 2007; Qin *et al*., 2017; JPICRA *et al.*, 2024b; BPM *et al*., 2024b). As Section 3.3 shows, this conflation has also shaped the interpretation of individual archaeological features at the site, including the attribution of boundary walls and the reading of kiln waste deposits as evidence of quality control for imperial production.

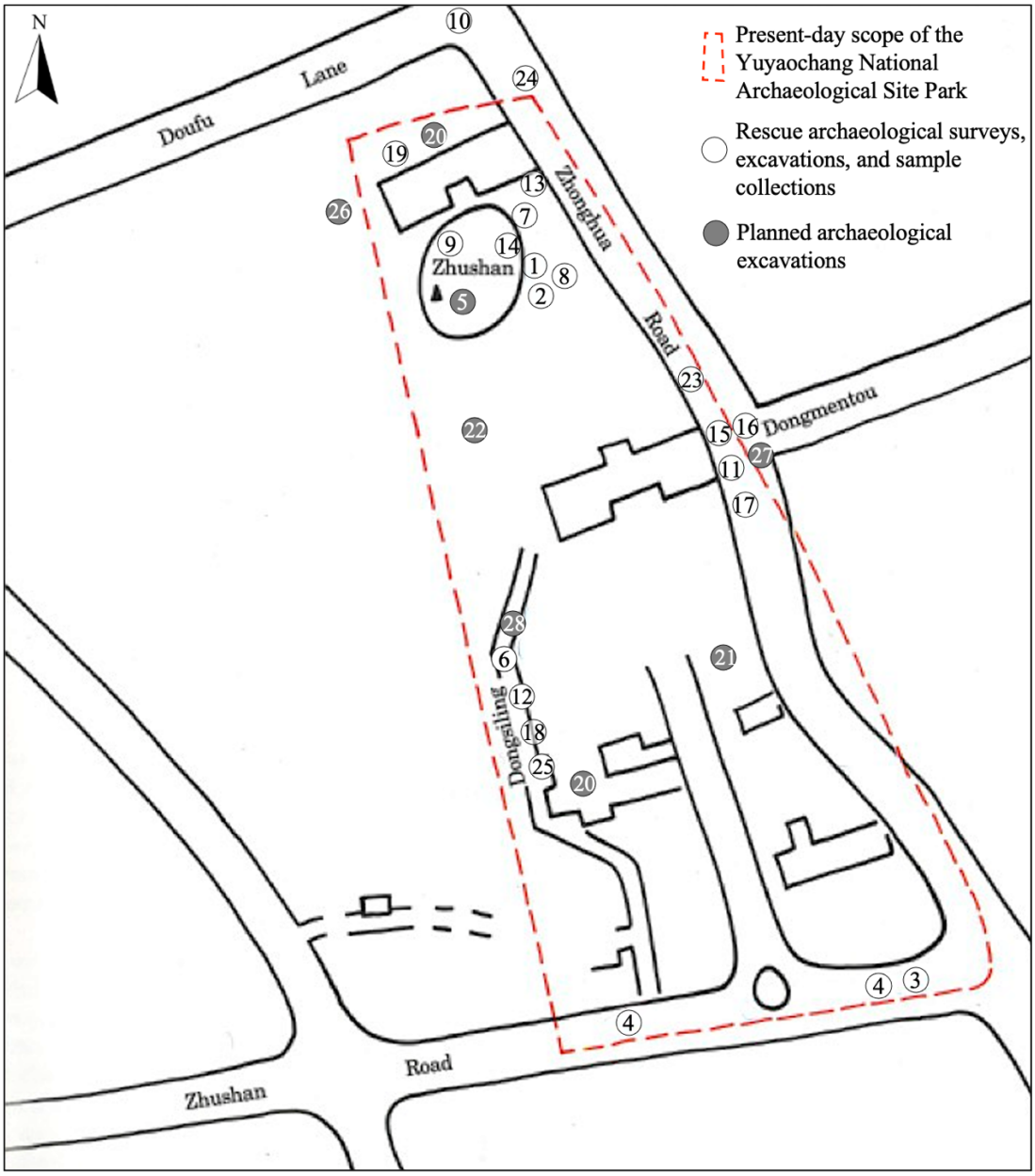


Figure 3-3: Distribution of archaeological surveys and excavations conducted at Yuyaochang. Redrawn after Liu, 1989, Figure 1.

3.2.2 Guanyinge

The Guanyinge site is located north of Jingdezhen's city centre. Guanyinge has been interpreted as a 'non-imperial' production site on the basis that its sherds are stylistically identical to vessels found at overseas shipwrecks and urban settlements without direct imperial consumption associations (Chen, 2017). This classification is complicated, however, by the site's assemblage of blue-and-white dishes, plates, and bowls with panelled decoration, commonly known as kraak porcelain (SAM-PKU *et al*., 2009; NCA *et al*., 2024d). Although long considered export ware for European markets in the late sixteenth to seventeenth centuries, kraak porcelain has also been recovered from local Jiangxi tombs, urban settlements formerly used as government institutions and princely households, and a deposited pit used in the early twentieth century to store porcelain discarded from the Ming and Qing imperial court collection, suggesting its possible use by Ming emperors (Xiang, 2018; Liu, 2020). The consumption contexts of Guanyinge products are therefore more varied than the site's current classification implies.

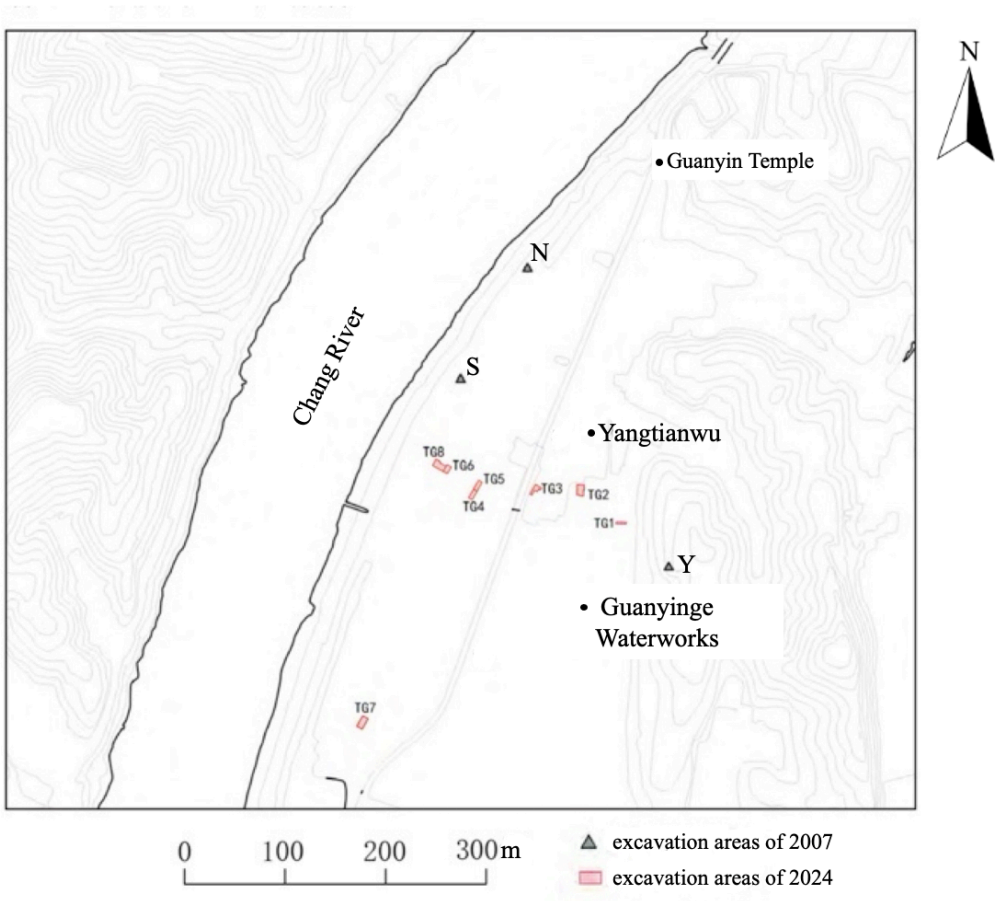


Figure 3-4: Distribution of archaeological surveys and excavations conducted at Guanyinge. Redrawn after NCA *et al*., 2024a, Figure 2.

3.2.3 Luomaqiao

The Luomaqiao site is located south of Jingdezhen's city centre (Figures 3-5, 3-6). As with Guanyinge, porcelain sherds excavated at Luomaqiao have been identified in the Nao'ao No.1 Shipwreck in the South China Sea, a ship loaded with trade goods without direct imperial associations, on which basis Luomaqiao has been regarded as a 'non-imperial' production site (Guo, 2016; Chen, 2018). Gao (2021, pp. 302–311) further documents the wide domestic distribution of Luomaqiao products across tombs, hoards, and urban settlements in Jiangxi, Anhui, Sichuan, Zhejiang, Hubei, Jiangsu, Henan, and Beijing.

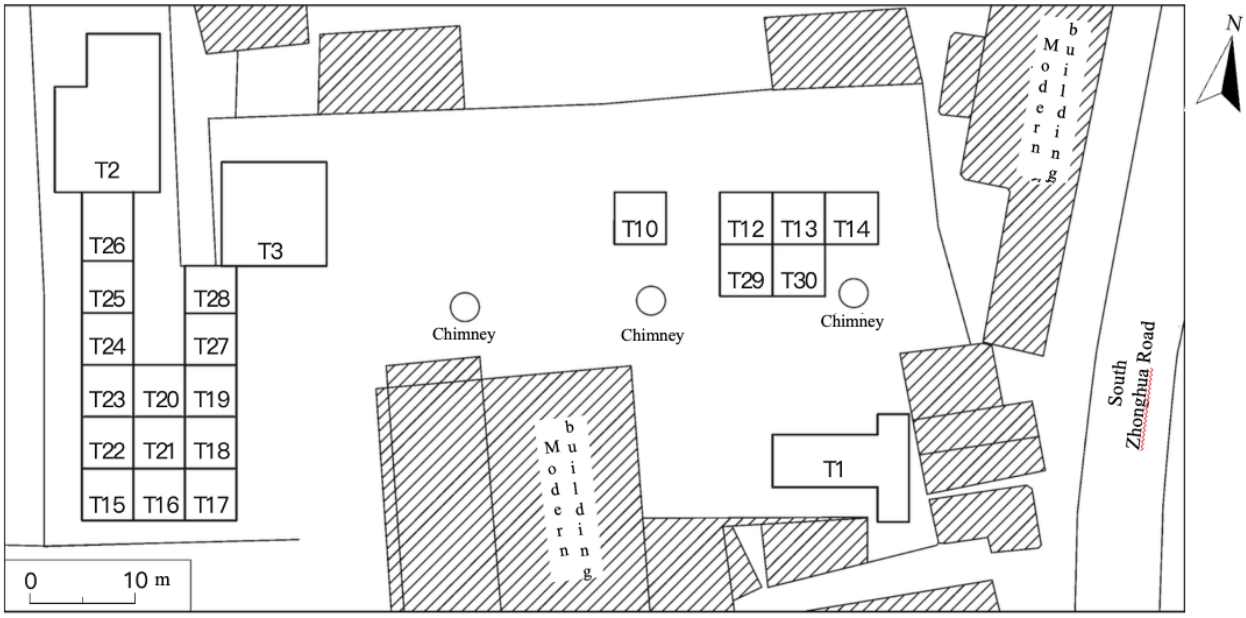


Figure 3-5: Distribution of excavation units during the 2012–2013 rescue excavation. Redrawn after JCARI *et al.*, 2017b, Figure 2.

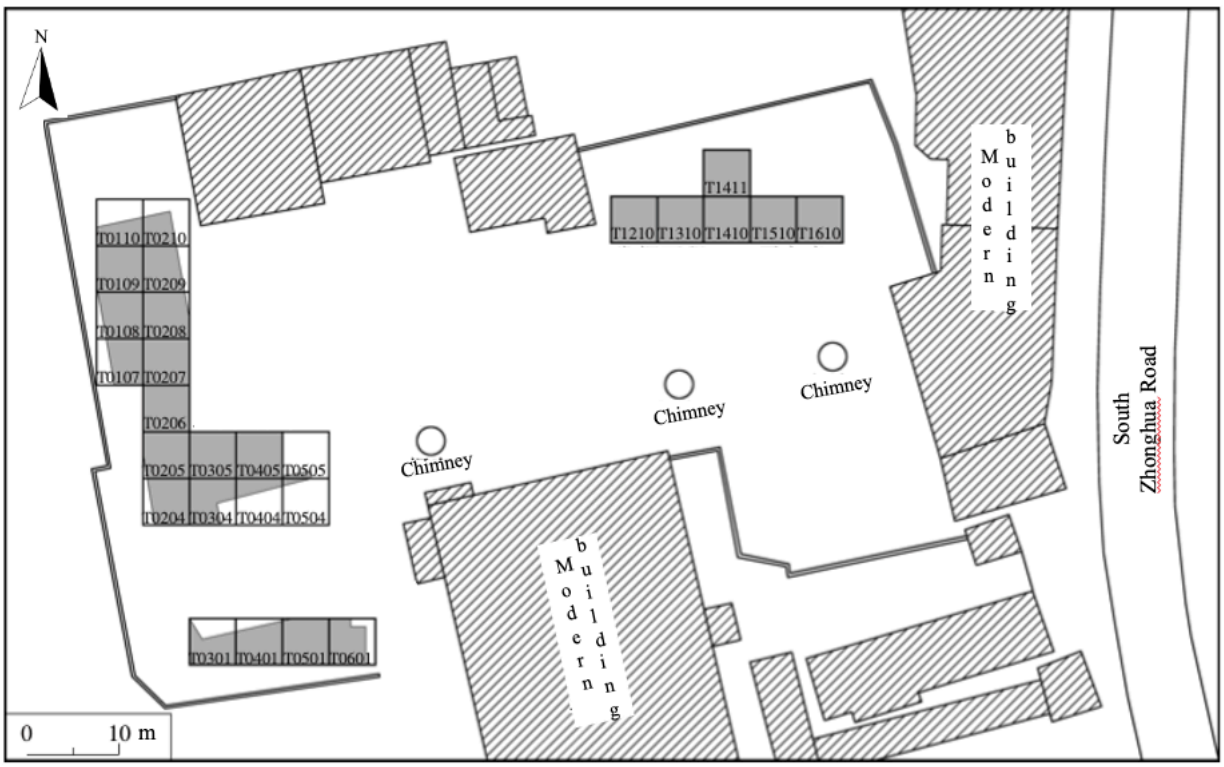


Figure 3-6: Distribution of excavation units during the 2023–2024 planned excavation. Redrawn after JCARI *et al*., 2024, Figure 2.

The 152 ceramic items recovered from Jiajing-period stratigraphic layers across several excavation units have raised new questions about the circulation of Luomaqiao products (Gao, 2021, p. 390). These items comprise yellow-glazed porcelain sherds and semi-finished products glazed on the interior and high-fired once to develop a cobalt inscription on the base, but left unglazed on the exterior. Because they bear Jiajing reign inscriptions (*Da Ming Jiajing nian zhi* 大明嘉靖年制 or *Jiajing nian zhi* 嘉靖年制) commonly found on blue-and-white or monochrome glazed vessels in the Ming imperial court collection, they have been interpreted as outsourced imperial orders from the Imperial Porcelain Workshop to Luomaqiao (Gao, 2024). However, contemporary blue-and-white vessels bearing identical inscriptions are known to have circulated well beyond the imperial palace, from the tomb of Prince Zhu Houye 朱厚燁 (1498–1556) in Fuzhou, Jiangxi Province, to the Ensenada Wreck discovered off the Pacific coast of Baja California, Mexico (Peng, 2018, p. 256; Weng and Li, 2020).

3.2.4 Hutian

The Hutian site is located in Hutian Village (湖田村), approximately four kilometres southeast of Jingdezhen's city centre (Figure 3-7). Blue-and-white porcelain sherds of the middle and

late Ming periods excavated at Hutian share vessel shapes, decorative motifs, and a comparatively free-handed painting style with those from Guanyinge and Luomaqiao, on which basis Hutian is frequently classified as a 'non-imperial' site (JPICRA *et al*., 2007, pp. 338–387; Gao, 2021, pp. 326–327). Nonetheless, physical resemblance between vessels alone cannot determine whether products from these sites shared the same intended destination. As the overlapping consumption contexts of Guanyinge and Luomaqiao products demonstrate, vessels from a single manufacturing site could circulate across both imperial and non-imperial contexts. Consumption-based classification is therefore an insufficient and unreliable criterion for characterising the similarities and differences between these sites' manufacturing activities.

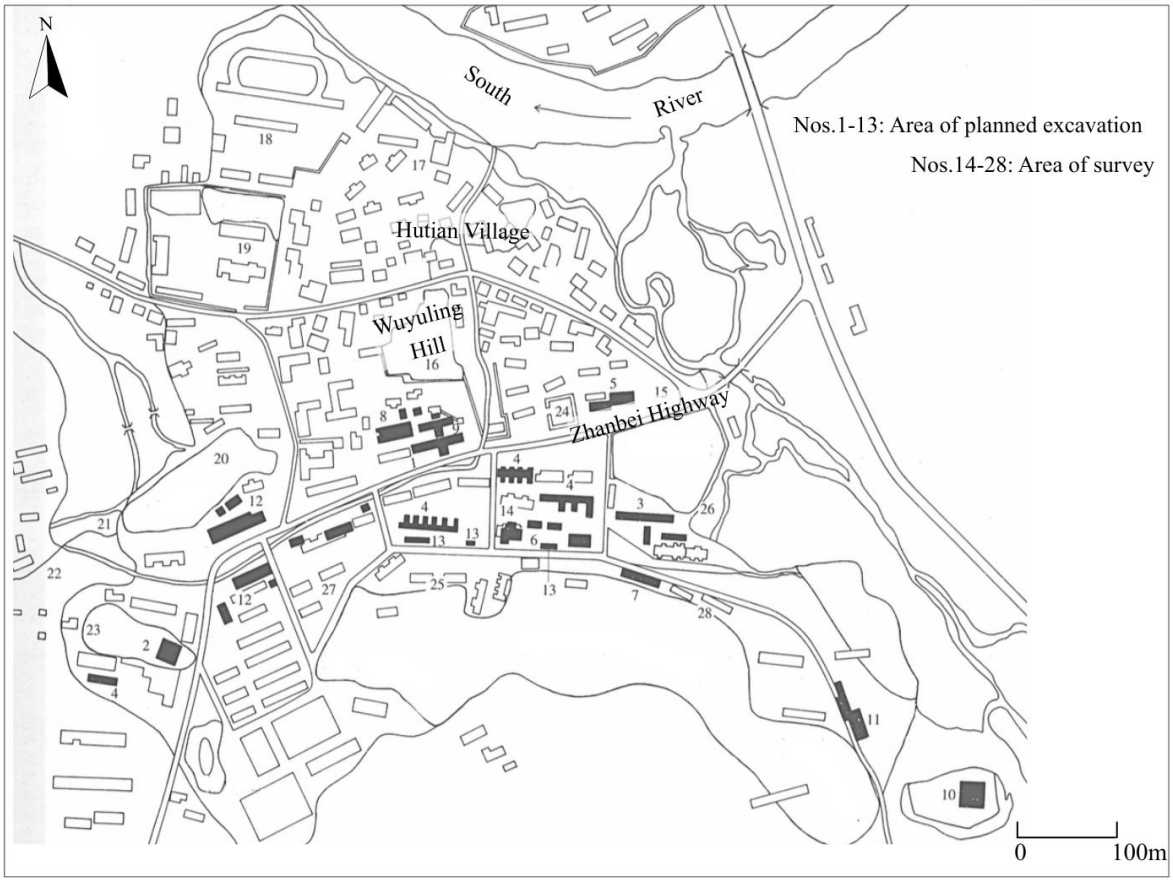


Figure 3-7: Distribution of archaeological surveys and excavations conducted at Hutian. Redrawn after JPICRA *et al*., 2007, Figure 3.

3.3 Comparative analysis of production evidence across selected manufacturing sites

To provide direct material evidence of manufacturing practices across four key sites, archaeological features of walls, pottery wheel foundations, kilns, and kiln waste deposits are analysed on the basis of excavation reports. Where relevant, historical accounts and

ethnographic comparisons are used to interpret the function and construction of individual features. Each feature is assigned a reference number corresponding to its full excavation record in Appendix B, where its complete archaeological context can be consulted.

3.3.1 Walls

Over sixty wall features were found across four sites, with nine documented in detail (see Table 3-2). The documented features display considerable intra-site variation likely shaped by wall function and construction history. Differences also emerge between sites, particularly in material selection and surface treatment, though these reflect construction choices rather than differences in how production was carried out. At Yuyaochang specifically, the construction histories of major boundary walls raise further questions about the site's attribution as the location of the Imperial Porcelain Workshop.

Table 3-2: Information on wall features at the four selected sites

Site	Feature	Period	Width (m)	Foundation Type	Laying Pattern	Construction Material
Yuyaochang	YYC-22-Q2	Zhengde–Jiajing	0.62-0.9	Ground level	Herringbone	Bricks, saggar fragments, porcelain sherds, clay soil
	YYC-26-Q1	Yongle–post-1620s	1.3	Ground level	Herringbone, staggered	Bricks, saggar fragments, porcelain sherds, clay soil
	YYC-27-Q3	Early Ming–post-1620s	1.43-1.58	Ground level	Herringbone, staggered	Bricks, saggar fragments, porcelain sherds, clay soil
	YYC-27-Q4	Mid-Ming–post-1620s	0.2-0.25	Ground level	Herringbone	Saggar fragments, clay soil
Guanyinge	GYG-2-Q2	Jiajing–Wanli	0.97-1.02	Foundation trench	Stacked irregularly	Large stones, clusters of fused bowls, saggar fragments, bricks, clay soil
	GYG-2-Q4	Late Ming–post-1620s	0.6-0.8	Foundation trench	Stacked irregularly	Large stones, clusters of fused bowls, saggar fragments, bricks, clay soil
	GYG-2-Q10	Late Ming–post-1620s	0.1-0.25	Ground level	Staggered	Bricks, clay soil
Luomaqiao	LMQ-1-F14	Zhengtong–Tianshun	0.8	Ground level	Stacked irregularly	Large stones, clusters of fused bowls, saggar fragments, bricks, clay soil
Hutian	HT-F108	Chenghua–Hongzhi	0.3	Unpublished	Unpublished	Saggar fragments, clay soil

Generally, walls at a porcelain manufacturing site can serve multiple functions, such as setting boundaries of the entire complex, enclosing or partitioning working areas, and protecting kilns from wind and rain. These intended functions, along with other factors such as available materials, ground conditions, and whether walls were built in a single phase or underwent repair and extension, would all shape their construction. The range of variation visible across the documented features confirms this. Within Yuyaochang alone, wall widths range from 0.2–

0.25 metres (YYC-27-Q4) to 1.43–1.58 metres (YYC-27-Q3), and construction techniques include both herringbone and staggered brick-laying patterns. Even a single wall can exhibit internal variation. The northeastern and southeastern sections of YYC-27-Q3 were built with different laying methods, which likely reflects at least two construction phases. At Guanyinge, similarly, walls range from the narrow GYG-2-Q10 (0.1–0.25 metres), likely an interior partition, to the substantially wider GYG-2-Q2 (0.97–1.02 metres), a boundary wall built from a foundation trench. This degree of intra-site variation suggests that differences in wall construction between sites should be interpreted with caution. Some variation is simply what one would expect across walls of different functions, periods, and construction histories at any production site.

Notably, two walls located at Yuyaochang's northwestern (YYC-26-Q1) and eastern (YYC-27-Q3) perimeters have been identified as the Imperial Workshop's exterior boundaries (JPICRA *et al*., 2024b; BPM *et al*., 2024a). The criteria for this identification were, however, never explicitly stated. Liu Xinyuan 劉新園, the principal investigator of one of Yuyaochang's earlier excavation projects, inferred the Workshop's physical boundary at Jingdezhen by matching architectural features recorded in the *Taoshu* 陶書 (Book of Ceramics) with excavated remains at the site (Liu, 1996). His identification was reinforced by the discovery of imperial porcelain sherds exposed alongside the identified 'exterior boundary walls' (Liu, 1996; Wang, 2015; Jiang, 2020b). This interpretive approach reflects the conflation of the Yuyaochang site and the historically documented Imperial Workshop, and more critically, it contradicts the stratigraphic evidence. YYC-26-Q1 was first constructed during the Yongle period and YYC-27-Q3 during the second half of the fifteenth century, both predating the Imperial Workshop's establishment during the Zhengde period. The identification of these walls as the Workshop's exterior boundary thus exemplifies how pre-assigned site classifications can shape the interpretation of individual features, even when the direct archaeological evidence points to a different conclusion.

Construction-wise, both YYC-26-Q1 and YYC-27-Q3 differ from other wall features at Yuyaochang and other production sites in their substantial width, indicating their role as primary boundary walls rather than interior divisions. YYC-26-Q1's construction reflects deliberate investment in a durable structure, whether from the outset or through subsequent reinforcement, as it comprises three parallel north-south sections bonded together (Figure 3-8).

This parallel-section structure is also evident in YYC-27-Q3, the northeastern side of which was built with three parallel rows of bricks, saggar fragments, and porcelain sherds. However, while stratigraphic evidence indicates initial construction during the early Ming period, both walls appear to have been expanded and reinforced over time. For instance, the southeastern section of YYC-27-Q3 was built with bricks laid flat in a staggered pattern, a form different from the northeastern section, suggesting multiple construction phases. That these walls were maintained and expanded across different periods does not rule out the possibility that they served successive forms of manufacturing workshops rather than the Imperial Porcelain Workshop alone. Their long construction histories, beginning well before the Zhengde period, make their attribution to a single historical institution difficult to sustain.

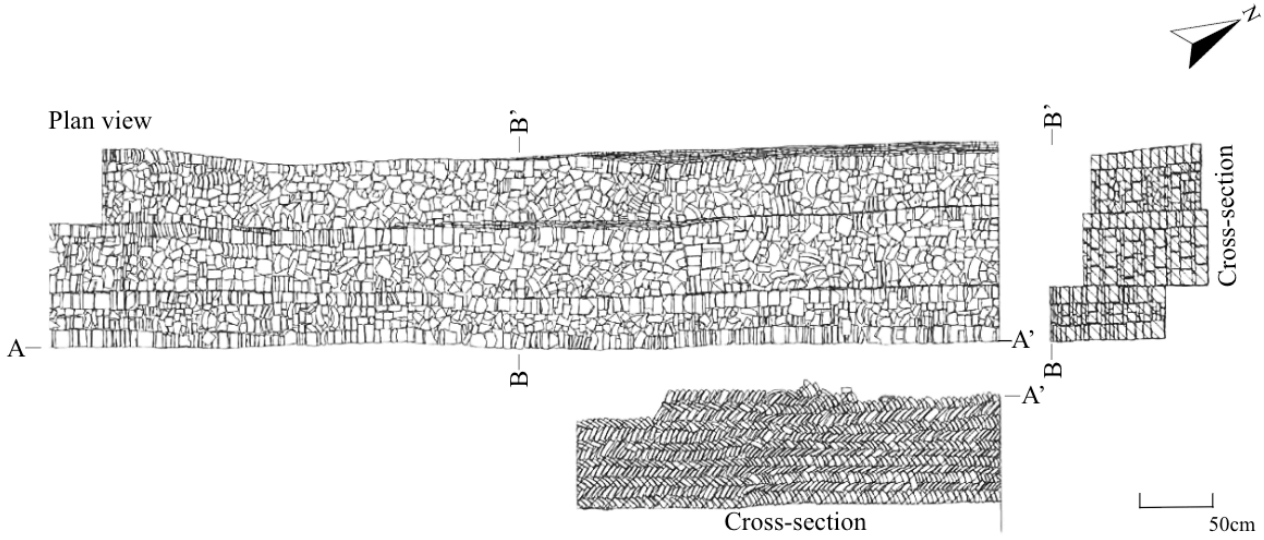


Figure 3-8: Plan and cross-section view of YYC-26-Q1. Redrawn after JPICRA *et al*., 2024b, Figure 4.

Additionally, all four wall features at Yuyaochang preserve at least one standing elevation displaying flat saggar fragments or bricks set vertically at alternating angles, creating horizontal herringbone patterns (Figure 3-8). This construction technique is also evident in kiln protective walls at Yuyaochang, discussed in Section 3.3.3, suggesting a consistent approach to constructing visible wall surfaces at this site throughout the Ming period. This technique was not documented at other production sites, raising the question of whether it represents a localised building convention at Yuyaochang or simply an absence in the published record for other sites.

In comparison, wall features at Guanyinge display different construction methods. Two walls (GYG-2-Q2 and GYG-2-Q4) were constructed in foundation trenches, a technique documented

only at Guanyinge; walls at Yuyaochang and Luomaqiao were built from ground level. Foundation trenches suggest a concern with structural reinforcement that took a different form from the parallel-section bonding seen at Yuyaochang. The third wall, GYG-2-Q10, built to a width of only 0.1–0.25 metres from ground level, may have functioned as an interior partition rather than a boundary wall. While walls across all four production sites used repurposed kiln waste, such as saggar fragments and porcelain sherds, as fill materials, walls at Guanyinge and Luomaqiao also incorporated large stones and clusters of fused bowls, with materials stacked irregularly rather than arranged in ordered patterns (Figure 3-9). These differences indicate that walls at Yuyaochang were constructed with more homogeneous materials and greater attention to visual uniformity.

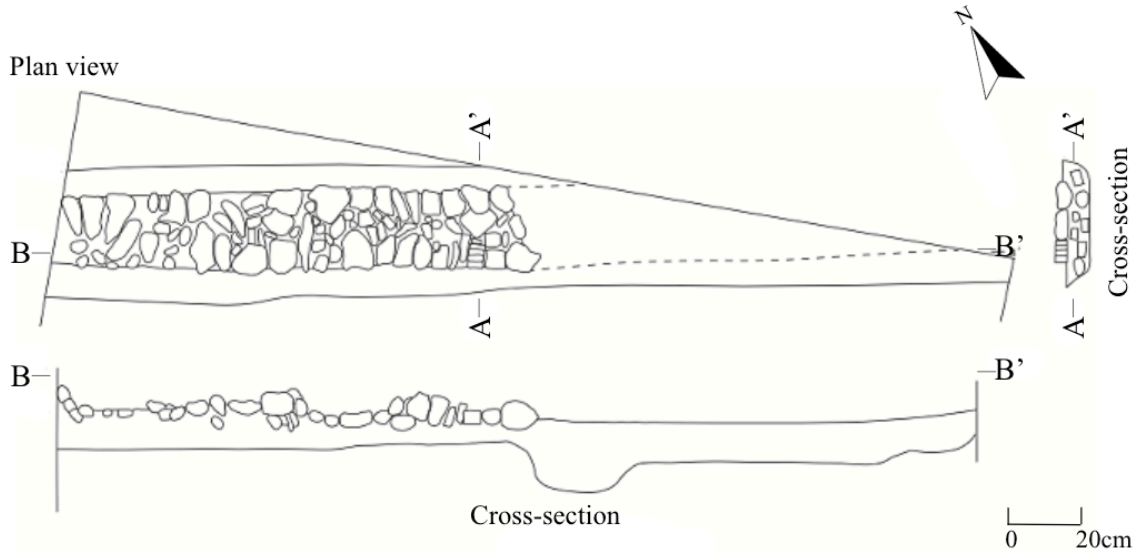


Figure 3-9: Plan and cross-section view of GYG-2-Q2. Redrawn after NCA *et al*., 2024a, Figure 11.

At Guanyinge, the use of large stones in workshop construction appears to have been a common practice. Within the same stratigraphic context as GYG-2-Q2, three stands with similar dimensions and construction methods were built using large cobblestones (Figure 3-10). Remnants of white clay suitable for porcelain bodies suggest these stands supported work platforms for clay preparation or forming. The consistent use of cobblestones across both walls and working platforms at Guanyinge points to a site-level pattern of material use, one that is distinctive but carries no inherent implication of how production was organised or conducted given the available evidence.

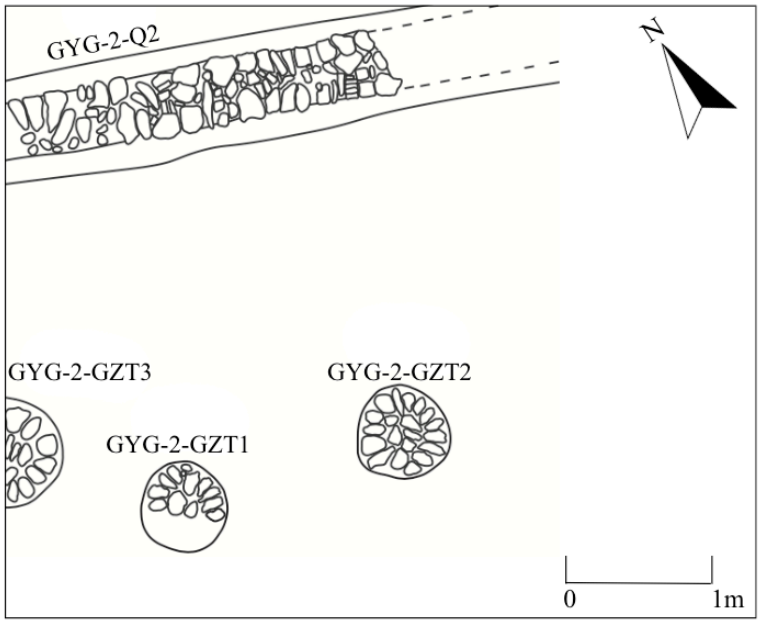


Figure 3-10: Relative location of GYG-2-Q2 and three stone stands (GYG-2-GZT1, GYG-2-GZT2, GYG-2-GZT3). Redrawn after NCA *et al*., 2024a, Figure 10.

3.3.2 Evidence for the use of pottery wheels

Pottery wheels are rotational devices used during forming, decorating, and glazing, allowing potters to access all sides of a vessel while remaining largely in place. They rotate about a vertical axis and typically consist of a wheel head mounted on a vertical cylinder shaft. These devices range from slow-speed turntables to throwing wheels capable of sustained, stable, high-speed rotation through adequate torque and rotational inertia when manually powered (for a summary of pottery wheel types, see Rice, 2015, pp. 235–237).

While no evidence for pottery wheels dating to the Ming period has been found at Jingdezhen, perhaps due to their construction from organic materials, remains of shafts on which wheels may have been mounted survive. When discovered alongside other features on the same stratigraphic layers associated with vessel forming (such as clay storage and levigation ponds), these shafts are identified as pottery wheel foundations.[20] Five late Ming foundations survive across Yuyaochang and Guanyinge, and all share the same basic structural principle of a shaft well and shaft hole to centre and stabilise a vertical shaft. Notably, the Guanyinge foundations are more substantially built and show evidence of more sophisticated bearing mechanisms than the single example at Yuyaochang.

[20] Modern ethnography also documents table-mounted turntables for blowing glaze and decorating (Zheng, 2022, pp. 155, 217), though no archaeological evidence of such devices has been found at Jingdezhen.

Among these five documented features, three share an identical underground structure consisting of a chamber (shaft well) and a positioning hole at its centre (shaft hole) (Table 3-3, Figure 3-11). The shaft well, constructed around the vertical shaft, likely protected it from soil slumping and provided access for maintenance, while the shaft hole centred the shaft, restricted its lateral movement, and ensured stable rotation. Despite this shared structural principle, the three features differ in scale and construction quality. YYC-29-LLK1 has a much smaller shaft well lined with repurposed saggars, which indicates simple construction with minimal maintenance requirements. The Guanyinge foundations (GYG-2-LLK4 and GYG-2-LLK5), in contrast, have larger shaft wells lined with uniform, same-sized bricks, indicating construction intended for more durable use.

Table 3-3: Information on pottery wheel foundations with single shaft well and shaft hole structure found at the selected sites

Site	Feature	Period	Shaft Well			Shaft Hole	
			Lining Type	Diameter (m)	Depth (m)	Diameter (m)	Depth (m)
Yuyaochang	YYC-29-LLK1	Late Ming–post-1620s	Repurposed saggars	0.29	0.2	0.1	0.26
Guanyinge	GYG-2-LLK4	Late Ming–post-1620s	Brick-lined	0.55	0.5	0.2-0.25	0.25
	GYG-2-LLK5	Late Ming–post-1620s	Brick-lined	0.52	0.4	0.08	0.35

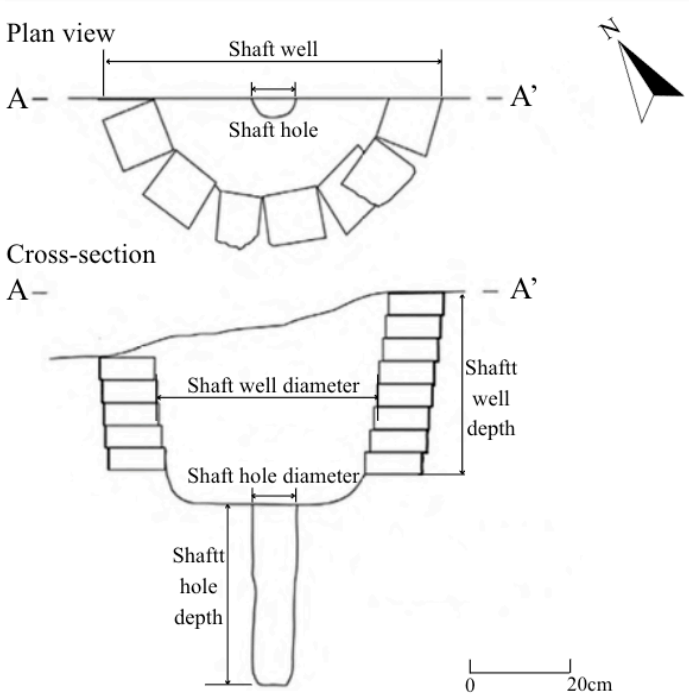


Figure 3-11: Plan and cross-section view of GYG-2-LLK5. Redrawn after NCA *et al*., 2024b, Figure 8.

These features also differ in shaft hole shape and size. YYC-29-LLK1's shaft hole is narrow and shallow, suggesting use for throwing smaller vessels or slower rotation with lower stability requirements. GYG-2-LLK4's shaft hole is wide and shallow, indicating accommodation of either a wider shaft or bearing and stabilizing mechanisms. Evidence for such mechanisms comes from two porcelain rings recovered from the abandonment layer of GYG-2-LLK4 and GYG-2-LLK5 at Guanyinge, measuring 0.124 metres and 0.11 metres in exterior diameter and 0.092 metres and 0.084 metres in interior diameter respectively (NCA *et al*., 2024d). Their glazed interiors show visible wear traces while their exteriors remain unglazed, confirming their function as bearings to support shaft rotation and maintain alignment (Figure 3-12). GYG-2-LLK5's shaft hole dimensions likely accommodated a single, smaller bearing ring, with its depth securing the shaft, whereas GYG-2-LLK4 may have employed a larger bearing ring with additional stabilizing components, though this interpretation requires additional evidence.



Figure 3-12: Bearing ring discovered at Guanyinge, formed from porcelain clay with a glazed interior and unglazed exterior. Measuring 0.11 m in exterior diameter, 0.08 m in interior diameter, and 0.015 m in thickness. Source: NCA *et al*., 2024d, Figure 136.

In addition to the single shaft well and shaft hole, two other features at Guanyinge represent an alternative foundation type, consisting of an outer pit surrounding a central shaft well, with a shaft hole excavated downward at the centre (Table 3-4, Figure 3-13). The outer pit is larger in diameter, shallower in depth, and positioned at a higher elevation than the shaft well. Wu *et al*. (2023) have argued that the outer pit accommodated the wheel head and contained excess clay during forming, suggesting a single-wheel device where potters sat above ground and used their hands or sticks to rotate the wheel. This interpretation likely draws from modern ethnographic accounts documenting such arrangements, as shown in Figure 3-14.

Table 3-4: Information on pottery wheel foundations with outer pit, shaft well, and shaft hole structure found at Guanyinge

Feature	Period	Outer Pit		Shaft Well		Shaft Hole	
		Diameter (m)	Depth (m)	Diameter (m)	Depth (m)	Diameter (m)	Depth (m)
GYG-1-SLLK1	Late Ming–post-1620s	1.1	0.25	Damaged	Damaged	0.15	0.15
GYG-1-SLLK2	Late Ming–post-1620s	0.8	0.16	0.34	0.34	0.1	0.24

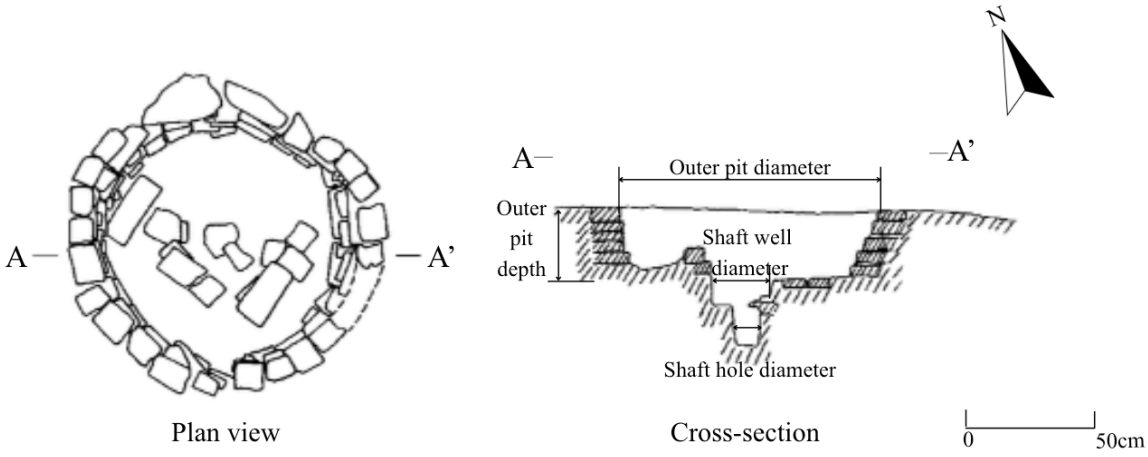


Figure 3-13: Plan and cross-section view of GYG-1-SLLK2. Redrawn after SAM-PKU, 2007, Figure 4.



Figure 3-14: A potter working on an underground-embedded wheel, filmed in Jingdezhen. Source: *Jiangxin yetao* 匠心冶陶 (Crafting Pottery with Artisan's Dedication), Episode 4 (2018), accessed via YouTube, https://www.youtube.com/watch?v=RoYcXYQ8bow&t=858s.

The late-Ming historical account *Taoshan* 陶埏 (The Making of Ceramics) describes a different type, a double-wheel device. A single shaft supported an upper wheel head, with a hollow circular disk passing through the shaft and connected to the underside of the turntable by wooden strips, in order to stabilise rotation (Figure 3-15). According to the *Taoshan*, the shaft was buried three *chi* (approx. 0.96 m) and extended about two *chi* (approx. 0.64 m) above ground, indicating that potters possibly sat on chairs (Song, 1637, p. 139).[21] The account also notes that potters rotated the wheel by pushing its rim with short bamboo sticks, ruling out the possibility of this double-wheel device functioning as a foot-powered kick wheel (Song, 1637, p. 139).

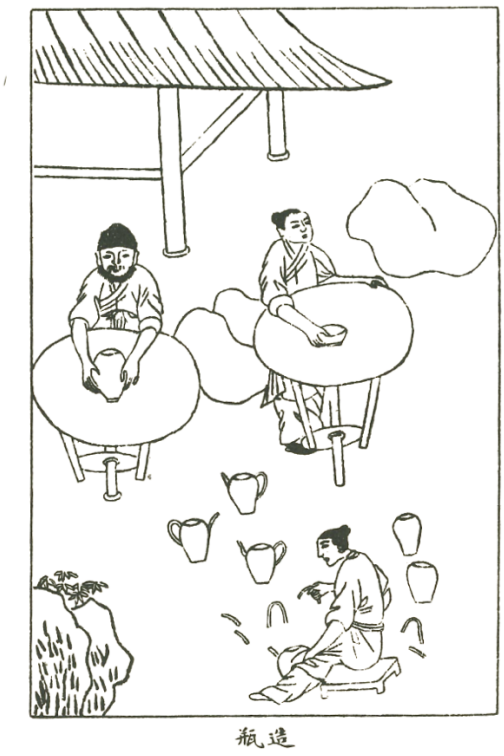


Figure 3-15: Potters working with double-wheel devices. The caption in the original image reads *zaoping* 造瓶 (making vases). Source: Song, 1637, p. 145.

Given the foundations discovered so far, additional evidence is needed to determine which pottery wheel types were used at Guanyinge. GYG-2-LLK4 and GYG-2-LLK5 likely correspond to the above-ground, elevated type mentioned in the *Taoshan*, as they lack outer pits. For GYG-1-SLLK1 and GYG-1-SLLK2, the outer pit may have accommodated the wheel head for an underground-embedded type, or provided a work surface for potters' seating and

[21] *Chi* 尺 was measurement unit used during the Ming period. One *chi* approximately equals 32 cm. For the conversion method, see Yang *et al*., 2001, p. 407.

wheel maintenance in an elevated setup. For GYG-1-SLLK1, GYG-1-SLLK2, and GYG-2-LLK5, clay storage ponds were discovered in the same stratigraphic layers in close proximity, indicating their use during the forming stage. In contrast, YYC-29-LLK1's construction suggests a temporary, elevated pottery wheel for tasks requiring slower rotation. Taken together, the surviving foundations suggest that pottery wheel construction varied according to intended function and durability. In this regard, it is notable that the most durable examples come from Guanyinge.

3.3.3 Kilns

While over fifty kilns have been excavated across Yuyaochang, Luomaqiao, and Hutian, many remain poorly preserved or lack documentation (Zhang, 2022). This section therefore focuses on four well-documented examples at Yuyaochang and Hutian that show shared kiln types across both sites, alongside differences in construction details showing site-specific responses to firing performance rather than distinct firing technologies or arrangements.

Gourd-shaped kilns at Yuyaochang date to the early Ming period, while those at Hutian remained in operation from the early through late Ming periods (SAM-PKU *et al*., 2007; JPICRA *et al*., 2007, pp. 462–464). Based on the two examples analysed (YYC-20a-04JYIY6 and HT-YZ), this kiln type consists of a flaring kiln door, a firebox, and two kiln chambers constructed on a slope (Table 3-5, Figure 3-16). YYC-20a-04JYIY6 exhibits larger overall capacity, reflected in its longer kiln chamber and larger firebox requiring more fuel consumption. A preserved outer wall encircles the kiln, likely built to protect it against heat loss and water damage. This wall consists of horizontally stacked saggars and bricks laid in a herringbone pattern, with porcelain fragments and red earth sandwiched between, identical to the boundary wall construction at Yuyaochang analysed in Section 3.3.1. In comparison, HT-YZ is shorter with a narrower passage between chambers. The slope of HT-YZ appears to have adapted to the natural gradient of Wuyuling Hill (烏魚嶺) at Hutian, while the incline of YYC-20a-04JYIY6 seems to have been manually constructed due to the flat topography at Yuyaochang.

Table 3-5: Information on gourd-shaped kilns found at Yuyaochang and Hutian

Feature	Period	Firebox		Front Chamber		Rear Chamber	
		Width (m)	Depth (m)	Length (m)	Width (m)	Length (m)	Width (m)
YYC-20a-04JYIY6	Hongwu–Yongle	3.2	1	1.46	2.28-3.2	6.9	2.14-2.28
HT-YZ	Early–mid-Ming	3.7	0.5-0.6	2.2	1.9-3.7	4.86	1.9-3

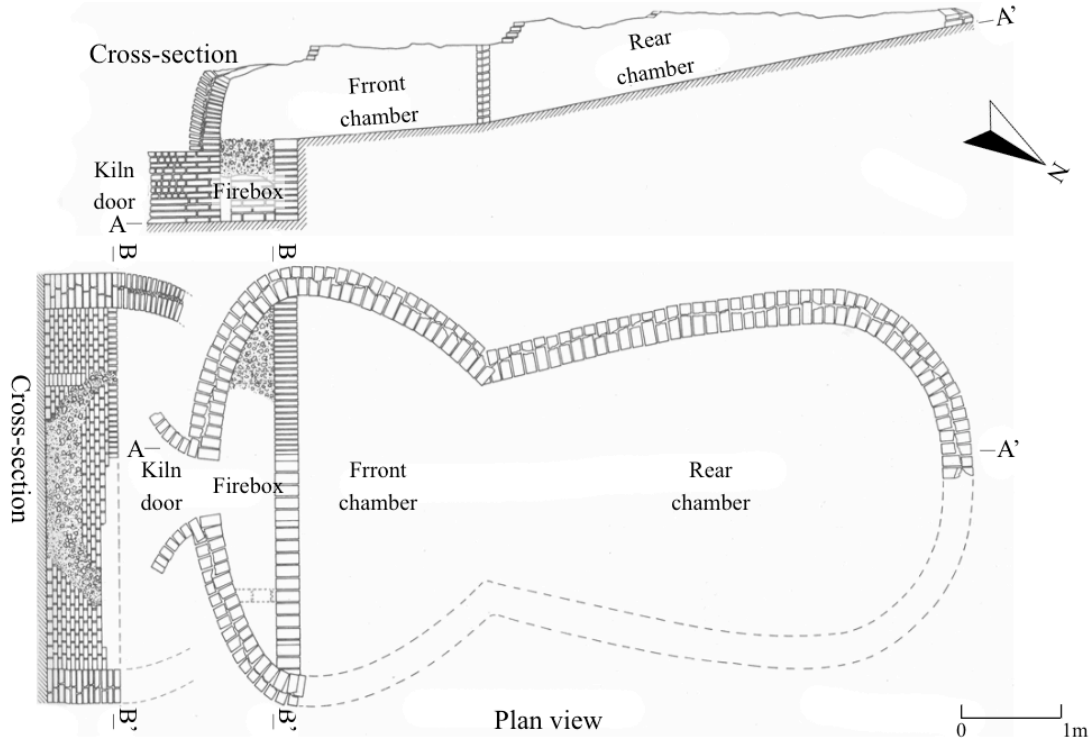


Figure 3-16: Plan and cross-section view of HT-YZ. Redrawn after JPICRA *et al*., 2007, Figure 42.

As a cross-draught kiln, combustion gases travelled semi-horizontally from the firebox to the kiln chambers, slowing flame speed and allowing more energy transfer from the burning fuel to heat the entire kiln (Kerr and Wood, 2004, p. 312). However, this kiln design resulted in lower temperatures towards the bottom and back of the rear chamber, causing uneven firing temperatures (Kerr and Wood, 2004, pp. 312–313). Notably, the multiple construction phases of HT-YZ suggest potters' solutions to this issue, where preserved traces indicate that the firebox, originally trapezoid-shaped, was later modified with brick walls built on both sides to form a smaller rectangular shape. By reducing the flame channel between the firebox and front chamber, this modification concentrated flame flow to achieve more uniform kiln temperatures. This practice was first observed in Song-period dragon kilns at Jingdezhen, where cylinder saggars were used to modify the firebox (Feng, 2021). The constriction between the front and

rear chambers in gourd-shaped kilns likely served the same purpose, with HT-YZ's narrower passage making its design more efficient at maintaining uniform kiln temperatures.

Although the upper structure of Ming-period gourd-shaped kilns does not survive in archaeological records, one illustration in the *Taoshan* 陶埏 (The Making of Ceramics) depicts a possible design (Figure 3-17). Holes were distributed across the kiln dome, enabling potters to add firewood from above. This design allowed potters to supplement heat in the cooler rear chamber through top-loading while maintaining the reducing atmosphere required to achieve the characteristic cobalt blue of blue-and-white porcelain.



Figure 3-17: Potters adding firewood to the rear chamber of a gourd-shaped kiln. The caption in the original image reads *ciqi yao* 瓷器窯 (porcelain kiln). The inscriptions describe the firing sequence, noting that the front fire (*menhuo* 門火) is lit first with the flame proceeding from bottom to top, followed by firewood added through twelve skylight openings (*tianchuang shi'er yan* 天窗十二眼), for a total firing duration of twelve time periods (*huoli shi'er shi* 火力十二時). Source: Song, 1637, p. 149.

Horseshoe-shaped kilns at Hutian date to the mid-Ming period, while those at Yuyaochang were used from the early through the late Ming periods (SAM-PKU *et al*., 2007; JPICRA *et al*., 2007, pp. 462–463). Based on the two examples analysed (YYC-20b-04JYIIY14 and HT-YW), this kiln type consists of a kiln door, firebox, flue, smoke vent, and chimney (Table 3-6;

Figures 3-18, 3-19). This design differs from the gourd-shaped type in its smaller firebox, shorter chamber length, and flue placement at the base of the chamber's back wall—a key feature of downdraft kilns. Although hot gases rise and circulate horizontally in the upper chamber, the bottom flues force all gases to pass through saggar stacks and exit by the chimney, allowing for greater heat efficiency (Feng, 2021). In gourd-shaped kilns, by contrast, gases possibly escaped through a chimney at the upper rear, as no bottom flues are observed in the rear chamber's back wall.

Table 3-6: Information on horseshoe-shaped kilns at Yuyaochang and Hutian

Feature	Period	Firebox		Kiln Chamber		Chimney		
		Width (m)	Depth (m)	Length (m)	Width (m)	Number	Length (m)	Width (m)
YYC-20b-04JYIIY14	Xuande–Wanli	2.02	0.46	1.38	2.02	1	0.35	2.02
HT-YW	Chenghua–Hongzhi	2.72	0.66	2.5-2.72	1.94	2	0.4	0.3

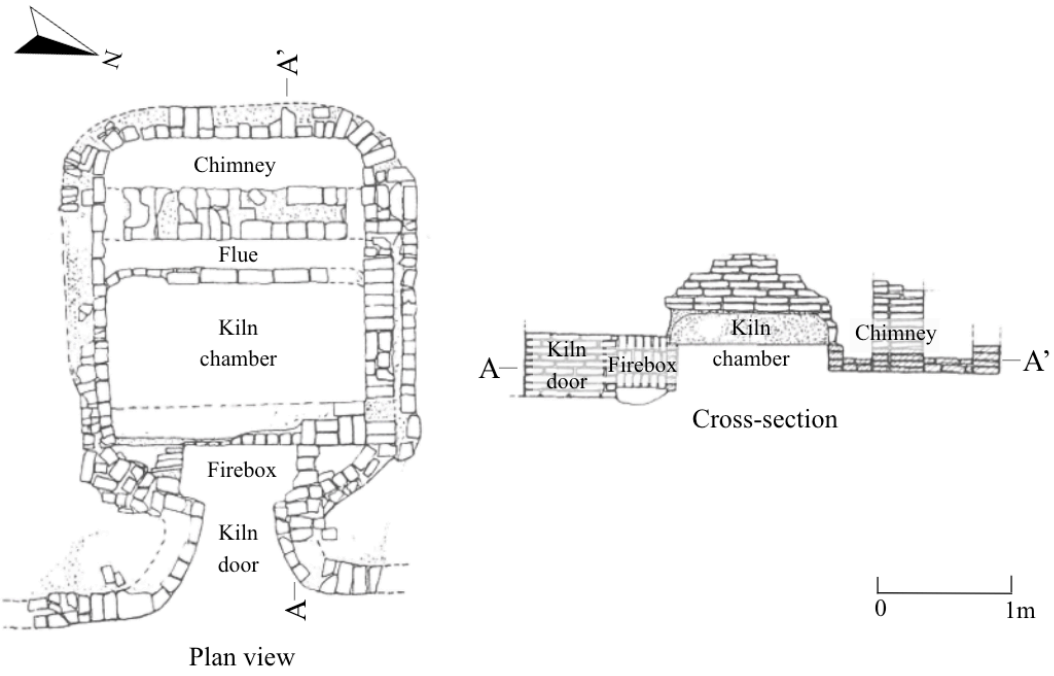


Figure 3-18: Plan and cross-section view of YYC-20b-04JYIIY14. Redrawn after SAM-PKU *et al*., 2007, Figure 7.

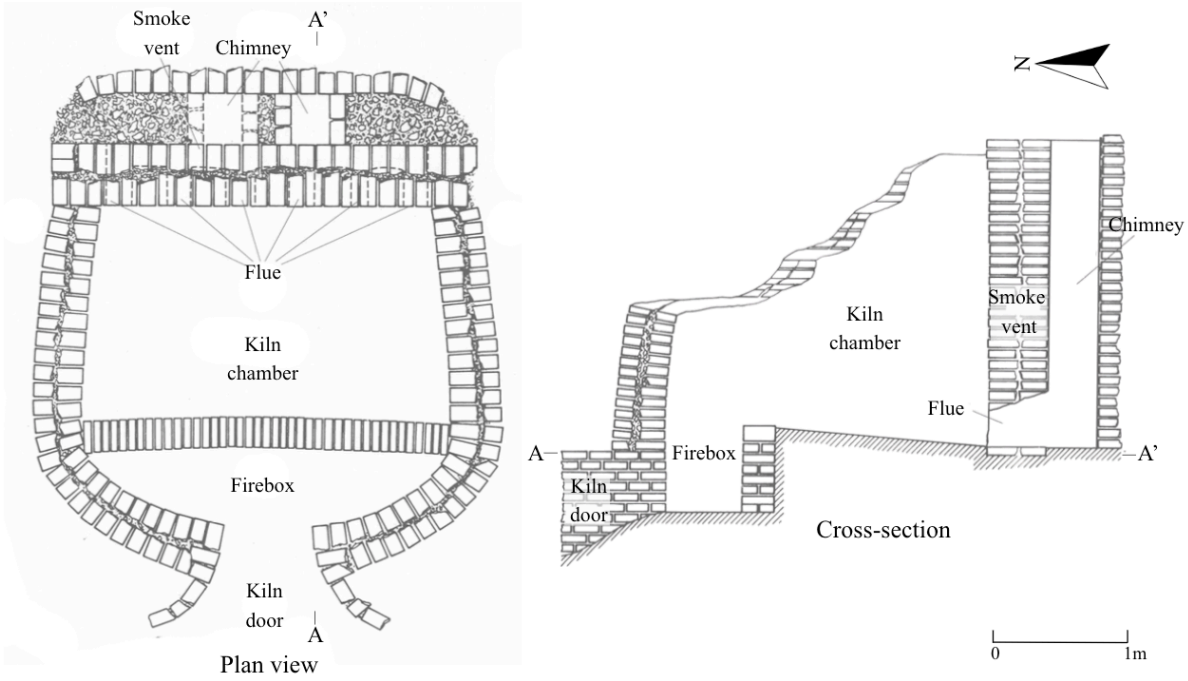


Figure 3-19: Plan and cross-section view of HT-YW. Redrawn after JPICRA *et al*., 2007, Figure 40.

In general, YYC-20b-04JYIIY14 at Yuyaochang and HT-YW at Hutian are similar in relative dimensions, though YYC-20b-04JYIIY14 is slightly smaller with a reduced firebox and shorter kiln chamber. The key distinction is their chimney design. YYC-20b-04JYIIY14 has one chimney connected to the chamber by six flues, while HT-YW has two narrow chimneys with three flues per chimney.

These chimneys vent smoke and help sustain fuel combustion by creating draught that pulls oxygen-rich air through the firebox (Kerr and Wood, 2004, p. 323). As gas temperatures rise, however, the expanding volume of hot gas in the stack can cause overheating and reduced chimney efficiency, weakening the draught when the kiln approaches peak temperature (Kerr and Wood, 2004, p. 324). A wider chimney helps maintain consistent gas extraction by providing greater volume and reducing overheating risk. Conversely, an excessively wide chimney can result in lower gas velocities and a slower draft response when adjusting fuel input or chimney venting, while increasing heat losses to the stack. In these respects, HT-YW's two-chimney design appears to have offered better firing performance. The ratio of each chimney width to kiln chamber width is ~0.15, falling within the recommended range (0.13-0.21) for downdraft kilns to balance draught stability, gas throughput, and efficient kiln control (Ying, 1988, p. 182). In contrast, YYC-20b-04JYIIY14's single-chimney arrangement may

have created the risk of gas concentration in more direct channels from firebox to flue, overheating these pathways while leaving peripheral zones inadequately fired.

According to current archaeological evidence, use of horseshoe-shaped kilns ceased after the Wanli period, when an egg-shaped kiln type was introduced, combining the large capacity of gourd-shaped kilns with the efficient heat utilisation of horseshoe-shaped kilns. Two such kilns have been reported at Jinjianong (Zhang, 2022), though analysis of their exact structure awaits further material publication.

Beyond kiln construction, saggars bear directly on the comparison of firing choices between sites. As recorded in the *Taoshu*, the saggar arrangement in kilns at the Imperial Porcelain Workshop protected wares from direct flame and controlled kiln atmosphere, which the text presents as one of the reasons for the superior production quality of imperial wares (Wang and Lu, 1597, pp. 843–844). If firing at the site identified as the Imperial Porcelain Workshop was in fact more protective, or more heavily invested, than firing elsewhere, saggar evidence is where that difference should be visible.

Excavation reports document one saggar type claimed to be unique to Yuyaochang—lidded porcelain saggars used during the early Ming to Jiajing periods (Figure 3-20a). Kiln waste evidence shows these saggars held single vessels (dishes, bowls, or stem cups) and were placed within cylindrical saggars made from coarse, refractory clay (Figure 3-20b; SAM-PKU *et al*., 2007, p. 43; JCARI *et al*., 2017a, p. 20; BPM *et al*., 2024b, p. 73).[22] This combination required greater material investment but provided superior protection from impurities, improved heat retention, and prevented volatilisation of colouring pigments in a reducing atmosphere. Such porcelain saggars were also discovered at Luomaqiao, used during the Chenghua and Jiajing periods (JCARI *et al*., 2020, p. 16), a site classified as non-imperial. So far, the archaeological evidence can only suggest that such protective and costly firing technology was not confined to the Yuyaochang site identified as ‘imperial’. Further research is required into whether it was specific wares that warranted the investment, whichever site produced them.

[22] For detailed documentation of the combination of an inner lidded porcelain saggar and an outer cylindrical saggar, see YYC-22-TN30W14, YYC-22-TN33W16, and YYC-28-Y1 in Catalogue A.



Figure 3-20: Saggars excavated from Yuyaochang. (A) Lidded porcelain saggars. (B) cylindrical saggars. (C) funnel-shaped saggars. Photographs taken by the author at the Jingdezhen Imperial Kiln Museum 御窯博物館.

In addition to lidded porcelain saggars and cylindrical saggars, Yuyaochang potters used funnel-shaped saggars made from coarse, refractory clay, each accommodating one vessel (Figure 3-20c; BPM *et al*., 2024b, p. 69). This saggar type was widely employed across all four sites throughout the Ming period (JPICRA *et al*., 2007; pp. 462–464; SAM-PKU *et al*., 2009, p. 54; NCA *et al*., 2024a, pp. 94–95; JCARI *et al*., 2020, p. 14; JCARI *et al*., 2024, p. 24). At Guanyinge, cylindrical saggars that could accommodate multiple stacked vessels were also present, indicating a priority of maximising production volume (SAM-PKU *et al*., 2009, p. 54).

Taken together, the use of saggar can indicate both the protection a given ware required and the volume a workshop sought to fire. The costly combination of a coarse outer saggar and an inner porcelain lidded saggar for a single vessel points to the firing of high-value wares at Yuyaochang and Luomaqiao alike, while the cylindrical saggars used for stacked firing at Guanyinge maximised output within a single firing. As with the kiln structures themselves, the use of saggars reflect specific production choices while showing commonalities across sites.

There is, however, one distinction the archaeological evidence cannot address. As Chapter 2 discusses, the *Taoshu* describes differences in how a firing was arranged (Section 2.3). At the Imperial Porcelain Workshop, wares of the same colour were loaded together and shielded from the flames by rows of empty saggars, and the kiln was sealed under mud, in contrast to the densely packed loads of the kilns run by local production communities (Wang and Lu, 1597, pp. 843–844). Whereas saggar form survives as discarded kiln furniture and can be compared across sites, the arrangement of wares within a firing leaves insufficient material trace once the kiln is unloaded, and the saggars recovered here derive from mixed waste deposits that cannot be reconstructed into individual kiln loads or matched to the vessels they held. Determining

which vessel types were fired in which saggars, let alone how they were disposed within the kiln, awaits fuller material publication and may not be recoverable at all. On this specific point, the text asserts a difference that the archaeology of production waste can neither corroborate nor refute, even as the saggar types it can compare point to shared practice rather than a divide between different sites.

3.3.4 Kiln waste deposits

Besides production features, large quantities of kiln waste deposits were found at all four sites, mainly comprising fragments of porcelain vessels and kiln furniture. Two distinct deposition practices can be identified: dedicated disposal pits containing relatively complete sherds from narrow time ranges, and mixed waste dumps where heavily fragmented sherds accumulated alongside discarded kiln furniture over extended periods. While mixed waste dumps are common across all four sites throughout the Ming period, dedicated disposal pits were observed only at Yuyaochang and only during the early to mid-Ming periods. The cessation of this practice after the Zhengde period raises important questions about its relationship to the Imperial Porcelain Workshop, which was established during that very reign.

At Yuyaochang, in stratigraphic layers dating to the Yongle, Xuande, Zhengtong, Chenghua, Hongzhi, and Zhengde periods, porcelain sherds were found deposited in dedicated disposal pits or piled on top of other kiln waste (Figure 3-21). The sherds in each pit or pile date to a relatively narrow time range within one reign period rather than showing prolonged accumulation (SAM-PKU *et al*., 2007; JCARI *et al*., 2017a; Jiang, 2020b).[23]

[23] For detailed documentation of these pits or piles, see YYC-20a-02JYIK2, YYC-20a-02JYIK4, YYC-20a-02JYIK6, YYC-20a-02JYIK8, YYC-20a-02JYIK12, YYC-20a-02JYIH2, YYC-20a-03JYIK12, YYC-20a-03JYIK14, YYC-20a-03JYIK16, YYC-20a-03JYIP3, YYC-20a-03JYIP4, YYC-20a-03JYIP5, YYC-20a-04JYIVK18, YYC-20a-04JYIVK20, YYC-20a-04JYIVK21, YYC-20a-04JYIVK31, YYC-20a-04JYIVP8, YYC-20a-04JYIVP10, YYC-20b-04JYIID1, YYC-20b-04JYIID3 in Catalogue A.

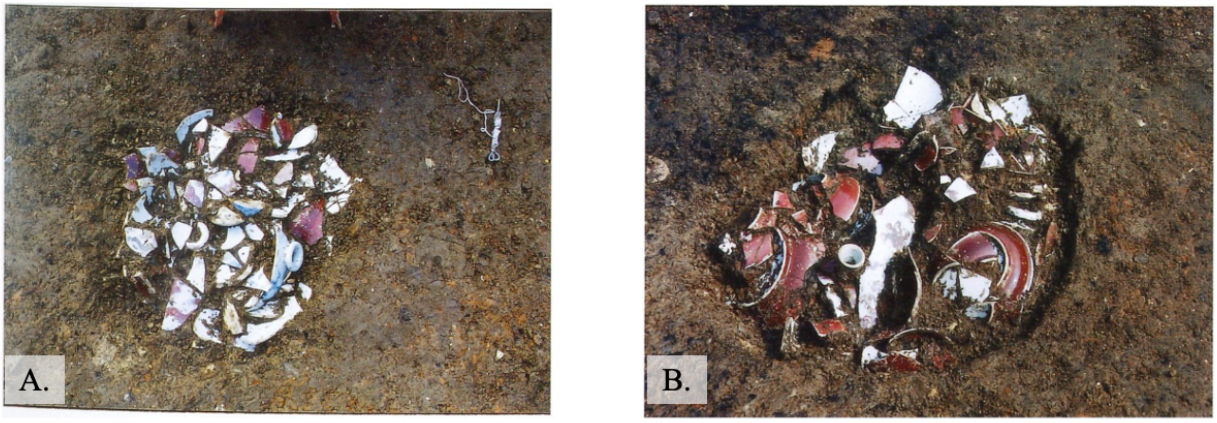


Figure 3-21: Dedicated disposal pits at Yuyaochang. (A) Pit YYC-20a-02JYIK8. (B) Pit YYC-20a-03JYIK12. Source: Liu *et al*., 2004, p. 11.

Since these sherds were relatively complete and could be reassembled into whole vessels identifiable as 'imperial porcelain' based on the generally accepted definition described in Chapter 1, they have been interpreted as products deliberately smashed after firing rather than as losses incurred during firing, indicating a post-firing selection process for imperial production (Quan, 2005; SAM-PKU *et al*., 2005, pp. 38–39). Given that Yuyaochang has been identified as the site of the Imperial Porcelain Workshop, this practice of selection and discard has been further understood as evidence of strict quality control over imperial products at the Workshop itself (SAM-PKU *et al*., 2007, p. 10). Selection appears to have been made during production. In a Zhengde-period deposit at Yuyaochang, large quantities of semi-finished porcelain vessels were discovered.[24] These vessels had been decorated with cobalt blue and underwent an initial firing to bring out the underglaze colour, but were discarded before receiving additional overglaze enamels and a second firing, as evidenced by the blank spots on exterior surfaces (JCARI *et al*., 2017a). Taken together, these deposits indicate that selection and deliberate destruction took place at multiple stages of the production sequence at Yuyaochang during the early to mid-Ming periods.

However, Yuyaochang also housed mixed kiln waste dumps throughout the Ming period—porcelain sherds deposited alongside other discarded kiln furniture in heavily fragmented form, identical to the deposition practices observed at the other three sites (JPICRA *et al*., 2007, p. 59; JCARI *et al*., 2017a; JCARI *et al*., 2020; NCA *et al*., 2024a). In these deposits, later sherds accumulated on top of earlier material, with individual pits containing accumulation spanning

[24] For detailed documentation of this depositional pit, see YYC-22-H20 in Catalogue A.

several reign periods.[25] After the Zhengde period, the practice of smashing certain porcelain vessels and depositing them in dedicated disposal pits ceased, and the current documentation indicates no notable differences in disposition practices across the four sites. This transition presents a striking contradiction. As previously discussed, the establishment of the Imperial Porcelain Workshop during the Zhengde period suggests a formalisation of government administration over imperial production at Jingdezhen. If the dedicated disposal practice reflected a quality-control process for imperial production, as it is currently interpreted, one would expect it to continue or even intensify under the Workshop superintendent's oversight. Instead, it disappeared when the Workshop was established. This contradiction suggests either that the practice operated under a different organisational logic that predated the Workshop, or that the Workshop's establishment brought changes to production management that rendered dedicated disposal unnecessary. In either case, the dedicated disposal pits cannot straightforwardly be attributed to the Imperial Workshop, and their cessation complicates any narrative of quality control over imperial production at Yuyaochang.

3.4 Shared practices and site-specific variation across Ming-period Jingdezhen

The comparative analysis of walls, evidence for the use of pottery wheels, kilns, and kiln waste deposits across Yuyaochang, Guanyinge, Luomaqiao, and Hutian does not show distinct production practices corresponding to the current imperial and non-imperial classification of these sites. Instead, the evidence shows a pattern of shared practices across Jingdezhen alongside site-specific variation that cuts across the supposed divide (Figure 3-22).

[25] For detailed documentation of these deposits, see YYC-22-TN33W16 in Catalogue A, GYG-2-H1 in Catalogue B, LMQ-1-T17H5 and LMQ-1-T27H1 in Catalogue C, and HT-H6 in Catalogue D.

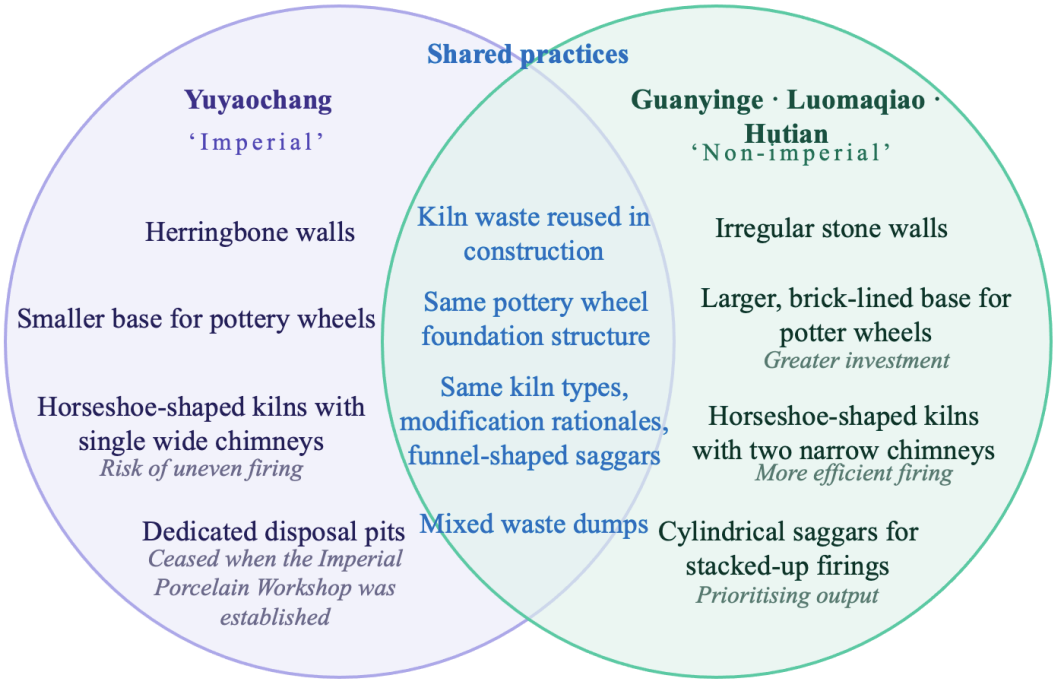


Figure 3-22: Summary of shared production practices and site-specific variation across Yuyaochang, Guanyinge, Luomaqiao, and Hutian, as identified in Section 3.3.

Several production practices were consistent across sites. All four sites incorporated repurposed kiln waste, primarily saggar fragments and porcelain sherds, into infrastructure construction. Pottery wheel foundations across Yuyaochang and Guanyinge share the same fundamental underground structure, with a shaft well and central shaft hole. Funnel-shaped saggars were employed at all four sites throughout the Ming period. Both gourd-shaped and horseshoe-shaped kilns appear at Yuyaochang and Hutian, and potters at both sites modified kiln structures to address the same functional challenge of achieving more uniform firing temperatures. These shared practices point to common manufacturing knowledge circulating across Jingdezhen's production sites, rather than to separate technological traditions operating under different administrative organisation.

At the same time, site-specific variation is evident, but it does not align with the imperial and non-imperial division. Wall construction at Yuyaochang employed more homogeneous materials arranged in ordered herringbone patterns, whereas walls at Guanyinge and Luomaqiao used large stones and clusters of fused bowls stacked irregularly. This suggests greater attention to visual consistency at Yuyaochang, though whether this reflects institutional requirements, site convention, or the availability of materials cannot be determined based on

the structural evidence alone. Pottery wheel foundations at Guanyinge were constructed on a larger scale with uniform brick lining and porcelain bearing rings, indicating investment in more durable equipment designed for sustained, high-intensity forming. The level of construction investment exceeded the single, smaller, saggar-lined foundation documented at Yuyaochang. Kiln design at Hutian appears to have provided more consistent heat distribution than its counterparts at Yuyaochang, as shown by the narrower inter-chamber passage in the gourd-shaped kiln and the two-chimney arrangement in the horseshoe-shaped kiln. Moreover, potters' choices of saggars varied according to production demands rather than site classification. Lidded porcelain saggars, previously claimed to be unique to Yuyaochang, were also employed at Luomaqiao, while Guanyinge used cylindrical saggars for stacked firing that maximised production volume. In none of these cases does the site classified as imperial consistently show greater technological investment or more sophisticated production infrastructure than sites classified as non-imperial.

The most pronounced site-specific pattern concerns the dedicated disposal pits at Yuyaochang, where deliberately smashed semi-finished and finished vessels were deposited during the Yongle through Zhengde periods. This practice, absent at the other three sites, has been interpreted as evidence of strict quality control for imperial production intended to limit the circulation of substandard products (Quan, 2005; SAM-PKU *et al*., 2007). However, two observations complicate this interpretation. First, the practice ceased after the Zhengde period, precisely when the Imperial Porcelain Workshop was established. If dedicated disposal reflected quality control under administrative oversight, one would expect it to continue or intensify following the establishment of the Workshop, not to disappear. Second, after the Zhengde period, Yuyaochang's deposition practices become indistinguishable from those at the other three sites, with mixed kiln waste dumps accumulating over extended periods. The dedicated disposal pits therefore cannot straightforwardly be attributed to the Imperial Porcelain Workshop, or even imperial production more broadly. Their cessation suggests either that the practice operated under a different organisational logic that predated the Workshop, or that the Workshop's establishment changed how production waste was managed.

The analysis results also throw into question the identification of Yuyaochang as the site of the Imperial Porcelain Workshop through its examination of individual features. The two boundary walls currently identified as the Workshop's exterior perimeter (YYC-26-Q1 and YYC-27-Q3) were first constructed during the Yongle period and the second half of the fifteenth century

respectively, both predating the Workshop's establishment during the Zhengde period. Their attribution as Workshop boundaries was based on matching architectural features recorded in historical texts with excavated remains at the site and on the presence of imperial porcelain sherds nearby—an interpretive approach that assumes the identification it claims to demonstrate (Liu, 1996; Wang, 2015; Jiang, 2020b). The walls' long construction histories, with evidence of expansion and reinforcement across multiple periods, further undermine their attribution to a single historical institution.

These findings must be read within the limits of what feature analysis alone can and cannot show. The production practices examined in this chapter represent common practical choices made in response to shared manufacturing requirements. They tell us about construction investment, production priorities, and disposal practices, but they do not tell us how production was organised or administered at any of these sites. The absence of a clear imperial and non-imperial divide in production practices does not mean that no administrative distinction existed. Instead, current evidence shows that such a distinction, if it existed, did not produce consistently different patterns in the categories of archaeological evidence examined here. Whether differences corresponding to the imperial and non-imperial divide can be identified in the finished products themselves is the question that the following chapter addresses.

Chapter 4 Reassessing the Imperial Quality: Porcelain Production Strategies Identified Through Compositional Analysis

Throughout earlier chapters, it has been made clear that the binary classification of porcelain discovered at Jingdezhen's production sites into imperial versus non-imperial categories cannot be sustained on the basis of stylistic criteria or consumption contexts. However, a supplementary classification standard has emerged that differentiates 'imperial' from 'non-imperial' porcelain based on production quality, attributing superior-quality pieces discovered at Jingdezhen production sites to 'imperial' porcelain and inferior-quality pieces to 'non-imperial'. Typically, high production quality is defined as dense, vitrified, white clay bodies without impurities, smooth vessel contours with minimal trimming marks, lustrous glazes, and fluid lines in painted decoration (Garner, 1954, pp. 66–67; Geng, 1993, pp. 5–6; Feng, 2001, pp. 467–539). This quality hierarchy derives fundamentally from the *Taoshu* 陶書 (Book of Ceramics), which emphasises the technological superiority of the Imperial Porcelain Workshop's products—commissioned for the emperors' use—as resulting from substantial investments of time and material resources (Wang and Lu, 1597, p. 844). Nevertheless, while current standards for high production quality rely largely on subjective visual assessment, the circular reasoning embedded in this approach is troubling. Characteristics of superior quality become criteria for identifying 'imperial' porcelain, yet these same 'imperial' pieces are then cited as evidence of the Imperial Porcelain Workshop's technological supremacy (SAM-PKU *et al*., 2005; Qin *et al*., 2017; Qin, *et al*., 2020).

To address the circular logic in the current 'imperial' versus 'non-imperial' classification framework, this chapter examines potential technological differences in Ming-period Jingdezhen blue-and-white porcelain bodies to independently evaluate possible production status. For example, do 'imperial' wares exhibit a distinctive body composition that consistently differentiates them from 'non-imperial' wares? And If compositional differences do exist, do they hold across the Ming or only within particular periods, and what technological factors, from raw material sourcing and selection to paste preparation techniques, might account for them?

Sections 4.1 and 4.2 first examine the nature of raw materials used in Ming-period Jingdezhen blue-and-white porcelain bodies~~,~~ to identify factors in raw material selection and processing that could account for compositional consistency or variation. Sections 4.3 and 4.4 then analyse

published compositional data to determine whether any technological differences exist between currently classified 'imperial' and 'non-imperial' porcelain, thus reconsidering existing classification criteria for this binary framework. This analysis demonstrates that the commonly accepted criteria for high-quality porcelain bodies neither apply exclusively to currently classified 'imperial' porcelain, nor to all pieces within this category. Achieving such characteristics required Jingdezhen potters and raw material suppliers to manage compositional variability in porcelain stone while carefully selecting kaolinite-rich, low-impurity materials. As will be shown, rather than exclusive access to raw materials and passive responses to institutional directives, high production quality was grounded more in these potters' adaptive capacity to draw on their accumulated knowledge of local materials and their practical skills in processing them.

4.1 Raw materials from past to present

Current interpretations of Jingdezhen porcelain body compositions suggest that Ming-period potters used two distinct raw materials—porcelain stone (*cishi* 瓷石) and kaolin (*gaolingtu* 高嶺土) (Zhou and Li, 1960b; Liu and Bai, 1982; Pollard and Wood, 1986; Guo, 1987; Kerr and Wood, 2004, pp. 219–239; Tite, Freestone and Wood, 2012; Xiao *et al*., 2020; Wood, 2021). Present-day understanding of these two materials derives from compositional analysis of raw materials used for modern Jingdezhen porcelain. Generally, porcelain stone refers to partially decomposed granitic rocks comprising quartz, albite, muscovite, sericite, and clay minerals (Ebelmen and Salvetat, 1850; Vogt, 1900; Efremov, 1956; Zhou *et al*., 1958; Nikulina and Taraeva, 1959; Yi, 1964; JPCIRI, 1973; Zhang, 1981). Kaolin refers to the finer-grained, clay-rich material from more advanced granitoid decomposition, consisting predominantly of kaolinite or halloysite (Ebelmen and Salvetat, 1850; Vogt, 1900; Zhou *et al*., 1958; Yi, 1964; JPCIRI, 1973; Keller *et al.*, 1980; Chen, Lin and Zheng, 1997; Lu *et al.*, 2016; Wang, 2018).

However, Ming-period potters are likely to have understood these raw materials differently, given that guiding scientific frameworks were developed only from the late eighteenth century (Pollard, 2015). To gain insights into how Ming-period potters may have conceptualized their raw material, this chapter will first examine the appreciation of porcelain stone and kaolin in two contemporary historical texts—the *Taoshu* 陶書 (Book of Ceramics) and the *Taoshan* 陶埏 (The Making of Ceramics)—and then identify possible raw material sources based on their

material nature and the regional geology around Jingdezhen. Although ethnographic accounts of Jingdezhen porcelain production since the 1900s have documented raw material sources used by modern potters (for a summary see Chen, 2004, pp. 8–26), proof of whether the same sources were available during the Ming period also requires closer scrutiny.

4.1.1 Terminology of porcelain stone and kaolin reflected in historical texts

According to the *Taoshu*, three primary materials were used in making porcelain bodies at the Imperial Porcelain Workshop: 'brick-shaped earth' (*duntu* 不土), 'ceramic earth' (*taotu* 陶土), and 'glaze earth' (*youtu* 釉土) (Wang and Lu, 1597, pp. 817–818). Their descriptions indicate that they were obtained as initially processed products rather than in raw form. For example, the *Taoshu* notes that 'glaze earth'—so named because it could also be used in glaze-making—was made from hard rocks (Wang and Lu, 1597, p. 818). It likely underwent the same processing as 'brick-shaped earth', which is recorded in greater detail in two eighteenth-century texts, the *Taoye tushuo* 陶冶圖說 (Illustrated Manual of Ceramic Production) and the first letter by Father d'Entrecolles. These later accounts are cited here for what they demonstrate about the referent of the Ming-period terms, rather than as direct evidence of Ming practices.

According to the *Taoye tushuo*, 'brick-shaped earth' was obtained from white rocks that, when cracked, showed an interior texture resembling brown algae (Tang, 1743, p. 954). After mining, these stones were crushed to powder using water-powered trip hammers, levigated in water pools to remove impurities, and formed into brick-shaped blocks called '*dun*' (不) (*ibid.*). Father d'Entrecolles (1712, pp. 64–66) records the same process, referring to these bricks as 'petuntse' (a transliteration of *bai dunzi* 白不子, meaning white clay bricks).

The production process for 'brick-shaped earth' recorded in sixteenth—eighteenth-century texts closely resembles the brick-making process for modern porcelain stone (Figure 4-1), which has been well-documented in ethnographic accounts (Addis, 1982, p. 57; Fang, 2002, pp. 263–265; Chen, 2004, pp. 2–6; Bai, 2005, pp. 56–58; Zheng, 2022, pp. 100–102). Zheng (2022, p. 105) further notes that the *Taoye tushuo*'s description of the parent rocks producing 'brick-shaped earth' shares identical traits with porcelain stone's composition, suggesting that

‘brown-algae-shaped minerals’ may refer to manganese oxides typically found on heavily weathered porcelain stone containing fine mica particles. While the similarities between these historical descriptions and present-day practice are striking, they do not in themselves imply an unbroken tradition of use, nor do they rule out alternative methods that may have coexisted or intervened during the intervening centuries. The *Taoshu* indicates that ‘brick-shaped earth’ reached the Imperial Porcelain Workshop as a processed product derived from hard rock but does not describe how it was made. The eighteenth-century texts and the ethnographic record document a procedure capable of producing material of that description. They give content to the *Taoshu*’s terminology without establishing that this procedure was the only one in use. The compositional consequences of levigation can then be examined independently, since its effect on the relationship between a source material and its processed form depends on the behaviour of the materials rather than on the period of manufacture (Section 4.2.3).



Figure 4-1: Production process of earth bricks from porcelain stone. (A) Crushing and grinding of porcelain stone; (B) levigation and separation of finer particles; (C) settling and drying of the refined slurry; (D) moulding of earth bricks. Photos taken by the author at Sanbao Village (三寶村), May 2023.

Unlike ‘brick-shaped earth’ or ‘glaze earth’, the *Taoshu* notes that ‘ceramic earth’ acquired by the Imperial Porcelain Workshop underwent only levigation, settling, and drying without any crushing (Wang and Lu, 1597, p. 817). This process indicates that the raw material for ‘ceramic earth’ was much softer than the rocks that produced ‘brick-shaped earth’ or ‘glaze earth’. According to the *Taoshu*, the rocks from which ‘ceramic earth’ could be directly obtained without crushing had blackish cracks, textures resembling granulated sugar and jade, and a metallic reflection (*ibid.*). Xu (1984) argues that this description matches kaolinised granite discovered locally at Jingdezhen (Figure 4-2A): ‘jade’ corresponds to quartz, the metallic reflection to muscovite flakes, the blackish cracks to contamination from humus or iron-rich surface water, and the ‘sugar’ texture to clay minerals, easily extracted due to their fine grain (Figure 4-2B). Following this interpretation, the raw material of ‘ceramic earth’ is essentially equivalent to modern kaolin—the clay-rich fraction of weathered granitic rocks. While the *Taoshu* does not specify in what form ‘ceramic earth’ arrived at the Imperial Porcelain Workshop, both the *Taoye tushuo* (Tang, 1743, p. 954) and d’Entrecolles (1712, pp. 66–67) state that soft earth obtained from such weathered rocks was also made into brick-shaped blocks identical to ‘*dun*’.





Figure 4-2: Kaolin and its parent rock. (A) Kaolinised granite sample from present-day Gaoling Village (高嶺村), Jingdezhen. The pale matrix represents former feldspar that has altered to kaolinite, while the darker grey areas consist of unreacted quartz crystals. Source: Lu *et al.*, 2016, Figure 2. (B) Kaolinised granite samples and kaolin clay collected from the bank of East River. Photograph taken by the author at the Jingdezhen Gaoling National Mining Park (景德鎮高嶺國家礦山公園), May 2024.

Beyond the Imperial Porcelain Workshop, the *Taoshan* notes that all 'earth' (*tu* 土) used by Jingdezhen potters for porcelain bodies were transported to Jingdezhen in brick-shaped form via water routes (Song, 1637, p. 138). This earth likely included materials processed from both hard rocks and soft kaolin. Upon arrival, these bricks underwent another levigating process by Jingdezhen potters, in which the slurry was settled and dried into clay paste (*ni* 泥) (Song, 1637, pp. 138–139). This paste could be stored and later mixed with water to form porcelain bodies as needed (Song, 1637, p. 139).

Based on the descriptions in the *Taoshu* and *Taoshan*, the raw materials for porcelain bodies can be understood in terms of three successive processing stages. First, raw materials as found in nature—hard rocks (essentially equivalent to porcelain stone) and soft earthy deposits (essentially equivalent to kaolin). Second, earth bricks, produced by crushing and/or levigating these raw materials and forming the resulting powder or slurry into brick-shaped blocks. Third, clay paste, further refined from earth bricks through additional levigation, settling, and drying.

In this framework, terms such as 'brick-shaped earth' (*duntu*), 'ceramic earth' (*taotu*), and 'glaze earth' (*youtu*) refer to earth bricks processed from raw porcelain stone or kaolin that could be further refined into clay paste, rather than to raw materials or specific mineral types, and a single term could encompass material derived from different geological sources. It is therefore important to examine both porcelain stone and kaolin in these three forms corresponding to successive processing stages—raw material, earth bricks, and refined clay paste—to better understand both raw material complexity and the technological choices potters made in transforming procured materials into production-ready paste. This approach informs the analysis and discussion in Section 4.2.

4.1.2 Raw material sources and unstable availability

While the *Taoshu* and *Taoshan* define and describe porcelain stone and kaolin sources for Jingdezhen potters, obstacles arise when attempting to locate the raw material sources mentioned in these texts, as they were listed according to administrative divisions whose boundaries differed from today's, even when the names remained the same. For example, Fuliang County was an administrative region under which Jingdezhen was subordinate during the Ming period, whereas today it is a county-level division administered by Jingdezhen City.

Previous scholarship has investigated specific locations in the mountains where porcelain stone and kaolin may have been mined using ethnographic accounts collected from native residents living in present-day Fuliang County (Xu, 1984; Feng, 2012, pp. 14–18; Wang, 2018; Feng, 2022). However, assessing the credibility of these accounts is difficult. Xu (1984, p. 70) notes that many of the informants described as long-established local inhabitants had in fact immigrated to Fuliang County only in the twentieth century. For families with longer local histories, place names recorded in stand-alone genealogies are as problematic as those found in historical records, as some of them inevitably refer to locations within administrative regions whose boundaries have since changed. Additionally, dialectal variations between interviewees and interviewers may introduce distortions, as previous research has noted (Wang, 2018, p. 71; Feng, 2022, pp. 110–111).

To overcome these difficulties, this section first locates the raw material sources recorded in the *Taoshu* and *Taoshan* by referencing the China Historical Geographic Information System

dataset (CHGIS, version 6), which has established the modern geographic boundaries of Ming-period administrative regions from provincial to county levels. After establishing the locations of these historical sources, the local geology of these areas is examined to understand what potential porcelain stone and kaolin sources might have been available to Jingdezhen potters. This geological analysis provides a broader overview of raw material availability than historical records alone suggest.

According to the *Taoshu*, porcelain stone used to produce earth bricks originated from Wuyuan County, Yugan County, and Fuliang County, while kaolin was sourced from Fuliang County (Wang and Lu, 1597, pp. 817–818). The *Taoshan* corroborates Wuyuan County as a source for earth bricks and further identifies Qimen County as an additional source (Song, 1637, p. 138). After establishing modern geographic locations of these four Ming-period counties, the availability of raw materials for porcelain production in these regions becomes explicable through geological processes that shaped northeastern Jiangxi Province and the contiguous southwestern area of Anhui Province (see Figure 4-3). This region lies within the Jiangnan Orogenic Belt, where linear zones of intense tectonic deformation, known geologically as *shear zones*, act as conduits for hydrothermal fluids often associated with the emplacement of granitoid bodies (Charvet, 2013; Xu, *et al*., 2016a; 2016b; Xu *et al.*, 2018). As such, shear zones are responsible for concentrating chemical alterations of granitic and related rock, through sericitisation or more localised kaolinisation. It is therefore significant that shear zones are also seen in close proximity to many other cities near Jingdezhen.

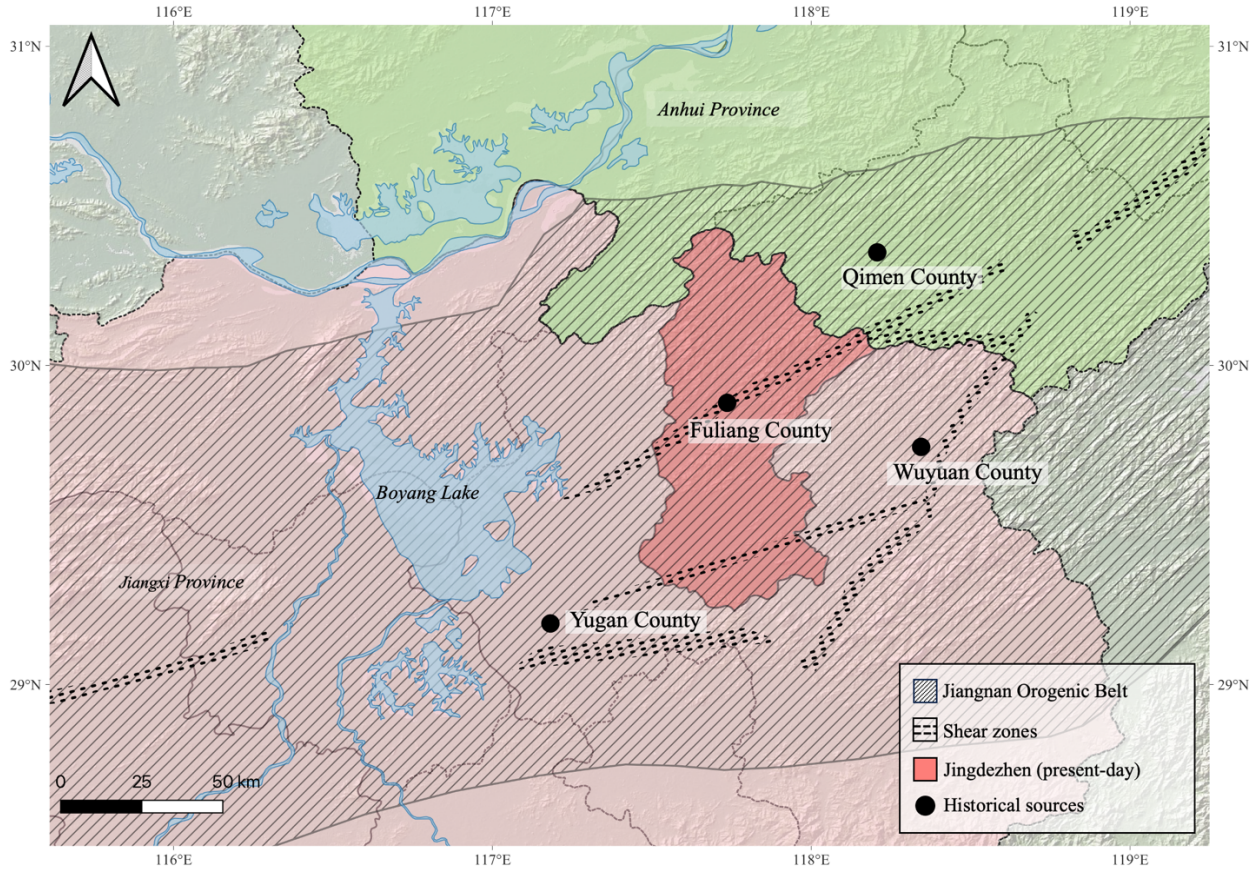


Figure 4-3: Geographical distribution of raw material sources documented in historical texts. Geological features (Jiangnan Orogenic Belt and shear zones) drawn after Xu *et al*. (2018). Historical sources refer to county-level administrative regions rather than precise locations; however, as Ming-period county boundary data is not yet available in the CHGIS database (version 6), only approximate location points are shown here.

According to Huang *et al*.'s (2019) summary of 189 geological reports from surveys conducted within Jiangxi Province, porcelain stone ore deposits are mainly distributed in Yichun, Yingtan, Shangrao, and Jingdezhen cities, while kaolin ore deposits are mainly distributed in Yichun, Jiujiang, Yingtan, and Jingdezhen cities, all located within the tectonically active areas illustrated in Figure 4-3. However, granitoids near Jingdezhen are scattered and significantly smaller in volume than those in southwestern Jiangxi (Huang *et al.*, 2019, p. 42). If Ming-period Jingdezhen potters relied primarily on local raw materials from Fuliang county, they would likely have faced the issue of resource depletion that would have necessitated frequent shifts between mining sites. The raw material sources from Yugan and Qimen counties, as the *Taoshu* and *Taoshan* records, indicate that potters were already seeking alternatives beyond locally available materials. This instability would have posed a critical challenge, as shifting

between sites introduced varying mineralogical compositions with different performance characteristics.

Figure 4.4A summarises the geological processes responsible for converting granitic rock to porcelain stone and kaolin. Surface weathering transforms potassium feldspar and albite, and to a lesser extent muscovite, into sericite and minor clay minerals, producing porcelain stone, while hydrothermal alteration achieves similar transformations more rapidly and extensively (Guo, 1987; Kerr and Wood, 2004, pp. 46, 48). Although potassium feldspar is another major constituent of the parent granite and the principal source of potassium for sericite formation through K^+ release (Skinner and Porter, 1987, pp. 210–212), it is rarely present in the local porcelain stone and kaolin sources available to Jingdezhen potters (see Section 4.2.1) and is therefore not discussed further here. Under combined effects by these two processes, sericite in porcelain stone may further transform into the clay minerals that compose kaolin (Keller *et al.*, 1980; Chen *et al.*, 1997). Alternatively, intensive hydrothermal alteration can directly transform granitic rocks into kaolin by converting the feldspars and the primary micas into clay minerals (Lu *et al.*, 2016). Porcelain stone and kaolin must therefore be understood as a compositional continuum with inherent variability between, and even within, individual sources, depending on where along this weathering and alteration continuum materials were mined (Figure 4-4B, C). This compositional variability of raw materials and how it resulted in varying performance characteristics of Ming-period porcelain bodies are examined in Section 4.2.

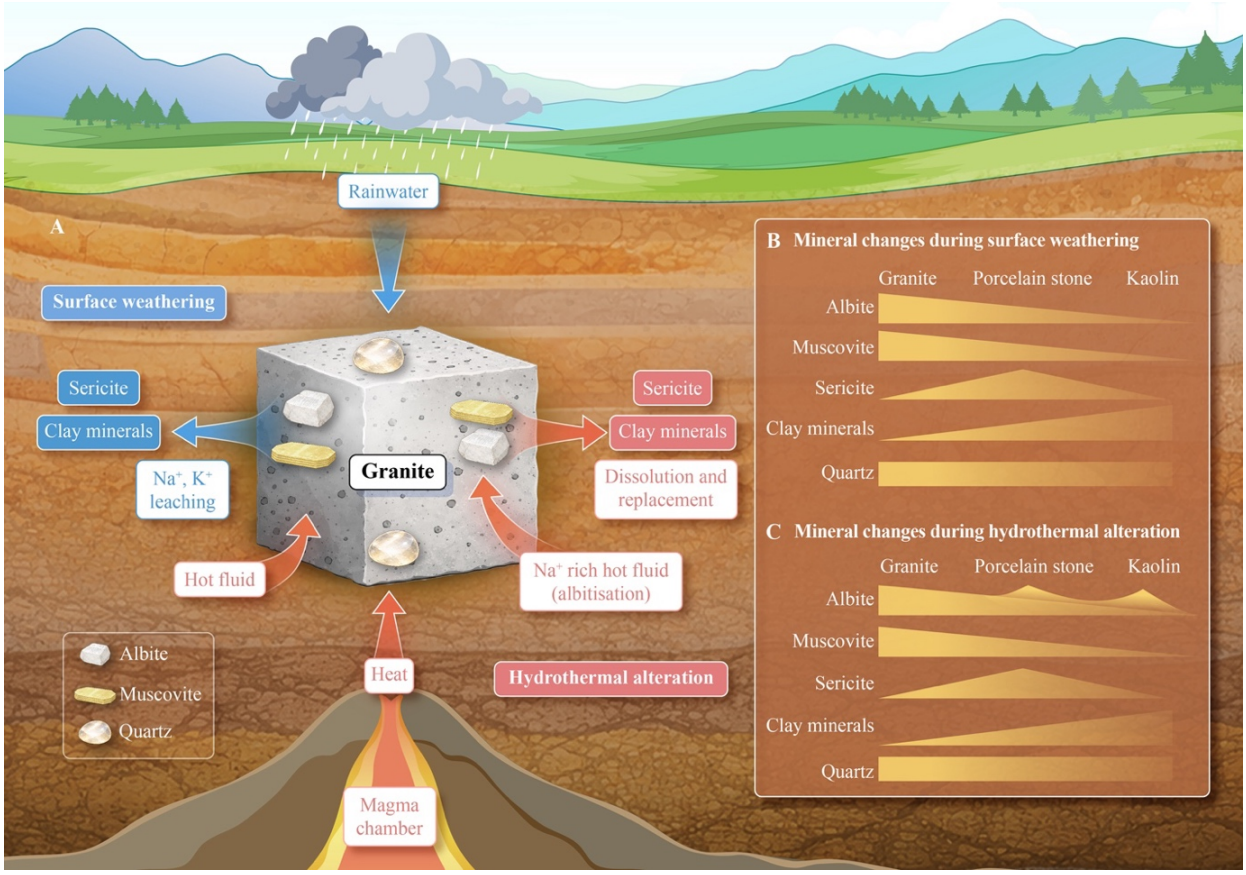


Figure 4-4: Granite transformation to porcelain stone and kaolin. (A) Surface weathering and hydrothermal alteration processes generating sericite and clay minerals in porcelain stone and kaolin; (B, C) corresponding changes in mineral composition. Panels B and C show compositional trends rather than absolute mineral proportions. Drawn after Skinner and Porter (1987, pp. 210–212), Kerr and Wood (2004, pp. 46, 48), and Lu *et al*. (2016).

4.2 Compositional variability of raw material sources and processed products

4.2.1 Mineral analysis from bulk chemical data

This section draws on published bulk chemical data from 53 modern porcelain stone and kaolin samples sourced from Jingdezhen and adjacent cities (Figure 4-5). All mineral conversions from these chemical data were conducted by the present author, and the interpretation and analysis that follow are based on these converted results. As discussed above, textual accounts, local transportation networks, and geological proximity suggest these sources were accessible to Jingdezhen potters. To ensure consistency, transliterations of raw material sources found in published analyses have been standardised using the Pinyin system and mapped to specific source localities following Chen's (2004, pp. 8–20) ethnographic research, which documents the varied nomenclature applied to individual raw material sources. Complete sample information and the standardisation process are detailed in Table B-1 (Appendix B). When data

permit, the analysis below incorporates both raw materials and their processed products (i.e., earth bricks and clay pastes) from identical sources.

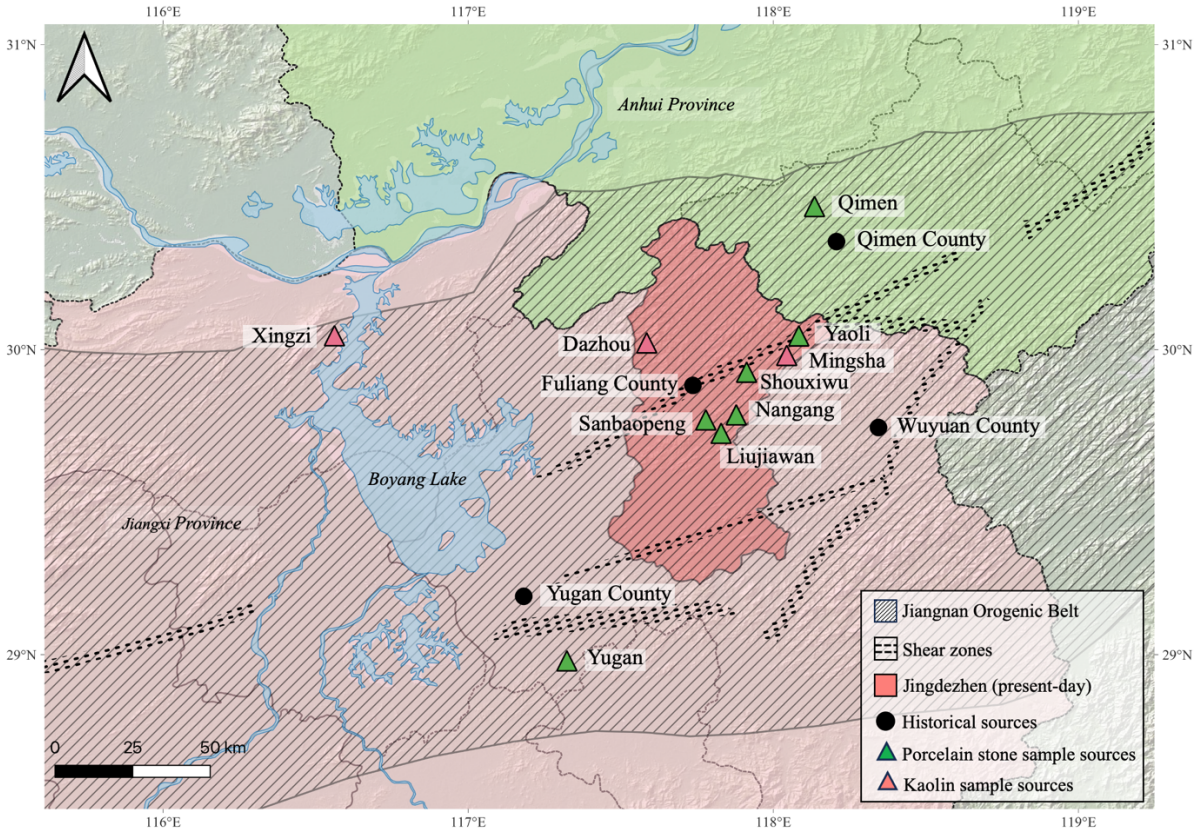


Figure 4-5: Geographical distribution of the raw material sample sources analysed in this study as well as sources mentioned in historical texts as having been used by Ming potters. Geological features (Jiangnan Orogenic Belt and shear zones) drawn after Xu *et al*. (2018). Historical source locations are shown as approximate points (see Figure 4-3). Modern sample location coordinates are listed in Table B-2 (Appendix B).

While bulk chemical data express raw material composition in terms of oxide weight percentages, they do not directly show which minerals are present or how those minerals influence ceramic performance. Moreover, changes in oxide proportions during processing can be misleading. For instance, when quartz decreases more substantially than mica during levigation, as is demonstrated in detail in Section 4.2.3, the relative K_2O proportion rises despite a reduction in total mica content, creating an apparent increase that does not reflect actual mineralogical change. Converting chemical data to normative mineral proportions—that is, ideal mineral compositions calculated by assigning measured oxides to standard mineral formulae—cannot fully resolve such discrepancies, but makes them visible and interpretable,

particularly when normative results can be compared against independent petrographic observations. This approach also enables raw material samples to be positioned along the granite–porcelain stone–kaolin transformation continuum discussed in Section 4.1.2, thereby linking compositional variation to the geological processes that shaped the materials available to Jingdezhen potters.

Accordingly, published bulk chemical data were converted to normative proportions of kaolinite ($Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$), sericite ($3Al_2O_3 \cdot 6SiO_2 \cdot K_2O \cdot 2H_2O$), albite ($Al_2O_3 \cdot 6SiO_2 \cdot Na_2O$), and quartz ($SiO_2$), following Wood (1983), Tite *et al*. (1984), and Pollard and Wood (1986). The calculation uses the Al–Si–K–Na system and treats other components (e.g., Fe–Mg–Ca–Ti phases) as minor and not modelled, consistent with the predominantly granite-derived mineralogy of porcelain stone and kaolin in the Jingdezhen region. Full chemical data and calculation results are provided in Tables B-3 and B-4 (Appendix B).

Because the conversion is based on major-element stoichiometry, differences in clay mineral structure and hydration state are not resolved. In particular, kaolinite and halloysite ($Al_2O_3 \cdot 2SiO_2 \cdot 4H_2O$) share identical anhydrous stoichiometry ($Al_2O_3 \cdot 2SiO_2$) and therefore cannot be distinguished on LOI-free data, although both occur in Jingdezhen kaolin (Keller *et al*., 1980; Chen, *et al*., 1997; Lu *et al*., 2016). Likewise, muscovite and sericite contribute to the same normative mineral. Sericite is the secondary phase produced by alteration of the parent granite into porcelain stone and subsequently kaolin, whereas muscovite represents the primary, unaltered form. For this reason, the potassium-bearing normative mineral is expressed here as sericite rather than muscovite, and it is examined alongside albite and kaolinite to determine to what extent the alteration has taken place.

A further assumption underlying the normative calculation is that all potassium is present in the form of muscovite and sericite, treated here as a single normative mineral, and that all potassium feldspar originally present in the parent granite has fully converted to sericite. This conversion would have almost certainly occurred in the kaolin deposits, where alteration was advanced. For porcelain stone, Tite *et al*. (1984) confirmed through petrological microscopy and scanning electron microscopy (SEM) that potassium feldspar was not present in samples from Jingdezhen. Although other published analyses sometimes report relict potassium feldspar, these works also confirm that most had converted to sericite, indicating that sericitisation was sufficiently complete to justify this assumption (Nikulina and Taraeva, 1959;

Yi, 1964; JPCIRI, 1973). Accordingly, the normative results are interpreted primarily as indicators of position along a granite–porcelain stone–kaolin transformation continuum, rather than as a fully resolved clay-mineral typology. Despite these limitations, this approach effectively characterises the mineralogical variability most relevant to ceramic performance and potters' raw material selection.

4.2.2 Inter- and intra-source variability

Porcelain stone

Twenty-eight porcelain stone samples from seven sources were analysed: Yaoli (n=4), Sanbaopeng (n=6), Qimen (n=4), Shouxiwu (n=2), Nangang (n=6), Yugan (n=4), and Liujiawan (n=2) (Figure 4-6A, B). One distinct group exhibits high kaolinite (11.46–13.68 wt%) and low albite (0–3.72 wt%), indicating a high degree of surface weathering and/or hydrothermal alteration compared to other samples. While quartz remains resistant during granitic transformation, sericite is produced primarily through the alteration of potassium feldspar in the parent rock. Albite, as a sodium feldspar, is also progressively lost during this process, though more slowly than potassium feldspar, and its depletion therefore serves as an indicator of the intensity of sericitisation and associated clay mineral formation, accounting for the elevated kaolinite observed in this group (Figure 4-4B, C).

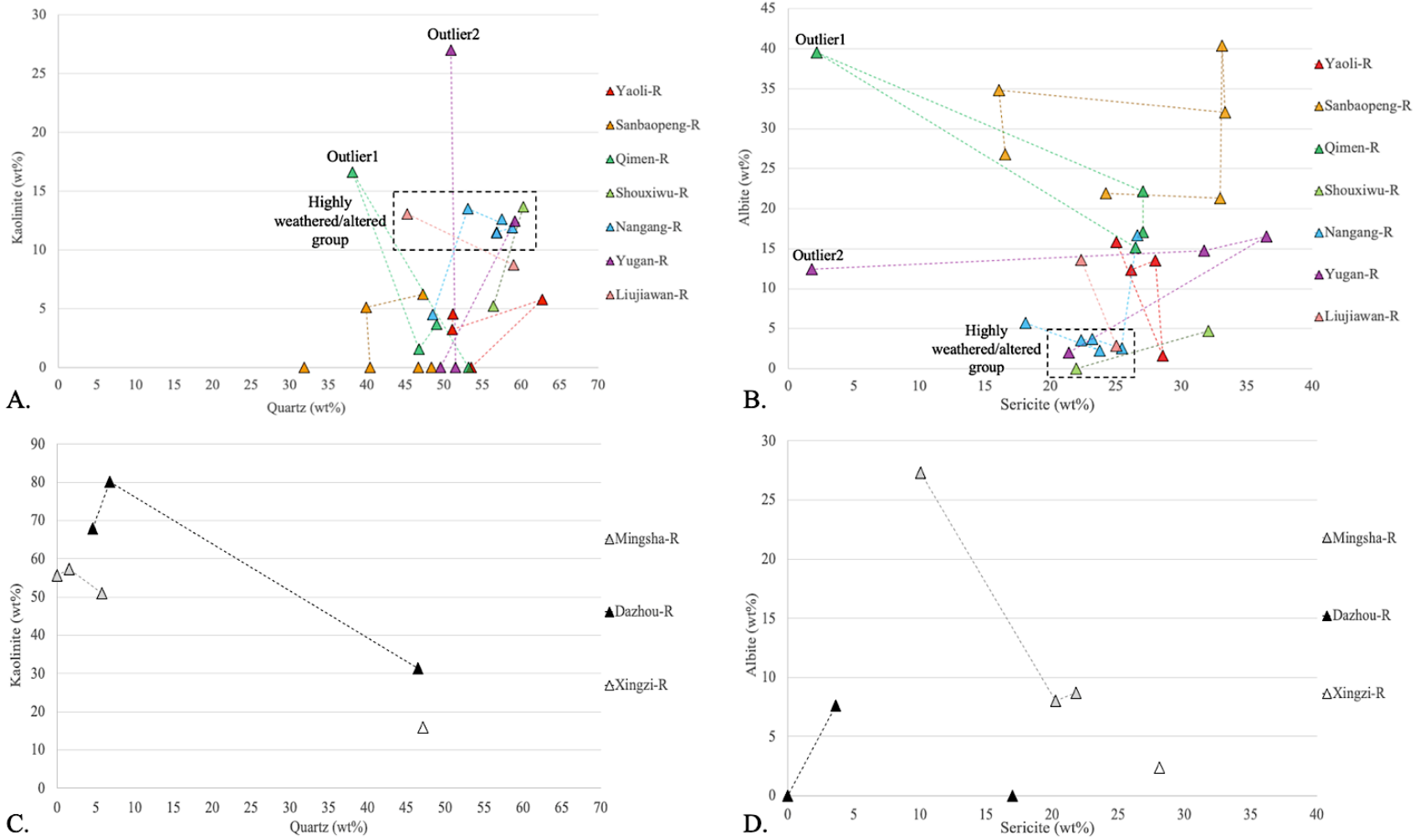


Figure 4-6: Mineralogical composition of raw material samples shown as bivariate plots (wt%): (A) kaolinite versus quartz for porcelain stone; (B) albite versus sericite for porcelain stone; (C) kaolinite versus quartz for kaolin; (D) albite versus sericite for kaolin. Data from Table B-4 (Appendix B).

Two samples deviate from this pattern (Outliers 1 and 2, Figure 4-6A), displaying high kaolinite (16.65 and 27.03 wt%) alongside anomalously high albite (39.52 and 12.44 wt%). While unusual in typical granite–porcelain stone weathering, this likely results from hydrothermal alteration introducing sodium-rich fluids that precipitate secondary albite (Figure 4-4A, C). The low sericite content in these samples (2.18 and 1.78 wt%) corroborates this albitisation process, indicating extensive transformation from parent rock along a different alteration pathway than that typical for porcelain stone generation.

Most other samples show less-advanced weathering/alteration, with kaolinite below 5 wt% and albite above 10 wt%. Samples exhibiting low albite and kaolinite (both <5 wt%) yet high sericite (>25 wt%) suggest that weathering and/or alteration has occurred, though to a lesser degree than in the highly weathered/altered group identified in Figure 4-6A, B.

Moreover, significant intra-source variability characterizes Nangang, Shouxiwu, Yugan, and Qimen samples. Kaolinite ranges from below 5 wt% to above 10 wt%, with Yugan showing extreme variation (0–27.03 wt%). Sanbaopeng, Qimen, and Yugan exhibit large compositional ranges in albite (up to 20 wt%) and sericite (up to 35 wt%).

This inter- and intra- source variability would have directly affected firing behaviour, as highly weathered/altered and less weathered/altered porcelain stone types can differ by 250°C in maximum firing temperature (Yi, 1964). Yet Despite the absence of a modern geological framework, Ming-period potters could distinguish these two types through test firings. The more weathered/altered the porcelain stone, the more refractory it behaved.

Kaolin

Seven kaolin samples from three sources were analysed: Mingsha (n=3), Dazhou (n=3), and Xingzi (n=1) (Figure 4-6C, D). Despite the limited number, five samples show significantly higher kaolinite (>50 wt%) and lower quartz (<7 wt%) than all porcelain stones. One Mingsha sample exhibits high albite (27.33 wt%), likely from hydrothermal albitisation. Two other Mingsha samples show high sericite (20.27 and 21.8 wt%), as also confirmed by petrographic analysis (Guo, 1985).

Dazhou samples show extreme intra-source variation (kaolinite at 31.46–80.19 wt%, quartz at 4.57–46.46 wt%). This range likely reflects differences between residual and secondary depositional contexts within the same source area. Residual kaolin, which forms *in situ* through the weathering and alteration of parent rock, typically retains a higher proportion of primary quartz, whereas secondary (transported and redeposited) kaolin tends to be more refined through natural sorting, concentrating clay minerals at the expense of coarser quartz (Kerr and Wood, 2004, p. 47). It should also be acknowledged that part of this variation may reflect sampling effects. Because kaolin deposits are inherently heterogeneous (for an example from a Jingdezhen kaolin mining site, see Wang, 2018), samples taken from different positions within a deposit, or from different stages of weathering and alteration, can yield substantially different mineral proportions, even within a single named source. The Xingzi sample suggests a similar residual context, though more samples are needed to confirm the extent of intra-source variability at that location.

Even where residual kaolin retains a higher quartz content, this can be reduced through washing without the need for crushing. As demonstrated in Section 4.2.3, washed products are consistently rich in clay minerals, which makes kaolin more refractory than highly weathered or altered porcelain stone, widening the firing temperature range and providing strength during rapid heating (Guo, 1987; Wood, 2021).

4.2.3 Variability between raw materials and their processed forms

Porcelain stone

Besides the intra- and inter-source variation among raw material samples, the levigation and refining processes during earth brick and clay paste production will also alter bulk mineral composition, though with varying effects across different raw material types. This can clearly be seen with the twelve earth brick (D) and clay paste (P) samples when these are plotted alongside their source raw materials (R) (Figure 4-7A, B). Here, compositional differences examined above persist between the highly-weathered group and less-weathered porcelain stone samples.

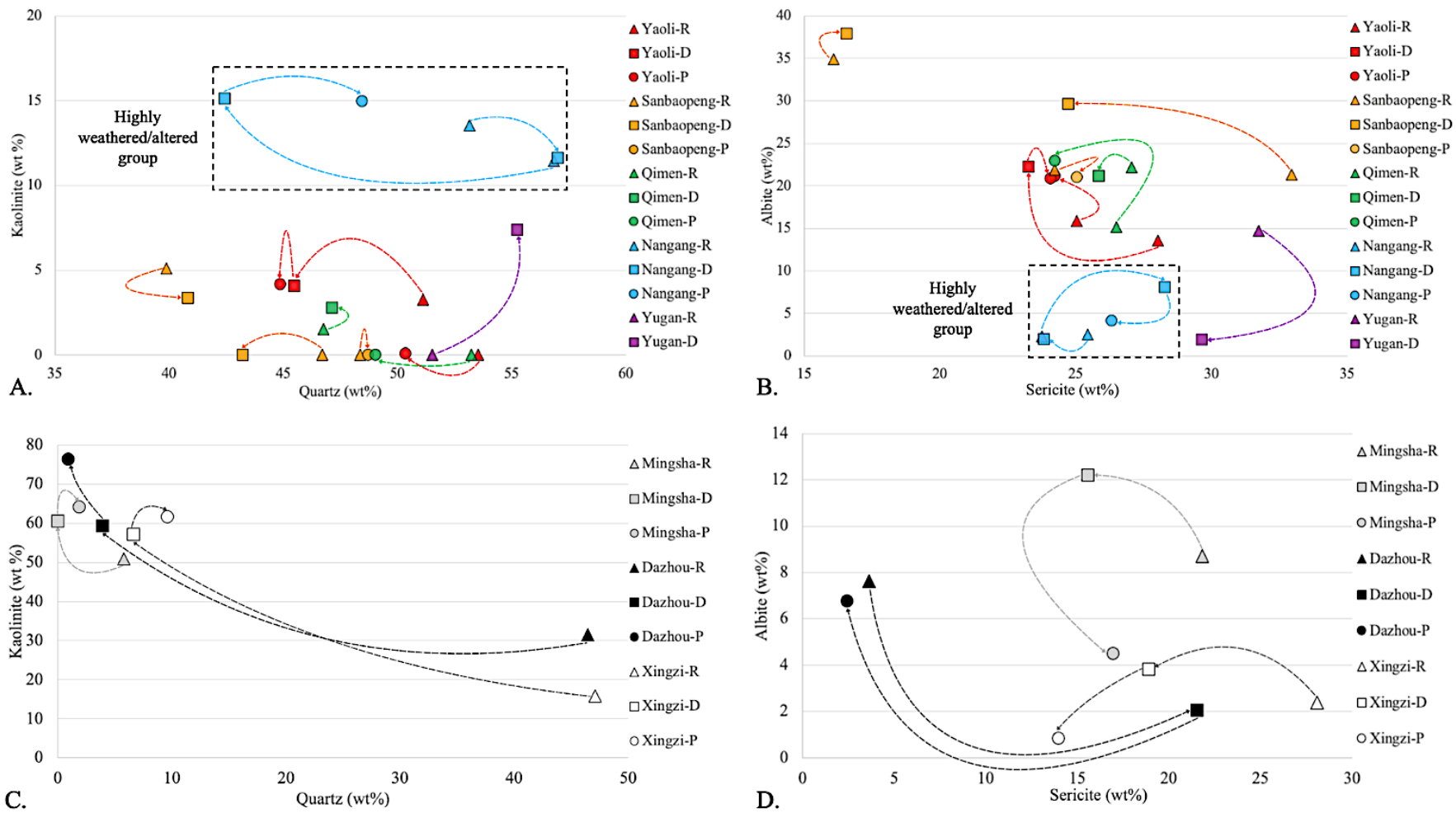


Figure 4-7: Mineralogical composition of raw material samples by processing stage shown as bivariate plots (wt%): (A) kaolinite versus quartz for porcelain stone; (B) albite versus sericite for porcelain stone; (C) kaolinite versus quartz for kaolin; (D) albite versus sericite for kaolin. Symbols indicate processing stage: triangles represent raw porcelain stone or kaolin; squares represent earth bricks; circles represent clay paste. Curved lines connect processed products from the same raw material source. Data from Table B-3 (Appendix B).

Interestingly, porcelain stone refining does not consistently increase the relative proportion of clay minerals or reduce quartz and albite content. Yugan-D shows increased quartz (3.73 wt% higher than raw material); two Sanbaopeng-P samples show albite increases of 6.55 and 5.23 wt%. These increases likely result from levigation and settling processes. As observed in modern ethnographic practices, crushed materials are levigated in the first pool, with upper slurry flowing to settling pools where settled material forms earth bricks for clay paste making (Figure 4-8A). Finer kaolinite and flaky sericite remain suspended and are lost, while quartz and albite precipitate more readily. This differential settling may increase their relative proportions despite reduced absolute content.

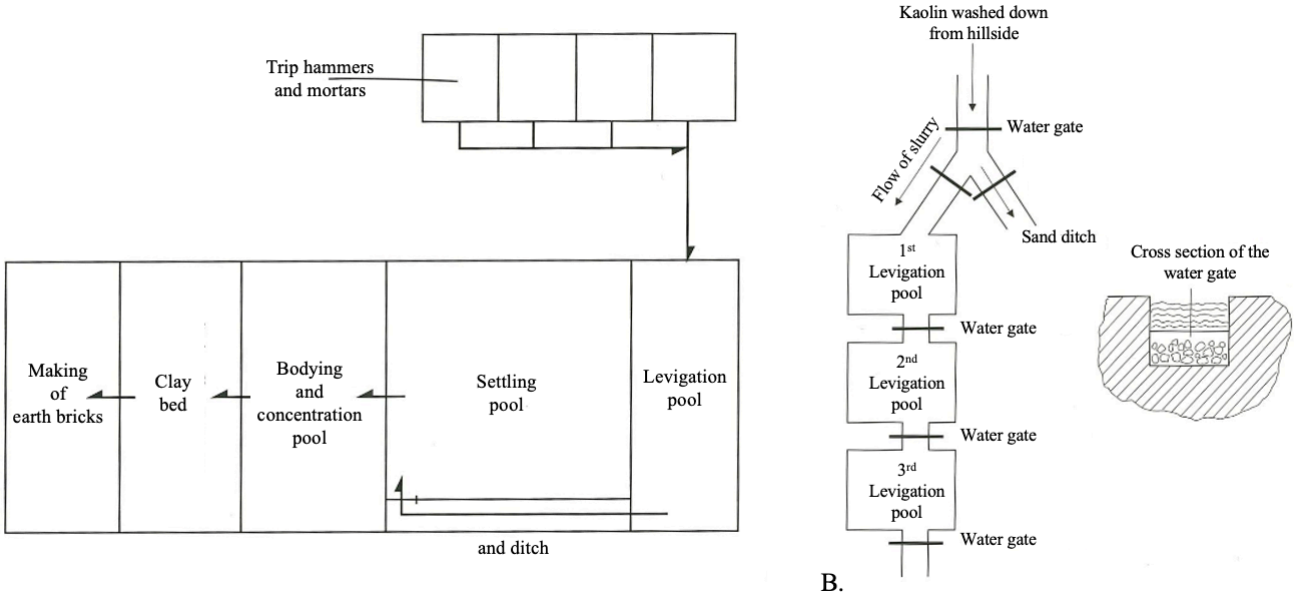


Figure 4-8: Levigation and purification processes for (A) porcelain stone; (B) kaolin, as practiced by Jingdezhen potters in the early 2000s. Redrawn after Bai (2005, pp. 43, 48).

Kaolin

Six earth brick (D) and clay paste (P) samples were analysed alongside their source raw materials (R) (Figure 4-7C, D). While porcelain stone retained inter- and intra-source variability after processing, kaolin became more homogenised, clay-rich material, with kaolinite above 57 wt% and quartz below 10 wt%.

As observed in modern practices, coarser mineral particles in kaolin are retained by water gates while upper slurry flows to levigation pools, producing this homogenised composition (Figure

4-8B). After processing, Dazhou and Xingzi kaolin show greater compositional changes than Mingsha, indicating higher impurity content in initial raw materials.

Notably, for kaolin with high quartz and sericite content—such as Dazhou kaolin—the changes in sericite-type minerals after earth brick production indicate limitations of the chemical-to-mineral conversion method employed in this thesis. As shown in Figure 4-7D, the Dazhou earth brick sample (Dazhou-D) shows substantially increased sericite proportions compared to its corresponding raw kaolin sample (Dazhou-R), due to higher potassium content in chemical analysis. However, JPCIRI's (1973) microscopic examination of both the raw kaolin and the earth brick sample produced from it suggests that during levigation, total mica decreases (from ~27 to 22 wt%), but quartz decreases more dramatically (from ~50 to 20 wt%). Since quartz contains no K element and decreases more substantially than sericite, the relative K_2O proportion increases despite reduced total mass, causing the chemical-based calculation to diverge from microscopic petrographic observation and calibration. When the Dazhou kaolin earth brick (Dazhou-D) is further refined into clay paste (Dazhou-P), the simultaneous decrease in both quartz and sericite reduces the K_2O proportion, resulting in lower quartz and sericite contents compared to the raw kaolin sample after chemical-to-mineral conversion—consistent with microscopic petrographic observations.

In summary, while the refining processes of both porcelain stone and kaolin increase kaolinite content and reduce coarse mineral particles to some extent, inherent differences between sources still result in compositional variability even after processing into earth bricks and clay pastes—more so for porcelain stone than for kaolin. Therefore, only data from refined clay pastes will be referenced when examining Ming-period Jingdezhen porcelain body compositions in subsequent sections.

4.3 Compositional analyses of 'imperial' and 'non-imperial' porcelain bodies in published studies

4.3.1 Data selection, classifications, and analytical methods

Since the 1950s, compositional analyses have been conducted on Ming-period Jingdezhen blue-and-white porcelain bodies to understand raw materials, paste recipes, and diachronic changes in body-making technologies (Zhou and Li, 1960a; 1960b; Chen *et al*., 1978; Li *et al*.,

1996; Li *et al*., 2016; Tripati *et al*., 2017; Jiang *et al*., 2018; Xiong *et al*., 2019; Wood, 2021; Wang *et al*., 2023). However, many studies have uncritically adopted existing 'imperial' and 'non-imperial' classifications based on presumed consumption contexts and subjective quality assessments, thereby reinforcing the circular reasoning identified in the current introduction. This study therefore examines the assumed compositional differences between currently classified 'imperial' and 'non-imperial' porcelain, interprets existing data in terms of potters' choices regarding raw materials and paste recipes, and investigates whether distinguished production strategies were applied to these 'imperial' versus 'non-imperial' wares.

Drawing from all accessible published data on Ming-period Jingdezhen blue-and-white porcelain bodies, this study analyses a comprehensive dataset including compositional data from thirty-one 'imperial' samples and fifty-seven 'non-imperial' samples spanning the early, middle, and late Ming periods, as well as post-1620s production. These classifications are applied provisionally here, and the degree to which they correspond to meaningful differences in production strategy is reassessed in Section 4.4.3 in light of the compositional patterns they yield.

Of the thirty-one 'imperial' porcelain samples, twenty-five pieces dating to the early and mid-Ming periods are archaeological specimens excavated from the Yuyaochang production site, currently interpreted as the products of the Imperial Workshop. This attribution rests primarily on stylistic and technological parallels with surviving pieces from the Ming imperial court collection, now housed in the Palace Museum, Beijing. The remaining six pieces, dating to the early, middle, and late Ming periods, come from public and private collection, which were also authenticated as identical to Yuyaochang products and Ming imperial court collection objects through macroscopic and microscopic analyses (Zhou and Li, 1960b; Chen *et al*., 1978).

Of the fifty-seven 'non-imperial' samples, twenty-one mid-Ming pieces are archaeological specimens from Yaoli, a kiln waste disposal site, while twenty-seven late Ming pieces come from maritime trade contexts, including the Nan'ao No. 1 Shipwreck (a Chinese merchant vessel that sank near Nan'ao Island, Guangdong Province) and riverside deposits at Old Goa on the Mandovi River, representing Jingdezhen exports to India's west coast (Tripati *et al*., 2017; Chen, 2018). The remaining nine Tianqi-period pieces from the Ashmolean Collection represent Jingdezhen exports to Japan (for discussion of Tianqi-style export porcelain, see Harrison-Hall, 2001, p. 118).

While ‘imperial’ porcelain samples are absent for the post-1620s period and ‘non-imperial’ samples are absent for the early Ming period, porcelain production for both imperial and broader consumption purposes persisted throughout the period, as recent archaeological discoveries suggest (Gao and Li, 2020; Gao and Qin, 2024). The analytical framework established here allows future complementation with newly discovered specimens.

As with raw materials, bulk chemical data of porcelain bodies were converted to major minerals present in raw materials—kaolinite, sericite, albite, and quartz. Detailed sample information, original chemical analytical data, and converted mineral compositions are presented in Tables B-5, B-6, and B-7 (Appendix B). Since quartz is relatively resistant to surface weathering and hydrothermal alteration, kaolinite, sericite, and albite compositions are the major focus of comparative studies below with the prime objective of finding out raw material selection and potential paste recipes. It should also be noted that, unlike raw material samples which could be ground and pelletised for analysis, some porcelain samples whose data are presented in published works were analysed directly on their surfaces using EDXRF in order to preserve archaeological materials and museum collections. This non-destructive method can produce artificially elevated sodium signals due to factors such as sample handling or preparation (Cole and Zhang, 2008). As such, a possible caveat to be aware of is that the albite contents may contain errors that affect the overall mineral composition conversion.

4.3.2 ‘Imperial’ porcelain

For the Yuyaochang dataset (n=25), porcelain bodies from early and mid-Ming periods exhibit distinct compositional patterns with some overlap (Figure 4-9A). Most early Ming bodies cluster toward lower kaolinite (12.86–22.1 wt%) and higher sericite (22.53–27.53 wt%), while mid-Ming samples typically display higher kaolinite (27.04–40.05 wt%) and lower sericite (12.52–19.06 wt%). Notably, three early Ming bodies exhibit elevated kaolinite (29.07–35.81 wt%) and decreased sericite (13.89–16.23 wt%), aligning more closely with the mid-Ming cluster; conversely, three mid-Ming bodies show lower kaolinite (22.05–23.15 wt%) and higher sericite (20.91–28.75 wt%), resembling the early Ming cluster.

Despite these chronological distinctions in kaolinite and sericite content, both periods exhibit similar albite ranges (Figure 4-9B). Early Ming samples contain 1.52–16.42 wt%, while mid-Ming samples contain 3.3–15.06 wt%.

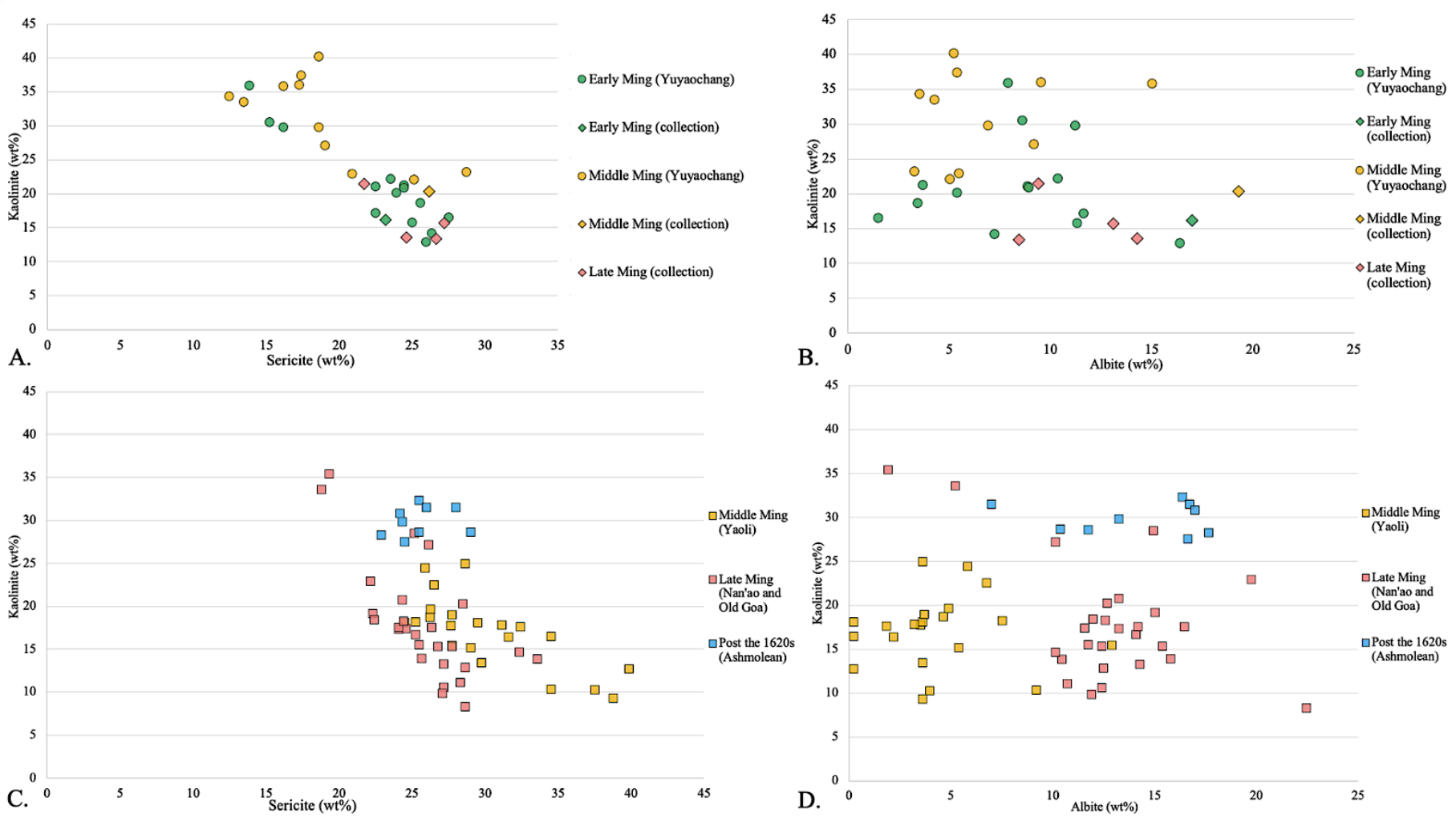


Figure 4-9: Mineralogical composition of porcelain body samples shown as bivariate plots (wt%): (A) kaolinite versus sericite for 'imperial' porcelain; (B) kaolinite versus albite for 'imperial' porcelain; (C) kaolinite versus sericite for 'non-imperial' porcelain; (D) kaolinite versus albite for 'non-imperial' porcelain. Data from Table B-7 (Appendix B).

The limited dataset from public and private collections (n=6) provides crucial supplementary information that further distinguishes the high-kaolinite, low-sericite mid-Ming Yuyaochang group from other samples (Figure 4-9A, B). The sole mid-Ming collection sample differs significantly from most contemporary Yuyaochang samples, with markedly lower kaolinite (20.3 wt%), higher sericite (26.16 wt%), and higher albite (19.29 wt%), aligning more closely with early Ming bodies. The four late Ming collection samples also resemble early rather than mid-Ming Yuyaochang samples, with kaolinite at 13.35–21.43 wt%, sericite at 21.72–27.21 wt%, and albite at 8.46–14.3 wt%.

4.3.3 'Non-imperial' porcelain

'Non-imperial' porcelain samples from mid-Ming (n=21), late Ming (n=27), and post-1620s periods (n=9), differ markedly in kaolinite and albite content (Figure 4-9D). The mid-Ming group is characterised by lower kaolinite (9.24–24.87 wt%) and albite (0–9.22 wt%). In contrast, most late Ming samples show similar kaolinite content (8.27–22.85 wt%) but higher albite (10.15–22.51 wt%). Notably, four late Ming samples (with 27.09–35.33 wt% kaolinite and 1.95–14.98 wt% albite) correspond more closely with the post-1620s group, which displays higher kaolinite (27.44–32.28 wt%) and albite (7.02–17.68 wt%). Although sericite content shows less chronological distinction, mid-Ming samples tend toward higher sericite (24.55–39.89 wt%), while late Ming samples range from 18.09–33.59 wt% and post-1620s samples range from 22.93–29.07 wt% (Figure 4-9C).

While current compositional data for 'imperial' and 'non-imperial' suggest both continuities and variations between and within different chronological periods and production contexts, the reasons behind such consistencies and changes lie in potters' strategies regarding raw material sources and paste recipes. These compositional patterns provide the foundation for examining how technological practices in blue-and-white porcelain body production developed during the Ming period, as well as whether these practices differed between 'imperial' and 'non-imperial' porcelain. The technological evidence offers critical grounds for reconsidering the current criteria used to differentiate 'imperial' and 'non-imperial' porcelain based on production quality.

4.4 Technological differences and changes in blue-and-white porcelain bodies

4.4.1 Modelling potential paste recipes through compositional data

Understanding Jingdezhen potters' choices of raw materials and paste recipes by considering porcelain body composition requires analysing these data alongside raw material properties, their variability, and how selective use of these materials could have addressed technological constraints in Jingdezhen porcelain production. First, a workable clay body recipe mixing kaolin and porcelain stone required a kaolin addition no more than 50 wt%. In one aspect, kaolin has restricted plasticity compared to other clay minerals and sericite due to kaolinite's mineral form and structure. Its particle size is generally comparatively larger than other clay particles, and significant hydrogen bonding between its layers makes the layers more difficult to slide when water is added, resulting in lower plasticity (Rice, 2015, pp. 108–111). Also, while kaolin widens the firing temperature range of porcelain bodies, it also raises the minimum firing temperature required for sufficient vitrification (Guo, 1987). Therefore, based on existing performance tests using Mingsha kaolin samples (Zhou *et al*., 1958), its addition should not exceed 50 wt%. This threshold allowed potters to work with porcelain stone exhibiting varied plasticity while ensuring vitrification temperatures remained below 1310℃—closer to the maximum 1300℃ firing temperature suggested by testing of Ming-period Jingdezhen blue-and-white porcelain samples (Li *et al.*, 1996).

Second, identical kaolinite ratios in porcelain body compositions can arise from different material selection and processing strategies, a complexity often overlooked by existing studies that model kaolin proportions primarily through kaolinite or alumina levels (e.g., Weng *et al*., 2015; Xiao *et al*., 2020). In fact, analysis in Section 4.2.2 has showed two compositional clusters with distinct material properties, though porcelain stone weathering and alteration form a continuum rather than fixed stages. Samples showing high transformation levels are characterised by high kaolinite (11.46–13.68 wt%) and low albite (0–3.72 wt%), while samples showing low transformation levels are characterised by low kaolinite (<5 wt%) and high albite (>10 wt%). The refractory nature of highly weathered/altered porcelain stone requires less kaolin addition. In contrast, less weathered/altered stone is more fusible and can benefit from moderate kaolin addition for structural strength during firing.

This section therefore uses albite content to determine which porcelain stone type was most likely used. As Section 4.2.3 demonstrates compositional changes between raw materials and

their processed products, only clay paste data are applied in paste recipe modelling. Available samples include one refractory porcelain stone, four fusible porcelain stones, and three kaolins (see Tables 4-1 and 4-2). Given this sample dataset, two compositional thresholds define the recipe categories. The upper threshold for refractory porcelain stone (alone or with kaolin) is 5.46 wt% albite, calculated from equal parts PNG5 and PDZ3 (the highest-albite samples) at maximum 50 wt% kaolin. The lower threshold for fusible porcelain stone with kaolin is 10.88 wt% albite, calculated from equal parts PYL3 and PXZ1 (the lowest-albite samples).

Table 4-1: Mineral composition of clay paste samples made from refractory and fusible porcelain stone (data from Table B-4, Appendix B)

Sample no.	Type	Sericite (wt%)	Albite (wt%)	Kaolinite (wt%)	Quartz (wt%)
PNG5	Refractory	26.32	4.15	14.96	48.45
PYL1	Fusible	24.22	21.15	0.1	50.33
PYL3	Fusible	24.06	20.9	4.18	44.87
PSBP1	Fusible	25.03	21	0	48.7
PQM1	Fusible	24.22	22.93	0	49.02

Table 4-2: Mineral composition of clay paste samples made from kaolin (data from Table B-4, Appendix B)

Sample no.	Sericite (wt%)	Albite (wt%)	Kaolinite (wt%)	Quartz (wt%)
PMS3	16.96	4.49	64.24	1.9
PDZ3	2.42	6.77	76.42	0.94
PXZ1	13/97	0.85	61.63	9.6

Based on these thresholds, sixty-six of eighty-eight samples can be attributed to either refractory or fusible porcelain stone. The remaining twenty-two samples display intermediate albite content, indicating use of porcelain stone with transformation levels between these two types within the current dataset, with or without kaolin additions. Although Section 4.2.2 also identifies two unusual porcelain stone samples characterised by high kaolinite (16.65 and 27.03 wt%), high albite (39.52 and 12.44 wt%), and low sericite (2.18 and 1.78 wt%), no porcelain bodies exhibit these characteristics, indicating potters avoided using extensively transformed and albitised porcelain stone.

For the sixty-six samples with identified porcelain stone type, possible body recipes are then calculated from kaolinite content. For refractory porcelain stone, the calculation uses PNG5 kaolinite content (14.96 wt%); for fusible porcelain stone, it uses the average of PYL1, PYL3, PSBP1, and PQM1 (1.15 wt%). Kaolin kaolinite content in both cases uses the average of PMS3, PDZ3, and PXZ1 (67.43 wt%). Full calculation results are presented in Tables B-8 and B-9 (Appendix B). It should be noted that the calculations assume consistent kaolinite values for each material type, though their actual compositions display inter- and intra-source variability. This idealisation makes systematic calculation feasible while acknowledging raw material heterogeneity. Results are used to estimate possible kaolin addition ranges for bodies made from materials with similar firing performance observable to Ming-period potters, rather than precise proportions for individual samples.

4.4.2 Strategies for raw material selection and paste recipes among Ming-period Jingdezhen potters

As shown in Figure 4-10, Jingdezhen potters used both refractory porcelain stone (L1) and fusible porcelain stone (L2), with or without kaolin additions, throughout the early, middle, and late Ming periods. Current data also suggests that the use of fusible porcelain stone became more common in the late Ming period. From the 1620s to the end of Ming period, only fusible porcelain stone was used. Notably, for the middle and late Ming periods where both ‘imperial’ and ‘non-imperial’ porcelain body data are available, both porcelain stone types were used, indicating that such binary classifications do not reflect distinct material selection practices.

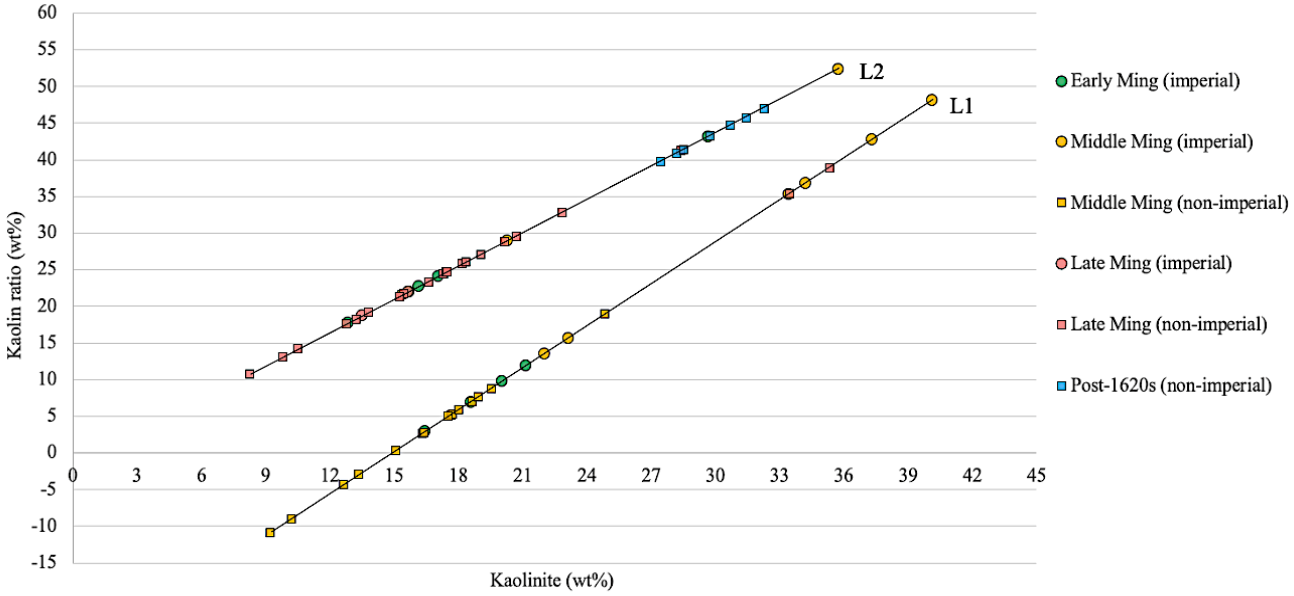


Figure 4-10: Kaolin addition ratios in paste recipes for porcelain body samples, estimated from kaolinite content (wt%). Lines represent recipes using refractory porcelain stone (L1) and fusible porcelain stone (L2). Data from Tables B-8 and B-9 (Appendix B).

Outliers in the calculated recipe results indicate that raw material variability exceeded the range represented by the clay paste samples used in recipe calculations. Four samples containing 9.24–13.38 wt% kaolinite with negative calculated kaolin ratios suggest the use of refractory porcelain stone alone, though its clay was possibly processed from less transformed raw material than that which yielded the PNG5 sample used in calculations. One sample shows a calculated kaolin ratio of 52.22 wt%, exceeding the 50 wt% kaolin workability threshold for porcelain bodies, which suggests the use of a relatively more transformed porcelain stone among the fusible type.

Interestingly, among samples made from both refractory and fusible porcelain stone, the calculated recipes show two distinct groups with kaolin ratios between 0–30 wt% and above 35 wt%. This gap indicates two distinct production strategies in raw material selection and paste making, namely reactive and aesthetic recipes.

Reactive recipes

The first strategy stabilised the performance of porcelain bodies made from different porcelain stone types through adjusted kaolin addition ratios in production processes. Applied to porcelain bodies with kaolin ratios of 0–32.74 wt% (predominantly below 30 wt%, with one exception), this strategy resulted in an inverse correlation between porcelain stone weathering degree and kaolin additions. As Figure 4-10 shows, among samples with identical kaolinite content, those using refractory porcelain stone (L1) required moderate or no kaolin additions (0–18.89 wt%), compared to those using fusible porcelain stone (L2) (10.74–32.74 wt%).

This adjustment is technologically rational. Greater albite content in fusible porcelain stone requires proportionally more quartz and kaolinite to react and form mullite crystals, thereby enhancing body strength and translucency (Guo, 1987; Tite *et al*., 2012). The kaolin additions also provide higher kaolinite content to enhance refractoriness, thereby balancing the porcelain body's firing performance (Zhou and Li, 1960b; Guo, 1987; Tite *et al.*, 2012). With refractory porcelain stone, kaolin widens firing temperature range but raises minimum firing temperature and reduces workability in shaping, thus only moderate additions are needed (Zhou *et al*., 1958; Guo, 1987; Rice, 2015, 108–111).

Calculated potential recipes align with previous research, which suggests that kaolin was introduced in response to the depletion of refractory porcelain stone—the sole raw material for Jingdezhen porcelain bodies before the Southern Song period (1127–1279) (Liu and Bai, 1982; Wood, 1983; Tite *et al*., 1984; Weng *et al*., 2015; Xiao *et al*., 2020; Wood, 2021). As Wood (2021) summarises, the combination of fusible porcelain stone and kaolin has been predominantly interpreted as a 'reactive choice' in order to address technological concerns to sustain production. Building on this interpretation, this study exemplifies that these reactive recipes were not merely a technological fix for using fusible porcelain stone, but potters' strategic management of unstable raw material supply, including shortages of specific porcelain stone types.

As reflected in previously discussed historical accounts, local geology, and compositional analysis of raw material samples, Jingdezhen had access to diverse porcelain stone sources, yet each mining site's volume was limited, and inter-and intra- source variability was present.

While Ming-period potters could readily determine raw material performance through test firing, they likely adjusted kaolin ratios to accommodate changes in raw materials between batches from the same source or when switching sources. Alternatively, potters could directly acquire processed clay pastes from raw material suppliers, the specialised sellers who quarried, processed, and traded prepared body materials (Section 2.4.1). Archaeological findings indicate that these suppliers provided test samples both to advertise their products and to allow potters to evaluate the performance of specific clay pastes during manufacture (JPICRA *et al.*, 2007, p. 436). These suppliers may have offered separate clays made from porcelain stone and kaolin for potters to mix themselves, or ready-mixed pastes with predetermined kaolin additions.

Regardless of procurement method, potters maintained consistent performance goals: workable clay bodies in shaping and dense, translucent porcelain bodies after firing. Achieved through varying porcelain stone and kaolin recipes, these fundamental requirements applied universally across porcelain production, irrespective of current 'imperial' or 'non-imperial' classifications.

Aesthetic recipes

Beyond recipes with 0–30 wt% kaolin additions, calculated results suggest that certain porcelain bodies contained substantially higher kaolin proportions, ranging from 35.22 to 50 wt%. Six samples used refractory porcelain stone with 35.22–48.01 wt% kaolin, including four middle-Ming 'imperial' porcelain from Yuyaochang and two late-Ming 'non-imperial' porcelain from the Nao'ao No.1 Shipwreck. Ten samples used fusible porcelain stone with 43.07–50 wt% kaolin, including two 'imperial' porcelain from Yuyaochang (early and mid-Ming) and eight 'non-imperial' porcelain made for overseas trade (late Ming and post-1620s).

Unlike reactive recipes, high kaolin additions to refractory porcelain stone were unlikely driven solely by technological concerns. Performance tests show that increased kaolin additions can raise the water demand of the clay body during shaping, thereby reducing workability, prolonging drying time, and increasing cracking risk (Yi, 1964; JPCIRI, 1973). Kaolin additions at 40 wt% also raise the minimum firing temperature to above 1270°C (Zhou *et al.*, 1958; Guo, 1987). This level is approximately 40°C higher than the average firing temperature of tested Yuyaochang samples (Li *et al.*, 1996), thus requiring greater fuel input and more

advanced kiln temperature control techniques. While fusible porcelain stone-kaolin combinations contain slightly less kaolinite than refractory ones, their kaolinite content (27.44–35.76 wt%) still exceeds functional requirements, as most reactive recipes using the same materials needed only 8.27–20.07 wt% for successful production.

However, higher kaolin additions can create whiter porcelain bodies, enhancing cobalt decoration through visual contrast. In practice, achieving whiteness required careful raw material selection to minimize iron and titanium oxides. As pointed out by Wood (2021), only 0.9 wt% of iron oxide would produce bluish tint through clear glaze. Although found in very small amounts (typically below 0.2 wt% in Jingdezhen porcelain), titanium oxides can react with iron oxide to form dark brown spinel, reducing whiteness and vitrification (Wang *et al.*, 2023). This aesthetic pursuit could result from production decision or consumer demand. Consumer preference for whiteness may have driven potters to seek out pure raw materials with high kaolinite content, while the scarcity of such materials likely made whiter porcelain more labour-intensive and costly to produce, limiting it to certain consumer groups.

This aesthetic priority is evident in six 'imperial' samples from Yuyaochang (one early-Ming and five middle-Ming), containing only 0.38–0.5 wt% Fe_2O_3 and 0.03–0.06 wt% TiO_2 (Figure 4-11A, C) Achieving such purity required careful selection and testing processes, given the colouring oxides present in raw materials accessible to Jingdezhen potters. According to the raw material dataset analysed in this study, most porcelain stone samples—whether raw rocks (R), earth bricks (D), or clay pastes (P) cluster between 0.5–1 wt% Fe_2O_3 (Figure 4-11B), while kaolin samples range from 0.44–1.7 wt% (Figure 4-11D). Although most raw materials reportedly contain only 0–0.05 wt% TiO_2 (Figure 4-11B, D), these very low values may reflect concentrations below detection limits of bulk analysis methods such as energy-dispersive x-ray fluorescence (EDXRF).

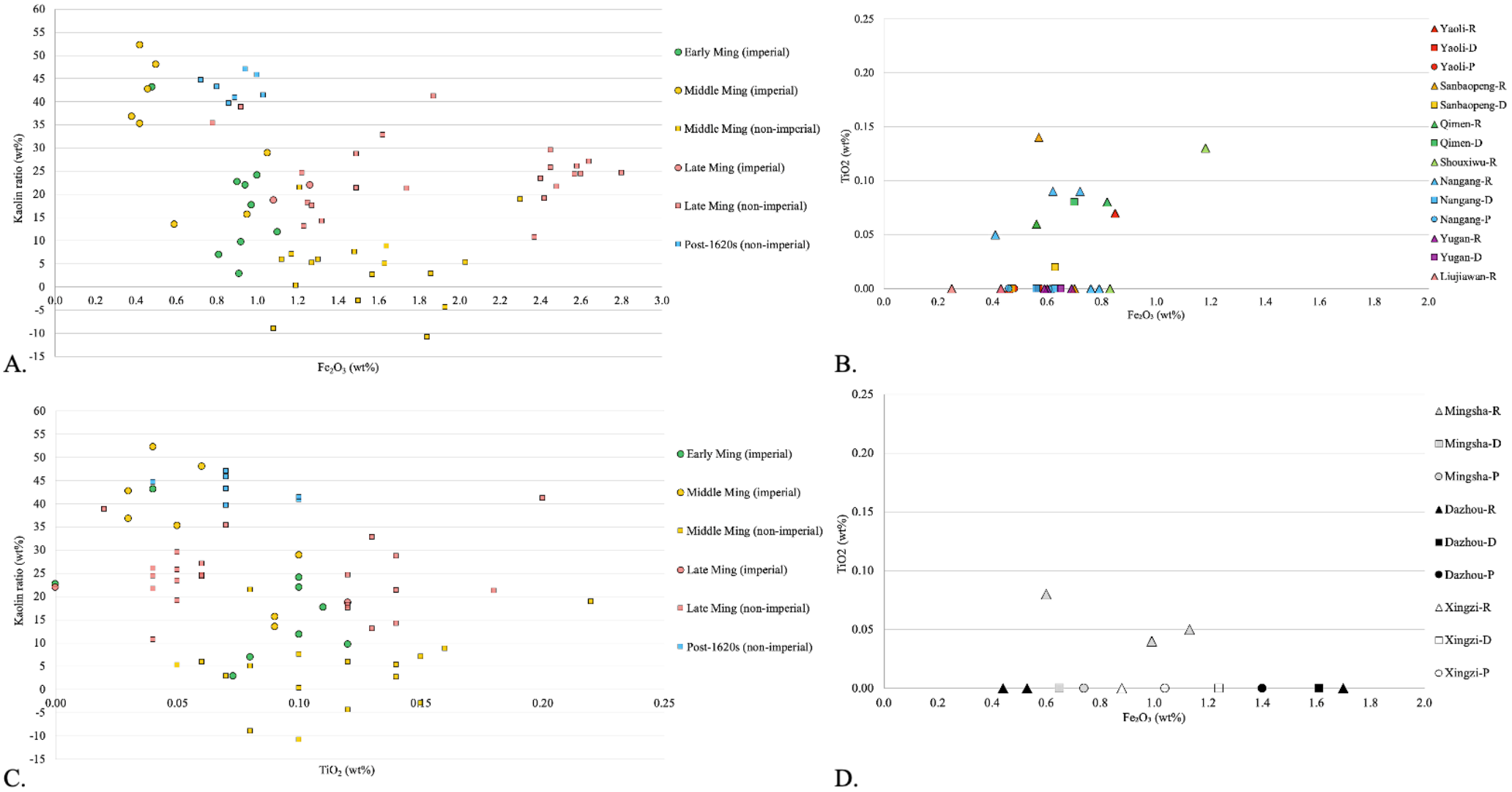


Figure 4-11: Colouring oxide content shown as bivariate plots (wt%). Porcelain body samples: (A) kaolin addition ratio versus Fe_2O_3; (C) kaolin addition ratio versus TiO_2. Raw material samples: (B) TiO_2 versus Fe_2O_3 for porcelain stone; (D) TiO_2 versus Fe_2O_3 for kaolin. Data from Tables B-3, B-6, B-8, and B-9 (Appendix B).

Nevertheless, these white bodies do not indicate exclusive access to purer raw materials in imperial production. Contemporaneous 'imperial' samples made with reactive recipes contain higher colouring oxides (0.81–1 wt% Fe_2O_3 and 0.07–0.12 wt% TiO_2), corroborating that aesthetic recipes required deliberate material choices beyond inherent raw material compositional variations (Figure 4-11A, C). Although 'imperial' samples exhibit narrower and lower iron and titanium ranges than 'non-imperial' ones, overlaps occur at the lower end of both distributions.

Two late-Ming 'non-imperial' shipwreck samples further suggest that potters producing for commercial markets accessed relatively pure materials and served consumers desiring whiter bodies (Figure 4-11A, C). Made with refractory porcelain stone and 33.51–35.33 wt% kaolin, these samples contain significantly lower Fe_2O_3 (0.78, 0.92 wt%) and TiO_2 (0.07, 0.02 wt%) than most contemporary trade porcelain.

For post-1620s samples made from fusible porcelain stone with 39.67–46.97 wt% kaolin, whether their bodies represent aesthetic recipes remains contested. Wood (2021) argues this high-kaolin recipe was created to suit specific high-temperature zones near the firebox, accompanying the development of large egg-shaped kilns. This hypothesis is plausible given that high-kaolin additions continued into the High Qing period (1683–1799) and were applied to monochrome porcelain where body whiteness was less critical (Guo, 1987; Xiao *et al.*, 2020; Wood, 2021). However, the examination of firing kilns in Section 3.3.3 has demonstrated that potters had been contending with uneven heat distribution in kiln chambers since the early Ming period, yet their solutions involved adjusting kiln designs rather than substantially increasing kaolin additions. The limited post-1620s dataset confirms the high-kaolin recipe, leaving uncertain whether potters employed varying recipes across different kiln zones with higher and lower firing temperatures. The relatively lower colouring oxide content (0.72–1.03 wt% Fe_2O_3 and 0.04–0.1 wt% TiO_2) suggests either deliberate selection or access to newly discovered purer material sources (Figure 4-11A, C).

4.4.3 Reconsideration of classification criteria in production quality for Ming-period Jingdezhen porcelain

Based on the data analysed in Section 4.4.2, it is evident that both 'imperial' and 'non-imperial' porcelain pieces—classified according to presumed consumption contexts and subjective quality assessments—utilised refractory and fusible porcelain stone with or without kaolin additions. During the mid-Ming period, the majority of both 'imperial' and 'non-imperial' samples indicate the use of refractory porcelain stone, while during the late Ming period, samples from both categories show a raw material shift toward fusible porcelain stone.

Most samples analysed were made from reactive recipes, characterised by kaolin additions typically below 30 wt% to stabilise clay paste performance. These recipes enabled potters to achieve consistent, workable clay paste for shaping dense, translucent porcelain bodies after firing, compensating for compositional variability in accessible porcelain stone sources. As discussed in the previous section, such recipes were likely developed by potters or raw material suppliers in response to the varied composition of locally accessible porcelain stone. More importantly, the present compositional data suggests that reactive recipes were employed for manufacturing both 'imperial' and 'non-imperial' porcelain from no later than the mid-Ming period, irrespective of current classifications.

Beyond reactive recipes, several mid-Ming 'imperial' samples from Yuyaochang suggest the use of aesthetic recipes with more than 35 wt% kaolin, pursuing whiter bodies. Such recipes required potters' deliberate selection of kaolinite-rich raw materials with lower colouring oxide content and substantial effort to manage the reduced workability and elevated firing temperatures that resulted. Across all mid-Ming samples, those produced through aesthetic recipes exhibit the lowest colouring oxides, with generally lower Fe_2O_3 (<1 wt%) and TiO_2 (<0.1 wt%) levels, indicating deliberate raw material sourcing. In contrast, the contemporary 'non-imperial' samples from Yaoli, which contain higher colouring oxides, likely utilised raw materials within convenient distance. While Yaoli is currently identified as a kiln waste disposal site due to the absence of production features (see Section 3.1), the surrounding area does offer viable raw material sources for porcelain production. Rich deposits of monzogranite and alkali feldspar granite form the parent rocks of potassium-rich porcelain stone, accounting for the high sericite content in Yaoli samples (Jiangxi Provincial Atlas Editorial Committee, 2008,

p. 24). The nearby kaolin source, Mingsha kaolin, also displays higher iron content consistent with Yaoli samples, owing to incomplete alteration of biotite in its granitic parent rocks (Wang, 2018). These samples' yellowish, less vitrified bodies, conventionally read as low quality (Wang *et al.*, 2023), are thus better explained by the materials locally to hand and the cost constraints of commercial production than by any technological limitation.

The mid-Ming contrast is the clearest compositional distinction between the two categories in the dataset, and it should be read with care. The 'imperial' and 'non-imperial' samples compared here come from Yuyaochang and Yaoli respectively, so the difference may reflect site-level manufacturing strategies rather than a categorical distinction between 'imperial' and 'non-imperial' products or production. What the data suggests is that imperial commissions were likely a principal driver of investment in purer, lower-impurity materials at this period, not that such materials were reserved only for imperial production. The same aesthetic recipe reappears outside the imperial category in the late Ming. As Section 4.4.2 has shown, two late-Ming 'non-imperial' shipwreck samples indicate that potters producing for commercial markets also obtained relatively pure materials to serve consumers who sought whiter bodies. The aesthetic recipe was therefore not confined to imperial production but was taken up more widely across the Ming, so its mid-Ming concentration at Yuyaochang reflects the conditions of that period rather than a permanent divide.

Taken together, the commonly accepted criteria for high-quality porcelain bodies—dense, vitrified, white, and free from impurities—neither apply exclusively to currently classified 'imperial' porcelain, nor to all pieces within this category. Achieving such characteristics required Ming-period Jingdezhen potters and raw material suppliers to manage compositional variability in porcelain stone while carefully selecting kaolinite-rich, low-impurity raw materials, processes that demanded substantial investment in raw material costs and experimentation. Such investment could be covered by imperial production using state revenue, and increasingly over the course of the Ming, by other wealthy consumers through commercial trade. Future research should therefore explore how quality variation within imperial porcelain might relate to different consumption purposes, and identify diverse niches within trade porcelain whose varying technological, economic, and aesthetic requirements reflect complex producer–user relations.

What the compositional data and modelled recipes do indicate, however, is the active role of potters in navigating raw material variability, selecting appropriate sources, and developing paste recipes tailored to technical and other social demands. These were not passive responses to institutional directives from the overseer of imperial production, but strategies exercised through a decision-making process that the textual accounts examined in Chapter 2 could record only as outcomes. While the compositional analysis pursued in this chapter shows how complex the factors involved in these decisions could be, the next chapter proposes a methodological framework to recover the reasoning behind them and how choices at one production stage reshaped the possibilities of the next. Through a case study of dragon bowl production, it demonstrates that ethnographic observation, grounded in the constancy of the materials' fundamental properties between past and present, provides the interpretive basis for reading textual accounts, porcelain body compositions, and production marks as evidence of those decisions.

Chapter 5 Tracing Jingdezhen Potters' Knowledge and Skills: Dragon Bowl Production as a Case Study

While Chapter 4 has demonstrated that Ming-period Jingdezhen potters actively navigated raw material variability and developed paste recipes tailored to different production demands, it also shows how complex the decision-making processes behind these choices can be, and how they sometimes extended beyond purely technical concerns. However, the reasoning through which potters arrived at these choices, as well as the interconnectedness between decisions made at different production stages, cannot be recovered from compositional data or textual accounts alone. As outlined in Section 1.4.4, ethnographic observation of present-day Jingdezhen potters offers a means of recovering this reasoning, not because modern and Ming-period production are equivalent, but because the material constraints governing porcelain production are set by geology and physics rather than by the period in which production occurred. It is this constancy that allows ethnographic evidence to capture the decision parameters within which Ming-period potters operated, and to recover the logic behind choices that textual accounts and compositional evidence document only as outcomes.

Dragon bowls serve as the case study for this chapter because they represent the most demanding test of potters' adaptive strategies, not only confined to paste recipes as identified in Chapter 4, but extending across subsequent production stages of forming and firing. The chapter develops a methodological framework anchored in ethnographic observation that documents the constraints potters navigate and the reasoning behind their choices at each stage. Methods of textual account reading, compositional analysis, and production-mark analysis provide the historical, compositional, and technological data against which that reasoning can be tested. Together, they trace the full chain of reasoning behind interconnected decisions across a full production cycle. It is these decision-making processes that constitute Jingdezhen potter's embodied knowledge—developed through sustained engagement with their materials and exercised at the point of making, as this chapter will demonstrate.

5.1 Introduction: what are dragon bowls and why do they matter?

Dragon bowls (*longgang* 龍缸) are defined by scale rather than by decorative motifs alone. According to the *Taoshu* 陶書 (Book of Ceramics), the term 'dragon bowl' refers to vessel types with maximum body diameters ranging from 48 to 96 centimetres and heights from 50

to 89.6 centimetres (Wang and Lu, 1597, p. 855).[26] Surviving examples in museum collections, however, represent only the smaller end of this range. In the current academic literature and museum exhibitions, the term 'dragon bowl' now generally refers to round porcelain vessels with rim diameters larger than 40 centimetres and heights exceeding 20 centimetres, distinguishing them from smaller vessel forms such as vases and jars (Cao, 2008; Li, 2015; Pei, 2019). As noted in the *Taoshan* 陶埏 (The Making of Ceramics), imperial commissions for large bowls decorated with dragons and phoenixes were typically made with pottery clay distinct from that used for Jingdezhen porcelain (Song, 1637, p. 137). The *Taoshu* records that it was not until the sixteenth century that porcelain-made dragon bowls were manufactured at the Imperial Porcelain Workshop to fulfil commissions by Emperors Shizong 世宗 (1507–1567; Jiajing reign, r. 1522–1566) and Shenzong 神宗 (1563–1620; Wanli reign, r. 1573–1620) (Wang and Lu, 1597, pp. 878–897). The *Taoshu*'s account is corroborated by the *Ming Shenzong shilu* 明神宗實錄 (Veritable Records of Emperor Shenzong), which documents that the emperor ceased dragon bowl production owing to the technical difficulties involved and the high rate of failure (*Ming Shenzong shilu*, volume 596, p. 3692).

The abundance of dragon bowl sherds discovered at the Yuyaochang suggests that production involved a high rate of unsuccessful firings (SAM-PKU, 2007, p. 11; BPM *et al*., 2019, pp. 34–35; (JPICRA *et al.*, 2024b, p. 50). Many scholars have therefore argued that dragon bowl production was the Imperial Porcelain Workshop's most challenging task, and its success symbolised the technological prowess achieved through imperial patronage (e.g., Zhang, 1997; Li, 2015; Lu, 2016). Such claims, however, deserve scrutiny. Findings in Chapters 3 and 4 have shown that shared production practices were observable across manufacturing sites regardless of their imperial or non-imperial classification, and that potters' access to raw material sources and adaptive strategies in response to production demands were not confined to imperial production. This chapter therefore poses two critical questions. What constituted the primary technological challenges in Ming-period dragon bowl manufacture? Were the knowledge, skills, and material resources required to address these challenges available exclusively within the Imperial Porcelain Workshop?

[26] The original measurements are given in *chi* 尺 and *cun* 寸. The conversions here follow Qiu *et al*. (2001, p. 407), where one *chi* equals approximately 32 centimetres and one *cun* approximately 3.2 centimetres.

To address these questions, Section 5.2 first examines the ethnography of modern dragon bowl production, then reads the *Taoshu*'s account of Ming-period manufacturing against the constraints identified ethnographically, and finally outlines the material traces through which potters' decisions can be recovered from surviving objects. Section 5.3 brings these lines of evidence together, using compositional analysis to examine raw material choices in archaeological dragon bowl sherds and production-mark analysis to identify forming techniques on eighteen dragon bowls in museum collections.

To support these analyses, information was collected on thirty-five objects identified as complete pieces of Ming-period Jingdezhen dragon bowls in museum collections (Table C-1, Appendix C), a subset of which is drawn upon for production mark analysis in Section 5.3.2. The findings are considered alongside the compositional analysis of archaeological sherds presented in Section 5.3.1. Together, these analyses will demonstrate that the material knowledge and technical expertise accounting for successful dragon bowl production were rooted in local ceramic traditions and production communities, rather than confined to imperial patronage. The potters, materials, and adaptive strategies crossed the boundary of the Imperial Porcelain Workshop, calling for a reconsideration of the technological supremacy attributed to the institution.

5.2 Identifying the technological challenges of dragon bowl production at Jingdezhen

5.2.1 Production processes and technological challenges reflected in modern ethnography

Modern dragon bowl coiling and throwing processes at Jingdezhen have been documented through multiple sources, including potters' oral accounts collected during interviews, systematic ethnographic fieldwork, and audio-visual records (Chen, 2004; Bai, 2005; Zheng, 2022). However, one alternative shaping method, moulding, has received significantly less attention and lacks detailed study regarding the technological factors underlying its use in dragon bowl making and the production marks it may leave.

To address this gap, fieldwork was conducted in 2023 and 2024 at the workshops of two informants (Informants A and B). The two informants were selected on the basis of their expertise in replicating blue-and-white porcelains of the Yuan, Ming, and Qing periods, production that has on occasion involved dragon bowls. The informants' relevance to this study lies not in any assumed continuity with Ming-period workshop organisation, but in the fact that

they work with the same locally sourced porcelain stone and kaolin, whose physical properties impose the same constraints on production as they did in the past. Of the two, Informant's workshop was further selected for observing the forming process because it continues to employ moulding methods central to Ming-period dragon bowl production. Selection was also shaped by the informants' willingness to permit observation and discuss their working practices. Access to specific production stages varied. For example, paste-making processes could not be observed directly in all cases, and the level of detail informants were willing to share regarding paste recipes differed. These constraints are noted where relevant. Drawing on observation and interviews with both informants, this section examines three critical stages where primary technological challenges lie: clay preparation, vessel forming, and kiln firing. The material traces from these production processes are further investigated in Section 5.3.

The two workshops

Informant A's family migrated from Yugan County to Jingdezhen during the Qing period. Informant A completed an apprenticeship at a traditional handmade porcelain workshop at the age of nineteen and subsequently worked at a state-owned porcelain factory, where he supervised clay preparation. After the factory closed in the 1990s, he worked as a freelance porcelain painter before founding his own workshop in 2005. The workshop specialises in replicating blue-and-white porcelains of the Yuan, Ming, and Qing periods. Production is organised into sub-workshops for forming, trimming, decorating, glazing, and firing, each occupying separate rooms within a two-storey building. Informant A oversees all stages of production together with his brother, who manages glazing and firing. The workshop employs both experienced potters and young apprentices, the latter learning through observation and guided practice.

Informant B grew up in Jingdezhen in a traditional porcelain workshop founded by his father in 1981. After working in Shanghai following college, he returned to Jingdezhen after the age of 30 and has assisted his father in operating the workshop since 2012. Like Informant A's workshop, the enterprise specialises in replicating blue-and-white porcelains of the Yuan, Ming, and Qing periods. Sub-workshops for forming, trimming, decorating, glazing, and firing occupy the ground floor of a two-storey building, with a separate bungalow housing clay preparation. Informant B and his father jointly oversee all production stages.

Both informants supervised dragon bowl production on commission. Informant A oversaw bowls of approximately 55cm rim diameter and 25cm height, replicating Ming-period forms, while Informant B's workshop produced larger examples of approximately 75cm rim diameter and 75cm height. Since dragon bowls are not regular products of either workshop, observation sessions focused on large jar moulding at Informant A's workshop, which was selected because it continues to employ moulding methods. These vessels, at approximately 33cm diameter and 30cm height, are comparable in scale to Ming-period dragon bowls. The sessions were conducted across both fieldwork periods, during which Potter I and Potter II were observed. As clay preparation could not be recorded directly at either workshop due to informants' unwillingness to share their recipes, information on raw material acquisition and processing derives from interviews and is noted accordingly in Section 5.2.1. Table 5-1 below summarises the production sequence from interview data with both informants, which structures the analysis of technological challenges at different production stages and how they may be connected.

Table 5-1: Dragon bowl production processes described by Informants A and B

	Informant A	Informant B
Source	Interviews, 6–8 May 2023, 22 May 2024	Interview, 6 May 2023
Clay Preparation		
Major raw materials	Raw porcelain stone and kaolin	
Acquisition	Purchased from mining companies or individual retailers (details unknown)	
Processing	Commissions a clay mill factory to process selected raw materials. Refined and homogenised clay pastes are delivered to the workshop. Exact recipe unclear	All raw materials processed on-site: porcelain stone is crushed, levigated, settled, and dried; kaolin clay is levigated, settled, and dried. Processed clays are then mixed and homogenised
Forming		
Shaping method	Moulding	Coiling
Trimming	Trimmed by the potters who mould the bodies. Dragon bowls and large jars do not enter the trimming sub-workshop	Trimmed by the potters who coil the bodies. Dragon bowls do not enter the trimming sub-workshop
Drying	Indoors initially; moved outdoors in sunny weather or near the kiln to accelerate drying	Indoors
Decorating and Glazing		
Decorating method	Underglaze painting using cobalt blue pigment	

Glaze type	Alkali–lime glaze (transparent after firing)	
Glazing method	Spray glaze to the exterior; brush glaze to the interior	
Firing		
Firing method	Gas kiln (highest temperature at 1320℃)	Wood-fired kiln or gas kiln

Clay preparation

Clay preparation for dragon bowl production involves two stages: sourcing raw materials for dragon bowl bodies and preparing body pastes. Due to their large size and thick walls, raw materials used for dragon bowl bodies differ from those of smaller vessels to enhance structural strength during subsequent production stages of forming, drying, and firing.

Although neither previous ethnographic research nor my informants identify specific raw material sources for dragon bowl pastes, contemporary production at Jingdezhen typically involves preparing clay paste by mixing processed porcelain stone and kaolin clay (Chen, 2004, p.1; Bai, 2005, pp. 28–48; Zheng, 2022, p. 156). As Zheng (2022, p. 156) observes, contemporary potters typically increase the kaolin clay proportion in porcelain bodies of large vessels, an adjustment that enhances resistance to cracking and increases refractoriness during firing. Compared with porcelain stone, kaolin clay's higher alumina content contributes to mullite network formation during firing, which stiffens porcelain bodies and prevents slumping under the substantial weight of dragon bowls (Tite, Freestone and Wood, 2012).

Both initially processed porcelain stone and kaolin clay undergo further refinement before being mixed into body pastes. This process is particularly labour-intensive, as Chen (2004, p. 70) notes that large porcelain pieces such as dragon bowls require ten to dozens of times more refined and kneaded clay than smaller vessels. During paste preparation, potters deliberately add coarse particles—such as residual sand left from the refining process—to dragon bowl pastes to reduce shrinkage and stabilise the ceramic bodies during forming, drying, and firing (Bai, 2005, p. 69; Zheng, 2022, p. 156). Notably, both Informants A and B emphasise the difficulty of achieving a suitable balance among different raw materials in dragon bowl bodies, as excessive kaolin clay or coarse particles would significantly reduce the body's workability during shaping. The balancing act the informants describe is the same trade-off that the *Taoshu* documents when it records the addition of crushed stone and unfired ceramic sherds to dragon bowl pastes, as will be shown later (Sections 5.2.2). Observing how the informants reason

through this trade-off recovers the decision-making process that the *Taoshu* records only as an outcome.

Forming

To shape dragon bowl bodies, modern Jingdezhen potters employ coiling, throwing, or moulding methods. Potters' choices of specific forming method depend on multiple factors, including the desired body size, individual skill sets, available equipment, and production timeline requirements.

The coiling process is the most time-consuming, as it requires a repetitive cycle of building and drying (Figure 5-1A). As Zheng (2022, p. 156) documents, the coiling process begins by placing kneaded and homogeneous clay paste on a wooden board and beating it into a circular base. Clay is then rolled into long coils and built up circle by circle from bottom to top according to the desired shape (Zheng, 2022, p. 157). While building, potters use their hands to smooth the seams, ensuring the clay coils adhere firmly to each other (Zheng, 2022, p. 157). After building to a certain height, natural drying is required until sufficient strength develops to support the weight of additional clay before continuing to roll coils and build upward until the form is complete (Zheng, 2022, p. 157). As section 5.2.2 will show, the *Taoshu* records that Ming-period potters added clay to dragon bowl bodies daily for eighteen days, with progress contingent on sufficient drying strength—the same build-and-wait cycle, governed by the same physical requirement that wet clay cannot support its own weight beyond a certain height.



Figure 5-1: Forming methods of dragon bowls. (A, C) Coiling and throwing, filmed in Jingdezhen. Source: *Jiangxin yetao* 匠心冶陶 (Crafting Pottery with Artisan's Dedication), Episode 7 (2018), accessed via YouTube, https://www.youtube.com/watch?v=urxOcvw8yoI&t=531s. (B) Moulding (photograph taken by the author at Informant A's workshop, May 2023).

Besides coiling, dragon bowl bodies can also be thrown on electric potter's wheels in modern-day practices (Chen, 2004, p. 70; Zheng, 2022, p. 158). The wheel throwing method (Figure 5-1C), however, is unlikely to have been used for Ming-period dragon bowl production. Evidence for the use of pottery wheels examined in Chapter 3 suggests a single-wheel installation powered by potters' hands or bamboo sticks, with a maximum wheel head diameter of 1.1 metres. Based on modelling calculations correlating wheel head diameters with the rim diameters of vessels thrown on these wheels, the maximum rim diameter achievable on a manually powered potter's wheel with a 1-metre wheel head is approximately 25 centimetres (Wu *et al*., 2023, p. 33), smaller than surviving dragon bowl examples.

In addition to the coiling and throwing methods documented in previous ethnographic research, Informant A describes the moulding process in dragon bowl production (Figure 5-1B). This method requires potters to mould pieces separately, typically three or four sections for dragon bowl bodies, which are then assembled into a complete vessel using clay slip or thin clay strips. Compared to coiling, both throwing or moulding processes offer faster drying times, as all clay

pieces can be formed and dried simultaneously. Moulding in particular accelerates drying because moulds are typically made from porous materials that absorb moisture from the clay. Nevertheless, as Informant A notes, moulding can limit the maximum diameter of vessels compared to coiling. This limitation occurs either because the mould lacks sufficient strength to support wet clay or because the clay cannot maintain its shape once removed from the mould. As Section 5.3.2 will show, this observation provides a material explanation for a pattern identified in Ming-period dragon bowls, where coiled ones achieved larger diameters than moulded ones, consistent with the same physical constraint.

Regardless of the forming methods applied, the primary technological challenge lies in achieving sufficient workability of dragon bowl bodies while maintaining structural strength to survive the extended drying process. Compared to smaller vessels that take two to three days to dry, dragon bowls can take weeks or even months, depending on their size and the weather (Zheng, 2022, p. 158). Potters may also adjust the body recipe according to the chosen method, as throwing typically requires a wetter, more plastic body, while coiling or press-moulding favour stiffer, lower-water bodies with higher drying strength (Kerr and Wood, 2004, pp. 41–42). In this case, documenting how informants reason through the interdependence of paste composition and forming method is essential for interpreting Ming-period production marks, where the choice of coiling or moulding carries direct implications for the paste recipe that would have been required.

Table 5-2: Effects of clay mineral and non-clay inclusion content on porcelain body forming properties
Note: The table is summarised from Rice (2015, pp. 84–165). '+' indicates an increase in the property and '−' a decrease.

Property	Clay minerals	Coarse inclusions
Plasticity	+	–
Water Demand	+	–
Green Strength	+	Increase wet stiffness and resistance to slump, but reduce green tensile strength
Slump Risk	–	–
Shrinkage	+	–
Surface Smoothness	+	–

While material properties of porcelain stone, the principal raw material of Jingdezhen porcelain bodies, depend on particle size, shape, and surface chemistry of their component minerals, the advantages and disadvantages of adding fine-grained clay minerals and coarse inclusions make the paste recipe a delicate balance between conflicting objectives (Table 5-2).[27] This balancing act is further complicated at Jingdezhen, where locally sourced kaolin is known for its relatively low plasticity, as is further discussed in Section 5.3.1. Generally, higher content of clay increases porcelain bodies' plasticity and green strength (Rice, 2015, pp. 129–132; 162–165). Greater plasticity helps shape individual coils, ensures strong adhesion between layers during coiling, and facilitates clay manipulation in moulding or throwing. Stronger unfired bodies also tolerate the stretching required for all forming methods. However, excessive fine-grained clay can be counterproductive, as it increases porcelain bodies' water demand and drying shrinkage (Rice, 2015, pp. 157–161). When different parts of the dragon bowl dry at different rates—between successive coils or across separately moulded or thrown sections—differential shrinkage may create cracking and warping during the drying process. Conversely, adding coarse particles stabilises the body by reducing shrinkage, wet deformation, and water demand, but also diminishes plasticity and surface smoothness (Rice, 2015, p. 149). Excessive coarse inclusions in dragon bowl bodies can result in cracking or tearing during forming.

Firing

After forming and before firing, dragon bowls undergo decorating and glazing. Chen (2004, p. 70) notes that their large size presents challenges, such as the additional labour required from painters and the difficulty of achieving even glaze coverage on both interior and exterior surfaces. For example, according to Informant A's experience, while painting intricate blue-and-white patterns on a small vessel such as a dining plate typically takes several hours, decorating a dragon bowl requires at least several days. During the glazing stage, Informant B explains that while small vessels can be dipped in a tank of glaze, dragon bowl glazing requires spraying or brushing glaze onto the body—methods typically used for large vessels and those with irregular forms. Nevertheless, despite the additional effort required due to their large size, both informants note that decorating and glazing processes for dragon bowl production are largely identical to those used for smaller vessels in terms of painting techniques and recipes

[27] Following Velde (1995, p. 8), the 'clay minerals' discussed here refers to crystallites less than approximately 2 μm in diameter.

for decoration and glazing materials. This is also evident in previous ethnographic studies (Bai, 2005, pp. 165–202; Chen, 2004, p. 70; Zheng, 2022, p. 158).

During the firing stage, the greatest challenge is kiln temperature control. Dragon bowl firing requires slow heating to ensure even body sintering through gradual temperature increases, as rapid temperature rise causes cracking and deformation (Zheng, 2022, p. 159). This slow temperature change process is equally important during cooling, which requires dragon bowls to remain in their saggars for several days after firing is completed (Chen, 2004, p. 70; Zheng, 2022, p. 159). As section 5.2.2 will show, the *Taoshu* records an almost identical protocol for Ming-period dragon bowl firing: seven days of slow heating, two days of intense firing, and ten days of sealed cooling. The convergence reflects the thermodynamic behaviour of thick porcelain walls—a constraint that any change in kiln design or fuel type cannot eliminate.

Table 5-3: Effects of clay mineral and non-clay inclusion content on porcelain body firing properties
Note: The table is summarised from Rice (2015, pp. 172–202). '+' indicates an increase in the property, '–' a decrease, and '↔' little to no change.

Property	Clay minerals	Coarse inclusions
Vitrification	↔	–
Hot strength (mullite content)	+	–
Thermal stress sensitivity	+	Increase if coarse quartz sand is present
Refractoriness	+	+
Slump risk	–	–
Shrinkage	↔	–
Workable firing range	+	–

To survive firing intact, dragon bowls must meet specific requirements in terms of body composition, challenging potters to balance conflicting characteristics of different raw materials (Table 5-3). While material properties of porcelain stone during firing depend on the particle size, shape, and surface chemistry of their component minerals, clay processed from porcelain stone generally provides more flux than kaolin clay due to constituent albite and muscovite in the raw materials, thus contributing positively to a denser, more vitrified, and uniform dragon bowl body (South China Institute of Technology *et al*., 1981, pp. 21–22).

Besides, previous firing experiments have shown that higher kaolin clay content widens the body's firing temperature range and provides sufficient strength to survive rapid heating and temperature fluctuations during the extended firing process (Guo, 1987). The effect of increasing kaolin proportion on firing shrinkage is, however, less straightforward. Because kaolin contributes fewer flux minerals than porcelain stone, it does not drive vitrification-based shrinkage in the same way, yet uneven drying patterns prior to firing can still result in body distortion during the firing process (Kerr and Wood, 2004, pp. 41–42; Rice, 2015, pp. 163–164). These uneven shrinkage patterns can lead to poor joints between successive coils or between separately moulded or thrown sections.

Moreover, adding coarse non-clay particles can stabilise large dragon bowl bodies by reducing shrinkage, but certain additions, such as quartz sand, may cause cracking. During drying, the clay matrix shrinks while the quartz inclusions do not, causing the matrix to pull away from them and sustain microdamage at these interfaces. This damage worsens during firing, when quartz's thermal expansion at 580°C creates tensile stress and microcracking in the already weakened areas (Tite *et al*., 2001). Another risk occurs during cooling, when quartz contracts but the fired clay matrix cannot follow this movement, leading to potential fractures (*ibid.*). This behaviour is size-dependent, which is why modern commercial clays are typically ground to reduce inclusion sizes and mitigate such damage (Ying, 1988, pp. 20–21).

Therefore, balancing the conflicting material properties of dragon bowl bodies remains a persistent challenge and poses significant technological difficulties for potters throughout different production stages. Potters' choices of paste recipes, forming methods, and firing profiles show how each stage is interconnected and how multiple competing factors must be weighed carefully. Having established these contemporary technological constraints and their interconnected nature, the next section examines whether similar challenges existed in Ming-period dragon bowl production and explore past potters' strategies for addressing them as recorded in historical accounts.

5.2.2 Dragon bowl production processes and technological challenges as reported by the *Taoshu*

Having documented the constraints and decision-making processes of modern dragon bowl production, this section examines whether the same constraints are reflected in the *Taoshu*'s

historical account and whether the reasoning the informants articulate can explain choices that the text records but does not justify. Among the textual accounts discussed in Chapter 2, the *Taoshu* provides the only detailed description of dragon bowl production during the Ming period. The book's influence extended into the subsequent Qing period, where its accounts were referenced in both the *Taoshuo* 陶說 (Description of Chinese Pottery and Porcelain) and *Jingdezhen taolu* 景德鎮陶錄 (The History and Manufacture of Jingdezhen Porcelain), which contain nearly identical descriptions of dragon bowl production at the Imperial Porcelain Workshop. Therefore, the *Taoshu* serves as the primary source for the following analysis, which examines the technological challenges of dragon bowl production reflected in the text.

It should also be noted, however, that this historical text alone cannot substantiate the claim that dragon bowls were produced exclusively within the Imperial Porcelain Workshop, nor can it be assumed that the production processes described represent the only methods by which dragon bowls were manufactured. Section 5.3 evaluates the *Taoshu*'s accounts against material evidence drawn from compositional studies and production-mark analysis.

Clay preparation

According to the *Taoshu*, the clay preparation process for dragon bowl production at the Imperial Porcelain Workshop involved sourcing raw materials and mixing pre-processed clay(s) into body pastes (Wang and Lu, 1597, pp. 817–819), paralleling practices observed in modern ethnographic studies. While making dragon bowl pastes required porcelain stone from Yugan County, all other smaller vessels used sources from Wuyuan County (Wang and Lu, 1597, pp. 820–821). In addition, all pastes for dragon bowls and other smaller vessels required kaolin clay from Fuliang County (*ibid.*).

Although, according to the *Taoshu*, all porcelain stone were shipped by water routes, the text notes that transporting Yugan porcelain stone took much longer than transporting other porcelain stone and kaolin clay (Wang and Lu, 1597, p. 818). According to the approximate modern geographic locations of major raw material sources recorded in historical texts, as established in Chapter 4, the distance between Jingdezhen and Yugan porcelain stone source was at least two times greater than that from other places (see Figure 4-3). Additionally, the topography of Jingdezhen and adjacent counties could have made transportation more difficult, as the route between the Yugan source and Jingdezhen would follow an upstream path (Jiangxi

Province Atlas Editorial Committee, 2008, pp. 6–7). The shipping distance also explains the price differences among raw materials for porcelain bodies. According to the *Taoshu*, Yugan stones were the most expensive among all sources of porcelain stone and kaolin. When converted to modern measurements, the cost of 40 kilograms of Yugan stones could purchase 112 kilograms of porcelain stone from Wuyuan County and 143 kilograms of kaolin clay from Jingdezhen (Wang and Lu, 1597, pp. 817–818; for the conversion method, see Qiu *et al*., 2001, p. 416).

In addition to Yugan porcelain stone and Fuliang kaolin, the *Taoshu* records three additional raw materials for dragon bowl bodies: porcelain stone from Fuliang County, crushed stone from the same county, and grog from unfired ceramic wares (Wang and Lu, 1597, p. 818). The latter two materials were exclusive to dragon bowls where they were used to increase body strength (*jian* 堅) (Wang and Lu, 1597, p. 818). The effort to source suitable porcelain stone and appropriate tempering materials, as recorded in the *Taoshu*, suggests the challenges of clay preparation for dragon bowl bodies. Both historical and modern potters have added coarse particles to enhance body strength, reducing slumping risks during forming, drying, and firing. Notably, while modern ethnographic studies have emphasised increased kaolin content in dragon bowl bodies compared to smaller vessels, the *Taoshu* highlights the importance of selecting appropriate porcelain stone. These raw material selection and processing strategies at the Imperial Porcelain Workshop are examined further in Section 5.3.

Forming

According to the *Taoshu*, manufacturing large dragon bowls required substantial investment of time and energy, with the forming stage alone taking nearly a month (Wang and Lu, 1597, pp. 855–856). During this stage, each potter was required to produce five to ten dragon bowls simultaneously, with the specific number determined by vessel size (Wang and Lu, 1597, p. 855). For the first eighteen days, potters added clay daily to the bowls they had shaped the previous day (*ibid*.). This process suggests that during production the bowls were works-in-progress, with additional clay added only when the existing structure had dried sufficiently and achieved the mechanical strength necessary to support further material. This gradual building process aligns with the requirements of the coiling method as observed in modern ethnographic studies. For Ming-period potters, the time-consuming challenge of balancing body building with adequate drying time remained present.

After dragon bowl bodies were shaped, they underwent drying and trimming (Wang and Lu, 1597, p. 856). The *Taoshu* also records that potters used wooden racks specifically designed for drying these bowls (Wang and Lu, 1597, p. 864). During this process, debris and impurities on the surface of the clay body were wiped away with water, and any cracks or uneven areas were filled with clay slip (Wang and Lu, 1597, p. 856). This careful finishing work required approximately twelve days to complete, further extending the time needed for the forming stage (*ibid*.).

Firing

Within the dragon bowl production chain, the *Taoshu* does not describe decorating and glazing stages. The decorating process is described elsewhere in the text for smaller vessels (Wang and Lu, 1597, pp. 833–835), and its omission here likely reflects that the procedure was identical to those used for smaller vessels, as modern ethnography suggests. After decorating and glazing, each dragon bowl was placed in a saggar and fired in kilns using slow heating followed by an extended cooling period (Wang and Lu, 1597, pp. 844–847). This process addresses the same technological challenge of temperature control that present-day Jingdezhen potters face—reducing uneven temperature changes between dragon bowls' surface and interior.

According to the *Taoshu*, firing began with a gradual, low-temperature phase (*liuhuo* 溜火) that lasted seven days and nights, allowing the clay body to dry and its remaining moisture to evaporate fully (Wang and Lu, 1597, p. 844). The temperature was then raised for two days and nights of intense firing (*jinjuo* 緊火) (Wang and Lu, 1597, p. 844). When the flame around the saggar turned red and then luminous white, the fire was stopped, and the kiln gate was sealed. The dragon bowls were then left to cool down for another ten days (Wang and Lu, 1597, pp. 844–845). Therefore, the forming and firing processes took nearly one and half months, excluding decorating and glazing.

The *Taoshu* reports that there were thirty-two kilns built specifically for dragon bowl firing, though some were later converted into smaller kilns for other vessels when demand for them arose (Wang and Lu, 1597, p. 845). Each kiln for dragon bowl firing measured six *chi* (1.92m) in front width, six *chi* and 5 *cun* (2.08 metres) in rear width, and six *chi* (1.92 metres) in firing chamber length. Given the dimensions of dragon bowls recorded in the *Taoshu* (Wang and Lu,

1597, p. 836), each kiln could accommodate at least two pieces, even of the largest type. However, only one dragon bowl was fired per kiln at a time (Wang and Lu, 1597, p. 845). While a kiln of similar size normally accommodated 200 pieces of smaller vessels (Wang and Lu, 1597, p. 843), firing only one dragon bowl per kiln shows the extraordinary care and expense the Imperial Porcelain Workshop invested in its production.

In short, the dragon bowl production process as recorded in the *Taoshu* describes technological challenges that remain fundamental to dragon bowl making today. Both past and contemporary potters were and are faced with the challenge of balancing conflicting material properties of dragon bowl bodies that profoundly impact subsequent production stages. Moreover, time and energy consuming challenges have been present in both past and present production processes. The *Taoshu* records that the forming stage alone took nearly a month, with potters adding clay daily for eighteen days and allowing gradual drying. This mirrors the contemporary coiling method, which requires the same repetitive cycle of building and drying. Similarly, firing processes in both past and present demand extended timeframes and careful temperature control compared to those of smaller vessels.

The persistence of these technological constraints across centuries suggests that they are governed not by changing traditions or techniques but by the unchanging physical properties of the ceramic materials themselves. Because these material constraints remain constant, modern ethnography offers a valuable means of understanding the practical decisions that Ming-period potters faced. As potters in the past and present respond to the same physical demands, modern potters' strategies for balancing competing technical requirements can inform the reasoning behind choices visible in the material traces of Ming-period dragon bowls.

5.2.3 Possible material evidence of dragon bowl production

Besides historical accounts, material traces left by dragon bowl production in the Ming period can reflect potters' decisions in addressing the technological challenges as previously discussed. While textual sources like the *Taoshu* provide valuable insights into production methods, material evidence offers an opportunity to examine these practices independently and can recover details about technological choices that may not have been explicitly recorded in contemporary accounts.

Clay Preparation

For the clay preparation stage, several analytical approaches can reconstruct both the raw material processing methods and paste recipes used by Ming-period potters. First, archaeological excavations at production sites can yield information about the raw material refining process, such as grinding equipment and clay settling basins, although it may be difficult to determine whether these processes were specific to dragon bowl production when sherds of other vessels are also discovered at the same sites.

Second, Wood's (2021) recent research summarises how mineral and chemical analysis of Jingdezhen porcelain body sherds can identify mineralogical compositions and quantify porcelain stone to kaolin clay ratios when compared with known reference samples from Jingdezhen and adjacent areas. Applying compositional analysis to archaeologically excavated dragon bowl sherds would therefore disclose potters' choices regarding raw material sources and kaolin proportions. Moreover, methods used in mineralogical analysis—such as petrographic thin-section analysis and scanning electron microscopy (SEM)—can help identify coarse inclusions (Quinn, 2013, pp. 44–53). Even without analytical equipment, coarse particle additions—if they would remain largely unvitrified after firing—can sometimes be observed directly in archaeological dragon bowl sherds.

Forming

While the *Taoshu* only records the coiling process for Ming-period dragon bowl production in Jingdezhen, tool marks and surface textures preserved on archaeological sherds may suggest alternative forming methods, such as moulding. However, difficulties exist in such production mark analysis, as previous research has suggested that the same surface features can be produced by different forming methods, and the same method can produce different surface features (Roux, 2016; Thér, 2020). The same problem applies to the potential use of tools discovered in archaeological excavations, as many ethnographic studies suggest that the same tool, such as a potter's wheel, can be used for rotating vessels during various stages throughout the entire manufacturing process (Rice, 2015, pp. 235–237).

Despite these interpretive challenges, macroscopic visual analysis of manufacturing marks remains a productive approach. The identification of production traces on finished vessels requires careful distinction from use-altered wear, which can be achieved by attending to their

patterning, location, and correspondence with known forming processes (Skibo, 2015). Womack and Wang (2020) demonstrated this approach on Chinese potter, identifying coil-building marks, scarping traces, and variation in surface treatments through macroscopic level alone.

For the present study, to differentiate possible traces of coiling versus moulding processes on dragon bowls, observation sessions of Potters I and II's moulding workflows were conducted at Informant A's forming workshop in May 2023 and May 2024 respectively. The material traces left by coiling are well documented in existing scholarship (e.g., Rice, 2015, pp. 228–230; Zheng, 2022, pp. 156–157), so no independent fieldwork on this method was required. Table 5-4 summarises the production stages and their associated material traces. As X-ray examination was not possible due to museum restrictions, the production mark analysis of objects in Section 5.3.2 focuses on macroscopically identifiable features derived from these observations. Notably, while both potters used the same moulding method, variation was observed in how they filled body moulds with clay and joined body sections. Potter I filled moulds using one of three techniques—pressing a ring-shaped clay lump, applying coiled clay sticks, or pressing a flat clay slab—all of which left subtly different interior surface marks. Potter II consistently used the ring method but reinforced body section joints with a thin clay coil pressed into a groove, which could leave a raised edge encircling the vessel's mid-body if not entirely smoothed out. These differences demonstrate that even within a single workshop, the moulding process can produce variable material traces, reinforcing the interpretive caution noted above.

Table 5-4: Summary of moulding process stages and possible material traces observed at Informant A's workshop

Note: 'Both' indicates a process shared by Potter I (observed May 2023) and Potter II (observed May 2024). Where only one potter is listed, the process was specific to that individual.

Production stage	Potter(s)	Process	Possible material traces
Filling body moulds	Potter I	Coiled clay sticks applied from bottom to top of mould; gaps smoothed by hand	Coil marks and finger impressions; initial vertical lines from joining coils, followed by horizontal smoothing marks
	Potter I	Flat clay slab applied to entire mould interior; pressed to adhere by hand	Palm and finger impressions; uniform pressure marks from hand contact
	Both	Ring-shaped clay lump placed in lower-middle section of mould, gradually expanded to conform to mould interior, then hand-smoothed	Finger impressions; initial vertical lines from hand pressure, followed by horizontal smoothing marks
Filling base mould	Both	Clay lump pressed into mould and hand-smoothed	Finger marks from clay placement followed by horizontal smoothing lines; sometimes hardly observable
Interior trimming	Both	Interior walls trimmed with knives for consistent wall thickness; shoulder and foot areas left thicker for structural support	Horizontal lines spiralling around interior walls
Drying and mould removal	Both	Sections dried indoors for approximately half a day; light bulb suspended inside mould to promote uniform drying	Not observed
Joining body sections	Potter I	Clay slip applied to joint surfaces; sections aligned and pressed together; excess clay hand-trimmed from seam	Joint line: horizontal seam encircling mid-body
	Potter II	Clay slip applied to joint surfaces; sections aligned and pressed together; thin groove created at joint; thin clay coil applied to groove and hand-smoothed over entire body	Coil marks; horizontal and vertical smoothing patterns from coil integration; raised edge encircling mid-body if coil not entirely smoothed
Joining body and base	Both	Clay slip applied; parts aligned and pressed together; thin clay coil applied into groove at joint and smoothed	Coil marks; raised edge at body-base junction if coil not entirely smoothed
Exterior trimming	Both	Exterior surface trimmed with knives for consistent wall thickness	Horizontal lines spiralling around exterior surface
Drying	Both	Dried indoors then moved to courtyard or near kiln; takes 2–3 days	Drying stress marks: hairline fractures from uneven moisture loss, especially at thick sections like shoulders and feet

Firing

While the *Taoshu* documents that special kilns and kiln furniture were designed for dragon bowl production, archaeological surveys and excavations of kilns and kiln furniture can reconstruct firing arrangements for dragon bowls and protective measures used to prevent thermal shock and contamination. Kiln wasters from dragon bowl firing can show characteristic defects such as warping, cracking, or bloating, providing direct evidence of thermal stress created by differential heating and cooling during the firing process of large vessels. These defects can also indicate failures in achieving homogeneous clay preparation or controlling different drying rates in preceding clay preparation and forming stages.

Moreover, analysis of clay mineral transformations in archaeological sherds can indicate firing temperatures and duration. For instance, mullite formation occurs only above approximately 1,100°C, and the greater development of elongated mullite crystals indicates exposure to higher temperatures and longer firing durations (Lee and Iqbal, 2001; Kerr and Wood, 2004, p. 59; Tite *et al*., 2012). The firing temperature of archaeological sherds can also be estimated through refiring experiments, as ceramic samples exhibit measurable shrinkage when reheated to temperatures approaching their original firing temperature (Zhou and Li, 1982). These analytical approaches await the future publication of dragon bowl sherds. To date, one preliminary excavation report from Yuyaochang has disclosed a saggar sherd with a diameter exceeding 120 centimetres, very likely used for dragon bowl firing (BPM *et al*., 2024b, p. 74). The sherd was recovered from a kiln whose structure had unfortunately been damaged (see YYC-28-Y1 in Catalogue A).

Drawing from potential material traces left by dragon bowl production, Section 5.3 will examine how Ming-period potters addressed the technological challenges reflected in historical accounts. While ethnographic studies provide valuable insights into the decision-making factors that may have guided Jingdezhen potters, material evidence from archaeological discoveries, production mark analysis, and compositional studies will test the prevailing hypothesis that dragon bowl production was feasible only at the Imperial Porcelain Workshop, as the *Taoshu* suggests.

5.3 Tracing Jingdezhen potters' knowledge and skills in dragon bowl production in Ming-period Jingdezhen

While large quantities of dragon bowl sherds have been discovered at Yuyaochang (SAM-PKU *et al.*, 2007, p. 11; BPM *et al.*, 2019, pp. 34–35; JPICRA *et al.*, 2024b, p. 50), preliminary excavation reports published so far provide little information about their specific archaeological contexts—whether they were found alongside features indicating particular manufacturing processes or within fire kilns of which the structures could be analysed.

First, results from chemical compositional analysis conducted by researchers at the Jingdezhen Ceramic Archaeological Research Institute and the Palace Museum, Beijing are re-examined to understand potters' raw material choices for large-sized porcelain bodies. Using EDXRF, these researchers analysed three archaeological sherds from Yuyaochang: one dragon bowl sherd dating to the Zhengtong period and two sherds with wall thickness identical to the Zhengtong piece, dating respectively to the Xuande and Jiajing periods (Jiang *et al.*, 2018). These results are compared against the compositional data established in Chapter 4 to contextualise the dragon bowl sherds within broader patterns of raw material use at Jingdezhen. Second, production-mark analysis is conducted on pieces in public museum collections whose authenticity and provenance have been established by previous scholarship (for an overview of object information, see Table C-1, Appendix C).

5.3.1 Balancing porcelain bodies using local raw materials

The choice of Yugan stone

Among the raw materials used for dragon bowl bodies at the Imperial Porcelain Workshop, one particular source, Yugan porcelain stone, stands out. According to the *Taoshu* (Wang and Lu, 1597, pp. 820–821), this material was specifically selected for large-sized dragon bowl bodies, despite requiring the longest transportation time to Jingdezhen and being the most expensive option. This textual account is corroborated by the approximate modern geographic locations of raw material sources established in Chapter 4 (see Figure 4-5), which confirm that Yugan stones are more distant than other local porcelain stone options.

In Chapter 4 it was shown that Yugan porcelain stone samples vary in their characteristics. Of four raw stone samples, one falls within the highly weathered/altered group, displaying high kaolinite content but low albite content (Figure 4-6A, B). The performance test results confirm

why this specific highly weathered/altered Yugan stone sample may be representative of the Yugan porcelain stone source documented in the *Taoshu*. Among raw materials tested by Yi (1964), this Yugan sample shows the highest Relative Plasticity Index (RPI=1.81),[28] exceeding the next highest material by a considerable margin (Figure 5-2A). This exceptional plasticity is critical for large-scale forming, as it allows potters to shape individual coils, ensures strong adhesion between successive coil layers, and make clay manipulation during moulding or throwing easier. The Yugan sample also shows respectable dried breaking strength (6.65, see Figure 5-2B), indicating that unfired dragon bowl bodies made from this material can tolerate the handling and forming, if required, during forming without cracking. Furthermore, the Yugan sample exhibits the lowest linear firing shrinkage among all tested materials (6.01, see Figure 5-2D).[29] This result is consistent with its classification as a refractory type in Chapter 4. The high kaolinite and low albite content that defines this group means fewer flux minerals are available to drive vitrification, resulting in both a more refractory body and greater dimensional stability during firing.

[28] RPI is an index showing plasticity during shaping. RPI = (d-b)/d × P, where d represents the diameter of the test sample after forming (wet state), b represents the diameter of the sample after drying, and P represents the breaking strength of the sample. For the testing and calculation method, see South China Institute of Technology *et al*., 1981, pp. 13–14.

[29] Linear body shrinkage measures the total volumetric change of the ceramic body during firing. For the testing and calculation method, see South China Institute of Technology *et al*., 1981, pp. 16–17.

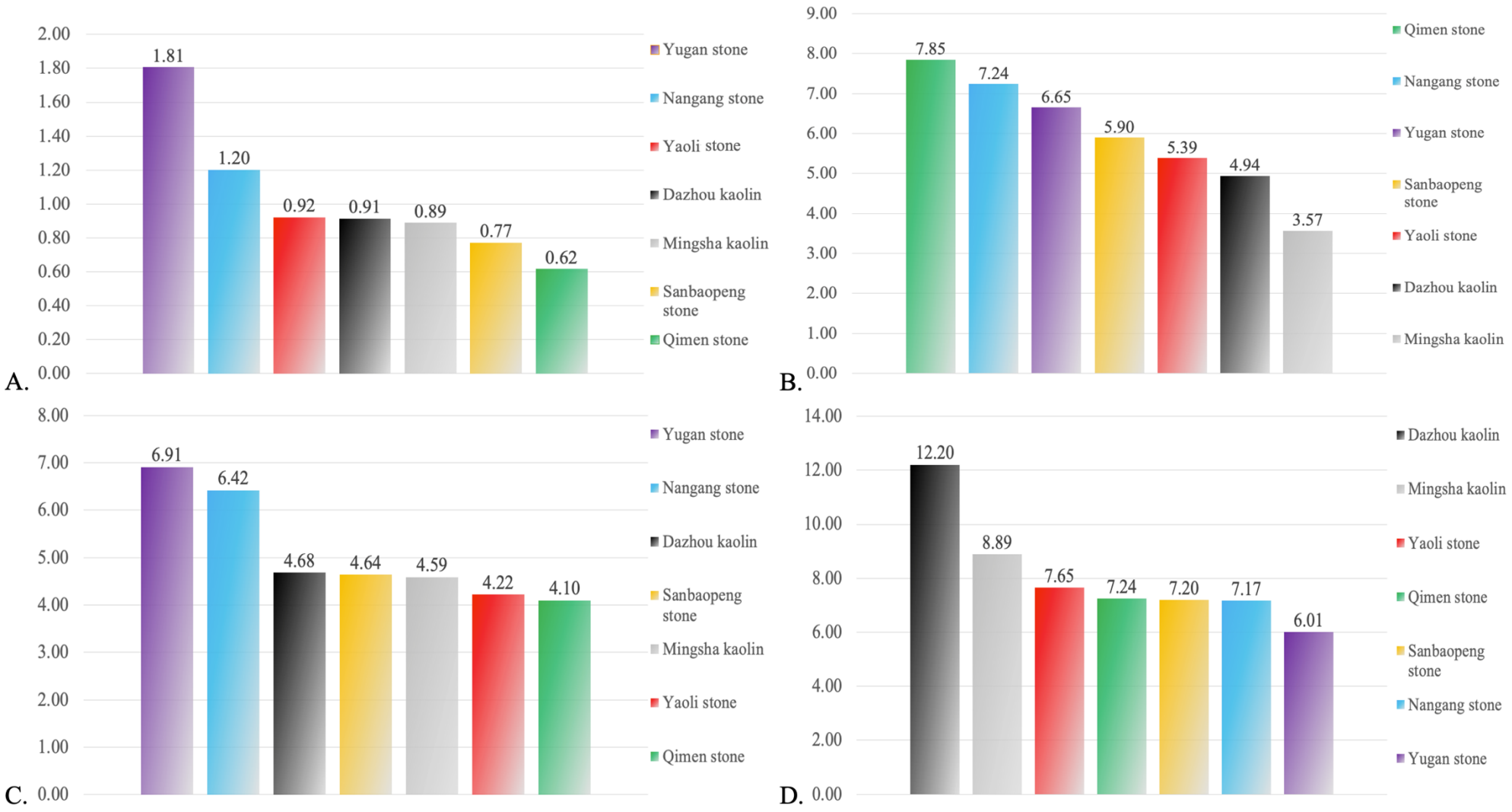


Figure 5-2: Performance test results of porcelain stone and kaolin. (A) Relative Plasticity Index (RPI) of major raw material types; (B) breaking strength (dried) of major raw material types; (C) linear shrinkage (dried) of major raw material types; (D) linear shrinkage (fired) of major raw material types. Data from Yi, 1964.

While the *Taoshu* records that Yugan porcelain stone was specifically acquired for dragon bowl production at the Imperial Porcelain Workshop, compositional analysis and performance tests suggest it may have not been the only suitable source. Among the highly weathered/altered group examined in Chapter 4, other samples within this group come from more local sources, including Nangang, Liujiawan, and Shouxiwu. The Nangang source deserves particular attention, as Yi's (1964) performance tests indicate that it has comparably high plasticity, high breaking strength, and low firing shrinkage to the Yugan sample (Figure 5-2A, B, D). Unlike the Yugan source, which had to be transported over a hundred kilometres, Nangang represents a more accessible source located near the South River in present-day Jingdezhen. Many porcelain stone sources in this area (known as the Nangang type) were used for the Song-period porcelain bodies (Liu and Bai, 1982; Zhou and Li, 1960b; Tite, Freestone and Wood, 2012; Wood, 2021).

The existence of these alternative sources raises important questions about raw material access. Besides the Yugan stone recorded in the *Taoshu*, current evidence indicates that other plastic and refractory porcelain stone sources may have supplied both the Imperial Porcelain Workshop and other local workshops in Jingdezhen. Modelled recipes of Ming-period porcelain bodies show that the use of refractory stone declined during the late Ming period, contemporary with the *Taoshu*, yet 'non-imperial' porcelain associated with production contexts beyond the Imperial Porcelain Workshop still used it (see Figure 4-10). Two scenarios may account for this pattern. If the depletion of the more accessible Nangang source had compelled the Imperial Porcelain Workshop to turn to the more distant Yugan source, the analytical results of porcelain bodies suggest that other local workshops could have had the same access to Yugan stone and were willing to bear higher transport costs for superior performance. Alternatively, if the Nangang source had remained available, both the Imperial Porcelain Workshop and other local workshops could have chosen this more accessible and affordable alternative, while supply instability may have driven the Imperial Porcelain Workshop to seek a more distant source. Either scenario suggests that the knowledge of selecting plastic and refractory porcelain stone sources extended beyond the Imperial Porcelain Workshop, and that access to these sources was similarly unrestricted.

The balanced recipe

While the highly weathered/altered Yugan porcelain stone type shows desirable material properties for dragon bowl production, its finer particles also create risks. As shown in Figure 5-2C, the Yugan sample records the highest drying shrinkage (6.91) of all samples tested, a direct consequence of its high kaolinite content.[30] For dragon bowls assembled from multiple coils or separately formed sections, high drying shrinkage poses the greatest risk of differential shrinkage between joints, potentially leading to cracking and warping before the vessel reaches the kiln. According to the balancing principle for dragon bowl bodies outlined in Section 5.2.1, balancing this disadvantage requires adding coarse inclusions to reduce shrinkage. This trade-off explains the unfired ceramic sherds and crushed stones from Fuliang County recorded in the *Taoshu*'s dragon bowl recipe (Wang and Lu, 1597, pp. 820–821). These coarse additions are also observable in several successfully fired dragon bowl bodies, either visible through glaze or resulting in numerous pinholes on the surface (Ming Tombs Special District Office, 2006, p. 248).

Furthermore, if the chosen Yugan stone contained less albite, a balanced recipe would require a more fusible porcelain stone to supply alkali fluxes and increase vitrification. According to the *Taoshu*'s recipe, the remaining porcelain stone from Fuliang County likely served this purpose. Wood (2021) developed a recipe for three sixteenth-century yellow-glazed porcelain bowls that combined clay processed from plastic and refractory Nangang stone, fusible Sanbaopeng stone, and Dazhou kaolin, though more evidence is needed to determine whether such balanced recipes were widely adopted. The modelled recipes in Chapter 4 support a porcelain stone-kaolin mixture in which refractory stone may have been blended with fusible stone, but without altering the overall refractory character of the porcelain stone component, as indicated by its high kaolinite but low albite content.

The results of compositional analysis conducted on three dragon bowl sherds from the Xuande, Zhengtong, and Jiajing periods, however, implies a more complex situation (Tables 5-5 and 5-6). The mineral compositions of the Xuande sherd (JDZ-2) and Jiajing sherd (JDZ-4) can be accounted for by the use of refractory porcelain stone, whether blended with fusible porcelain stone or not, combined with over 40 wt% kaolin additions. The Zhengtong sherd (JDZ-3), on

[30] Linear shrinkage measures dimensional change in length during drying. For the testing and calculation method, see South China Institute of Technology, 1981, pp. 16–17.

the other hand, is notable for its high albite and kaolinite content. Although the current dataset of Ming-period blue-and-white porcelain bodies presented in Chapter 4 does not contain identical compositions (see Figure 4-9), the Zhengtong sherd matches the outlier porcelain stone samples that underwent albitisation during hydro-thermal alteration (see Figure 4-6). It remains unclear, however, whether the recipe suggested by the Zhengtong sherd was widely used. As established previously, the combination of high kaolinite and high albite suffers from elevated shrinkage at both the drying and firing stage. The high flux content also narrows the workable firing temperature range, leaving less room for error during the extended firing process required for dragon bowls.

Table 5-5: Major oxide composition (wt%) of dragon bowl test samples

Note: The samples were analysed by energy-dispersive micro-X-ray fluorescence (μ-EDXRF). Data from Jiang *et al*. (2018).

Sample no.	Date	SiO_2	Al_2O_3	Fe_2O_3	TiO_2	CaO	MgO	K_2O	Na_2O	MnO
JDZ-2	Xuande period	73.17	23.43	0.48	0.06	0.25	0.42	1.58	0.61	0.02
JDZ-3	Zhengtong period	69.82	25.8	0.55	0.08	0.1	0.4	1.48	1.74	0.03
JDZ-4	Jiajing period	73.46	22.66	0.99	0.07	0.5	0.48	1.81	Below detection limit	0.03

Table 5-6: Major mineralogical composition (wt%) of dragon bowl test samples

Note: The data was converted from the oxide composition in Table 5-5 using the method described in Section 4.2.1.

Sample no.	Sericite	Albite	Kaolinite	Quartz	Sum
JDZ-2	12.76	5.16	37.68	43.19	98.79
JDZ-3	11.95	14.72	39.50	32.67	98.84
JDZ-4	14.61	0.0	36.56	46.75	97.93

For JDZ-2 and JDZ-4, the high kaolin additions may appear counterintuitive, given that adding more clay minerals typically increases shrinkage, yet the characteristics of Jingdezhen's local kaolin source suggest otherwise. The relatively low plasticity of Jingdezhen kaolin has long been noted (Vogt, 1900; Efremov, 1956; Zhou and Li, 1960b; Wood, 2021). Polarising and electron microscopic analysis of Dazhou kaolin shows that while fine clay minerals less than 2 micrometres meet Velde's (1995, p. 8) definition of 'clay', the majority consists of coarser kaolinite minerals as stacked plates in the 2–5 micrometres fraction (Chen *et al.*, 1997). This coarser particle size means that Jingdezhen kaolin behaves differently from the fine-grained clay minerals described in Tables 5-2 and 5-3. Performance tests further confirm that samples

of Dazhou and Mingsha kaolin show lower plasticity than Nangang and Yugan samples (Figure 5-2A).

While Chapter 4 has suggested that high kaolin additions to plastic and refractory porcelain stone were likely pursued for a whiter porcelain body to contrast with the underglaze blue decoration, this does not apply to JDZ-2 and JDZ-4. Compared to porcelain bodies using identical combinations, the higher colouring oxides (TiO_2 and Fe_2O_3) of these two sherds do not suggest a deliberate use of pure raw material sources (Table 5-5). In the case of dragon bowl production, the high kaolin additions may have served as a functional additive to plastic porcelain stone, reducing shrinkage while widening the firing temperature range. The ceramic sherds and crushed stones recorded in the recipe could further reduce the kaolin's higher water requirements. Fusible porcelain stone, if used, could provide flux to promote mullite formation during firing, adding hot strength to prevent cracking or slumping during the extended firing process. While findings in this section suggest that both the Imperial Porcelain Workshop and other local workshops had equal access to porcelain stone and kaolin clay as well as sophisticated knowledge of their nature, determining whether they mixed these materials differently for smaller vessels and why requires a larger sample of porcelain sherds and further investigation at production sites.

5.3.2 Developing shaping methods based on individual expertise

The compositional distinctions between dragon bowls and smaller vessels likely added to the challenge in dragon bowl production during the Ming period. The different working properties of different clays required sufficient expertise on the side of the potters to understand how the specific material they were dealing with would behave, which shaping method worked best with it, and how to adapt techniques used for smaller vessel forms for this particular material. To examine potters' technological choices during the forming stage, this section conducts an analysis of production marks on eighteen Jingdezhen dragon bowl bodies during the Jiajing, Longqing, Wanli periods, contemporary to the *Taoshu*'s accounts (for detailed object information, see nos. 8–25 in Table C-1, Appendix C).

The analysis of production marks focuses on macroscopically identifiable features derived from published ethnographic documentation and observation of Potters I and II's moulding processes at Informant A's workshop (Table 5-4). Due to museum collection management

restrictions on these large vessels and limited research time for this thesis, it has not been possible to conduct X-ray examinations. Production marks were therefore analysed through photographs and direct observation in museum galleries and storage rooms. Although the current analysis is constrained by photographic resolution and observational limitations, the available evidence demonstrates potters' use of two forming processes, each employing different yet occasionally overlapping techniques.

Among the dragon bowls examined, observable marks of the coiling process include production defects such as protruding coils or parallel glaze crawling. Object no. 13 exhibits protruding coil marks on the lower part of its body (Figure 5-3C), while Object no. 28 displays similar evidence on its upper-middle section (Figure 5-3A, B).



Figure 5-3: Protruding coil marks on dragon bowls. (A, B) Object no. 28, rim diameter 55.2 cm, height 37.8 cm (photographs taken by the author). (C) Object no.13, rim diameter 74.5 cm (source: Li, 2012, p. 133).

Unlike protruding coils, evidence for glaze crawling remains inconclusive. During coiling, this effect typically occurs where coils are inadequately smoothed, creating surface irregularities that prevent proper glaze adhesion (Hamer and Hamer, 1997, p. 87). In modern dragon bowl coiling processes, potters bond successive coils by hand and use paddles to smooth both inner and outer surfaces, creating horizontal trimming lines that are slightly raised above the surface level (Figure 5-4). However, similar horizontal lines can result from trimming the outer surfaces of moulded dragon bowls. While Object no. 29 exhibits horizontal glaze crawling patterns across its entire body (Figure 5-5A), the specific cause cannot yet be determined. Object no. 21 similarly displays parallel crawling patterns on its lower section (see Figure 5-5B).



Figure 5-4: Hand impressions from smoothing process, filmed in Jingdezhen. Source: *Jiangxin yetao* 匠心冶陶 (Crafting Pottery with Artisan's Dedication), Episode 7 (2018), accessed via YouTube, https://www.youtube.com/watch?v=urxOcvw8yoI&t=531s.

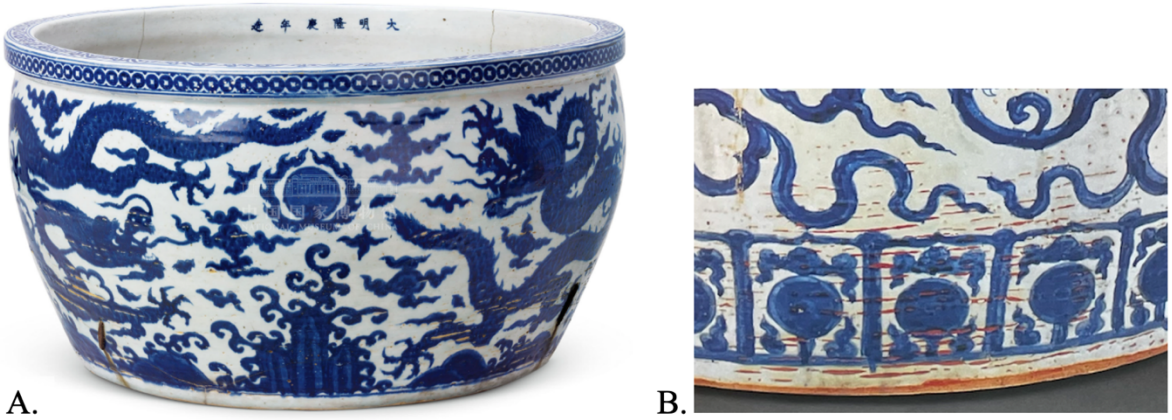


Figure 5-5: Horizontal glaze crawling marls on dragon bowls. (A) Object no. 29, rim diameter 69 cm, height 35.6 cm (source: The National Museum of China, accessed via https://www.chnmuseum.cn/zp/zpml/csp/201812/t20181218_27744.shtml). (B) Object no. 21, rim diameter 66 cm, height 54.5 cm (source: BPM *et al.*, 2018, p. 91)

Another set of production marks that should be noted are vertical lines or panels visible on the inner surface of dragon bowls, as seen on objects no. 24 and no. 25 (see Figure 5-6A, B). These marks may result from potters using their hands to seal the seams between coils. As documented in Zheng's (2017) video ethnography of the dragon bowl coiling process, while one hand creates horizontal lines on the outer surface to smooth the joints between coils, the other hand moves vertically along the inner surface (Figure 5-4). When the inner surface is not entirely smoothed, the vertical hand movement leaves slightly raised edges that may cause

glaze crawling. Such vertical glaze marks are displayed on the inner surface of object no. 28 (Figure 5-6C).

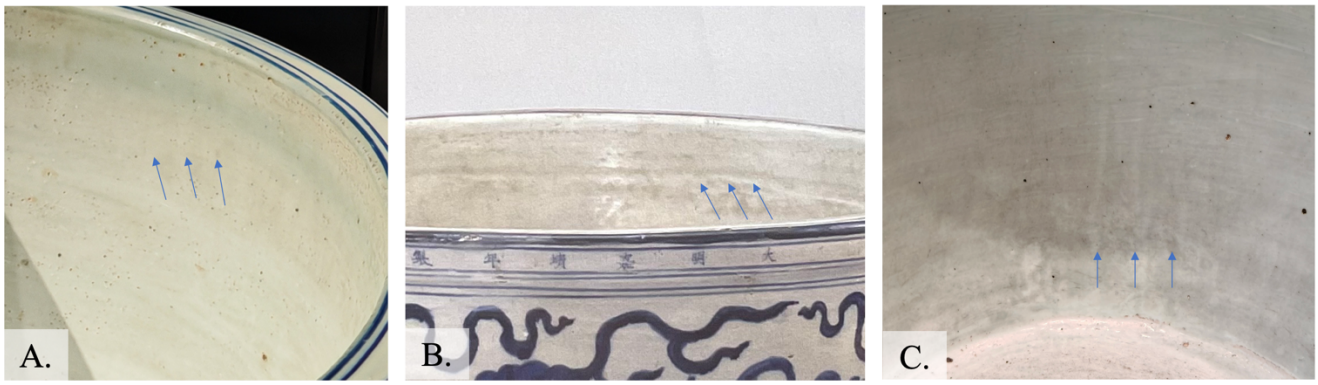


Figure 5-6: Vertical hand impression marks or glaze crawling marks on dragon bowls. (A) Object no. 24, rim diameter 59.1 cm, height 29.3 cm (photograph taken by the author). (B) Object no. 25, rim diameter 71.7 cm, height 35 cm (source: Lu, 2007, p. 158). (C) Object no. 28, rim diameter 55.2 cm, height 37.8 cm (photograph taken by the author).

Alternatively, these vertical traces on the inner surface can result from moulding. From the moulding process observed in Informant A's workshop, Potter I employs three methods when pressing clay into the mould. The first is directly hand-pressing a lump of clay, the second uses clay strips gradually coiled into the mould, and the third requires making a complete clay slab before placing it into the mould. When using the first method, he adheres the ring-shaped lump to the mould's inner wall with hand movements similar to those used when smoothing the inner surface of a coiled vessel. When using the second method, the inner surface displays horizontal production marks similar to those of a coiled vessel—if not entirely smoothed. However, when potters coil clay strips within a mould, the resulting vessel's exterior surface will not exhibit the characteristic horizontal coil marks found on vessels formed entirely through coiling, even when the piece remains untrimmed immediately after removal from the mould. This occurs because the mould wall provides resistance against which clay strips are pressed, creating sufficient pressure to compress coil joints through the clay's plastic deformation.

Other than the inconclusive evidence from glaze crawling marks and hand-movement traces, production marks indicating the use of clay slip or thin strips to join body sections point more directly to the moulding process. In Informant A's workshop, when joining separately moulded body sections, Potter I uses clay slip to join the upper and lower body sections and applies clay strips to join the body to the bottom section. In contrast, Potter II uses only clay strips to join

all sections. Whether using clay slip or strips, joints that are not properly trimmed leave raised strip-like traces, most noticeable at approximately the middle or one-third height of the bowl's body. These production marks are displayed on objects no. 32 and no. 34 (see Figure 5-7).

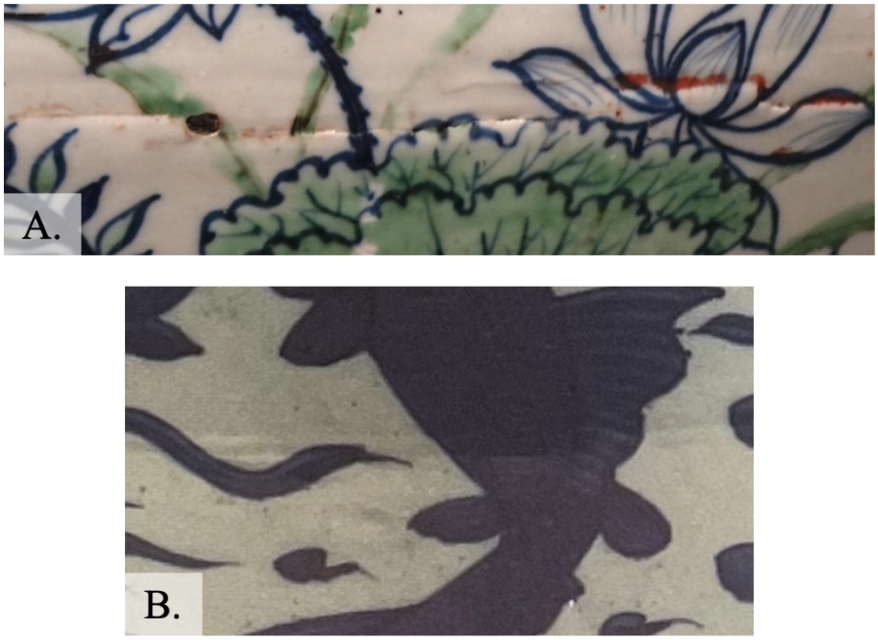


Figure 5-7: Section joining marks on dragon bowls. (A) Object no. 32, rim diameter 58.5, height 30cm (photograph taken by the author). (B) Object no. 34, rim diameter 40.9 cm, height 30.2 cm (source: Lu, 2007, p. 55).

Moreover, when differential shrinkage patterns of separately moulded body sections create tensile stress that exceeds the body's structural capacity, encircling crack lines appear below the glaze at the joints. This can be observed on Objects no. 9 and no. 27 (Figure 5-8). Similar cracking defect caused by poorly jointed dragon bowl body and bottom parts are also reported by museum curators when examining the dragon bowls (Objects no. 18, no. 19, and no. 20) in their collections for future preservation and conservation (Zhang, 1997; Pei, 2019).



Figure 5-8: Horizontal encircling cracking marks on dragon bowls. (A) Object no. 9, rim diameter 49.5cm, height 45.5 cm (source: Chen, 2019, Figure 2). (B) Object no. 27, rim diameter 65.5 cm, height 38.8 cm (source: the Art Gallery of New South Wales, accessed via https://www.artgallery.nsw.gov.au/collection/works/EC4.1964/).

Overall, coiling marks appear on vessels from the Jiajing and Longqing periods, while moulding marks appear on vessels from the Jiajing and Wanli periods. Both methods could produce vessels with rim-to-height ratios of 1:1 and 2:1, though coiling achieved larger maximum diameters than moulding. This size constraint supports Informant A's argument that moulding faces diameter constraints due to limited mould support strength and slumping risks after removal. Furthermore, analysis of glaze crawling marks and vertical hand-smoothed coiling marks indicates shared techniques between moulding and coiling, including trimming, hand-smoothing surfaces, and making clay coils. These shared technological roots between the two processes suggest that potters practising one method may have been familiar with or able to adopt the other, raising questions about how forming expertise developed and circulated, as discussed in the following section.

5.3.3 Jingdezhen potters' knowledge and skills beyond the Imperial Porcelain Workshop

The analyses of body composition and production marks in the previous two sections suggest that Jingdezhen potters chose different shaping methods for dragon bowl bodies, adapting their techniques to work with clay having different material properties than those used for smaller vessels. This raises two important questions: how were the knowledge and the skills behind these technological choices developed from these potters' existing experience? And were they confined to the Imperial Porcelain Workshop?

While the *Taoshu*'s account suggests that dragon bowl bodies were manufactured only within the Imperial Porcelain Workshop using coiling, production marks indicating moulding provide contradictory evidence. If potters at the Imperial Porcelain Workshop had employed only coiling, then moulded pieces might have been produced by other local workshops in Jingdezhen, either fulfilling outsourced imperial orders or commissions from 'non-imperial' consumers. This latter possibility would challenge the longstanding assumption that porcelain dragon bowls were manufactured exclusively for imperial use during the Ming period.

Assuming only coiling was employed in dragon bowl production at the Imperial Porcelain Workshop, it should be noted that dragon bowls were the only vessel type using this method there, according to the *Taoshu* (Wang and Lu, 1597, pp. 855–856). While potters responsible for forming were organised into sub-workshops specialising in moulding, throwing, or carving, no dedicated coiling workshops supported dragon bowl production (Wang and Lu, 1597, p. 816). Therefore, if dragon bowls had been manufactured by potters in existing sub-workshops, those skilled in moulding most likely adapted certain techniques—such as coiling clay strips—to dragon bowl production, though they had to work with their clay differently. While coiled clay strips used in moulding benefit from external support structures that absorb excess moisture, fully coiled vessels must rely entirely on their own structural strength. The knowledge and the skills required for coiling substantial-sized porcelain vessels may thus have been developed through trial and error within the Imperial Porcelain Workshop itself, with potters experienced in moulding being reassigned to coil dragon bowl bodies when imperial orders demanded production. The ethnographic parallel supports this inference. The shared technological roots between moulding and coiling observed at Informant A's workshop, particularly the use of clay coils within the moulding process itself, demonstrate that the skill transfer the *Taoshu* implies was materially feasible.

Another possible way for successful dragon bowl coiling at the Imperial Porcelain Workshop was recruiting potters who already possessed the requisite knowledge and skills. As examined in Chapter 2, while the Workshop's workforce was primarily drawn from potters registered under artisan households and from local ceramic production communities, those with desirable expertise could also be employed as demand required on a daily-wage basis. According to the *Taoshu*, the highest-paid recruited potters were those who excelled at shaping large vessels, including dragon bowls and large jars (Wang and Lu, 1597, p. 854). Therefore, the knowledge

and the skills necessary for dragon bowl production, whether through coiling or moulding, could be brought into the Imperial Porcelain Workshop through direct recruitment of experienced potters who would then apply their expertise to imperial production.

An alternative assumption would be that both coiling and moulding were used for dragon bowl production at the Imperial Porcelain Workshop, despite the latter remaining unrecorded in the *Taoshu*. Even under this scenario, the pathways for acquiring the required expertise would follow similar routes. The moulding method may have been developed by potters who were skilled in moulding smaller vessels—whether they already worked in the moulding sub-workshop at the Imperial Porcelain Workshop or were recruited from outside. The coiling method could have been developed either by these same potters at the Imperial Porcelain Workshop who excelled in moulding adapting their techniques to larger vessels, or through recruiting potters from local ceramic production communities who had already demonstrated expertise in coiling.

Regardless of which assumption proves correct, the foundation for developing the required knowledge and skills for dragon bowl production was rooted in local ceramic traditions in Jingdezhen. For coiling, archaeological excavations have identified production sites making coiled pottery and stoneware within Jiangxi Province from the Neolithic period to the Tang period (Zhao and Wu, 2000; Feng, 2001, p. 28; Centre for Chinese Archaeology *et al*., 2018). Coiled stoneware jars for clay or glaze storage have been discovered at various porcelain production sites in Jingdezhen dating to the Song, Yuan, and Ming periods, indicating that coiled vessel production may have continued locally (JPICRA *et al*., 2007, pp. 41–42; JCARI *et al*., 2020, p. 10; NCA *et al*., 2024a, p. 91; NCA *et al*., 2024c, pp. 103–104). The *Taoshu*'s account of expenses for purchasing ceramic jars as glaze containers at the Imperial Porcelain Workshop corroborates this practice (Wang and Lu, 1597, p. 866). At Guanyinge, the discovery of an unglazed ceramic paddle-shaped tool further attests to the use of the coiling technique (NCA *et al*., 2024d, p. 36). Therefore, potters who manufactured these coiled jars likely possessed the foundational techniques that could be adapted for working with porcelain bodies—they could either extend their techniques to coiling larger vessels made of porcelain clay or adapt their skills to moulding.

While the coiling method was rarely employed for shaping Jingdezhen porcelain bodies other than dragon bowls, the moulding method was already widely used for manufacturing vases and

jars since the Yuan period. Archaeological materials from that period suggest the same production marks—clay slip or thin strips applied to join separately moulded body sections—that continued throughout the Ming period (Huang and Huang, 2007). Moulding marks appear on objects ranging from hand-sized vases to large incense burners whose maximum body width nearly matches that of smaller dragon bowls (Huang and Huang, 2007; BPM *et al*., 2015b, pp. 98–99). In this case, potters who employed the moulding method to dragon bowls likely drew upon their experience in shaping more substantial-sized porcelain vessels or adapted their existing techniques when transitioning to the coiling process.

Taken together, this case study of dragon bowl body preparation and forming processes suggests that the key to their successful production lay not in whether they were made at the Imperial Porcelain Workshop, but in the local ceramic traditions and production communities from which potters drew their expertise. Specifically, potters responded to unfamiliar clay properties, adapted their existing techniques to accommodate substantially increased vessel sizes, and navigated the interdependence of decisions across successive production stages. Their knowledge developed in practice during these processes, rather than being held as codifiable procedure. Central to recovering this knowledge was the macroscopic analysis of finished objects. Their surfaces preserve legible traces of the gestures and decisions that produced them, while ethnographic observation supplies the interpretive frame through which those traces could be read as technological choices. This combined approach has applicability beyond the present case to other crafts where production depends on embodied knowledge of variable raw materials, if the material constraints in question persist between past and present.

These findings also provide material and ethnographic support for the argument developed in Section 2.4.2 that process specialisation deepened rather than restricted the knowledge potters held. The evidence of skill transmission between forming methods shows that specialisation could deepen integrative knowledge extending well beyond one single task. Even though dragon bowls have long symbolised the technological prowess of imperial patronage in historical records, these findings call for a reconsideration of what that patronage entailed in technological terms, and of the relationship between institutional oversight and the production knowledge on which it depended.

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Chapter 6 Discussion: Reframing Porcelain Production in Jingdezhen

6.1 Questioning the imperial versus non-imperial divide

The preceding chapters have shown that the binary divide has been shaped by different yet intertwined perspectives: administrative oversight, historiography-driven archaeological fieldwork, and object classification in ceramic scholarship and connoisseurship. More importantly, they have contributed findings that call the divide into question. In this section, I draw those findings together to show that the divide cannot be sustained when the material evidence is examined from the standpoint of potters' technological choices. These choices were made within specific social contexts, and they both shaped and were shaped by the processes of making. Across the production sites that scholarship has labelled imperial and non-imperial, potters worked with the same local materials, shared manufacturing knowledge, and developed adaptive strategies through sustained mutual engagement in the craft.

From the perspective of administrative oversight, government officials drew the imperial and non-imperial divide in fiscal and institutional terms. As Chapter 2 shows, these officials understood imperial production in Jingdezhen as a means to fulfil the emperors' porcelain commissions, encompassing both production directly supervised by government officials and the acquisition of products from local ceramic production communities. After the establishment of the Imperial Porcelain Workshop during the Zhengde period, Wang Zongmu, who oversaw the fiscal administration of imperial production at the provincial level, drew a further distinction between production within the physical boundary of the Workshop and production beyond it. His claim of the Workshop's technological superiority served to justify the substantial expenditure of state resources, distinguishing the Workshop's products even from outsourced imperial orders produced by other local workshops. This boundary was thus at once physical and conceptual, but in neither sense did it mark a distinct mode of production. Beyond official histories and Wang Zongmu's accounts, contemporary textual sources show little awareness of such a divide. Instead, they document the networks of raw materials, potters, and their process-specialised expertise that sustained production both within the Workshop and beyond it.

From the perspective of archaeological fieldwork, archaeologists have redrawn the boundary in spatial and material terms, still guided by the administrative framework and quality claims established in Wang Zongmu's account. As Chapter 1 introduces, the Yuyaochang site was

identified as the location of the Imperial Porcelain Workshop on the basis that its excavated sherds matched pieces in the Ming imperial court collection housed in the Palace Museum, Beijing. Chapter 3 further demonstrates how this identification has shaped the interpretation of individual features. Scholars have interpreted boundary walls at Yuyaochang as the Workshop's perimeter, and read dedicated disposal pits as evidence of imperial quality control. These interpretations are not supported by the stratigraphic evidence. For instance, archaeologists reconstructed the Imperial Porcelain Workshop's physical boundary by matching architectural features recorded by Wang Zongmu with excavated remains at Yuyaochang. However, these 'exterior boundary walls' show long construction histories predating the documented establishment of the Workshop, calling into question their attribution to a single historical institution.

From the perspective of object classification in ceramic scholarship and connoisseurship, the boundary has been drawn in consumption-based terms. Building on the archaeological reconstruction of Yuyaochang as the Imperial Porcelain Workshop, scholars classified porcelain of high production quality as 'imperial', while the site's imperial attribution was in turn used to explain the quality of its products. The same consumption-based logic designated other sites, Guanyinge, Luomaqiao, and Hutian, as 'non-imperial'. The consumption contexts that scholars assigned to these sites were themselves derived from classifying excavated objects through stylistic comparison with the imperial court collection and from subjective assessments of production quality that followed Wang Zongmu's claims. The comparative analysis of archaeological features across the four manufacturing sites presented in Chapter 3 shows no distinct production practices corresponding to this classification. Potters across these sites shared fundamental manufacturing practices—reusing kiln waste in construction, designing pottery wheel foundations on common structural principles, and modifying kilns to improve firing performance. Where site-specific variation existed, it did not align with the supposed divide. On the contrary, 'non-imperial' sites sometimes showed greater investment in production infrastructure than Yuyaochang.

Underlying this classification are the stylistic differences and quality hierarchy that, as introduced in Chapter 1 and examined in Chapter 4, originated in late nineteenth-century European collecting circles. These circles distinguished pieces acquired from the imperial palace in Beijing during military plunders from export wares that had long circulated through commercial trade. The palace pieces became the standard of 'imperial quality' against which

all other Jingdezhen products were measured as ‘non-imperial’. While the divide rests on observable differences in finished products, these differences were identified from a limited group of wares whose characteristics were then used to classify further pieces as imperial, rendering the distinction circular.

Chapter 4 tests the ‘quality’ criterion by examining porcelain body compositions independently of classifications drawn from stylistic comparison and subjective production quality assessment. The analysis shows that both ‘imperial’ and ‘non-imperial’ wares utilised the same types of porcelain stone with or without kaolin additions, and that both were produced using reactive recipes through which potters navigated compositional variability in their raw materials. Aesthetic recipes pursuing whiter bodies also appeared in both categories, predominantly in middle-Ming Yuyaochang samples but also in late-Ming trade porcelain. Indeed, the range of compositional variation within ‘imperial’ porcelain was no narrower than the gap between the two categories. A dense, white, and vitrified body—the characteristics associated with high production quality—reflects how porcelain was made and what resources were invested, not simply for whom it was intended.

Taken together, each perspective captures something that corresponds to the imperial versus non-imperial divide, with a line drawn to encircle what counts as imperial. Yet in each case, the line separates categories that the material evidence shows to be connected through shared production organisation, overlapping manufacturing practices, and equivalent raw materials and recipes. What sustains the divide is not the evidence itself but the particular purposes each perspective serves: the administrative need to deliver imperial commissions and to justify state expenditure, the material manifestation of the Imperial Porcelain Workshop as an archaeological site, and the assertion of a superior ‘imperial quality’. The limitation of this binary framework, then, lies in the absence of a maker’s perspective grounded in Ming-period Jingdezhen potters’ decisions and in the actual processes of making. It is this perspective that the following section develops, by building parallels between past and present production to foreground the potters’ voices that neither textual accounts nor archaeological evidence can fully capture on their own.

6.2 Building parallel narratives between past and present in porcelain production

Throughout the thesis, I have drawn on present-day porcelain production in Jingdezhen not as a continuation of Ming-period practices but as a parallel narrative—one shaped by the same natural landscape yet situated within a fundamentally different social world. This section sets out what grounds this parallel, where it holds, and where its limits lie.

What makes comparison possible is the natural landscape within which potters in both periods have worked. I have shown (Chapter 4) how the raw materials available to Jingdezhen potters derive from the same geological formation processes that have supplied porcelain stone since ceramic production began in at least the tenth century (JPICRA *et al*., 2007, p. 1). The intra- and inter-source variability that Ming-period potters navigated is itself an outcome of how these raw materials formed through granitoid transformation, and remains a defining condition for potters using local materials today. However, not all variability is geological in origin. The progressive extraction of porcelain stone deposits, which exhausted the more weathered surface layers, was itself the principal driver behind the adoption of kaolin addition. This extraction history is not one that modern potters necessarily share, given that contemporary quarrying reaches depths and deposits that were inaccessible through earlier methods of surface extraction (Zheng, 2022, pp. 99–100). Furthermore, the physical properties of these materials, in terms of their performance throughout all production stages, are determined by mineralogy and physics, not by how production was organised or in what period. It is this constancy that allows present-day practice to inform our understanding of Ming-period potters' decision parameters in production.

These constraints are not merely contextual to specific manufacturing processes but define what porcelain production can be, in the sense that porcelain can only be made in certain ways. Both modern and Ming-period potters have had to navigate between competing material properties of their raw materials for dragon bowl bodies, such as plasticity, slump risk, shrinkage rate, vitrification, and workable firing range. These properties are determined by physical principles that no administrative arrangement can override. The extent to which directives from the overseer of imperial production could 'control' the production process was limited by the fundamental properties of the material themselves. The emperors and appointed administrators of imperial production could determine what was commissioned, how much was spent, and who bore responsibility for delivery. But they could not prescribe how a particular batch of porcelain stone would perform, or how a potter should adjust the kaolin ratio when

the material's behaviour differed from the previous batch. These were decisions embedded in the physical realities of production, made by potters drawing on knowledge developed through practical testing, adjusted paste recipes, and adapted forming techniques.

Through comparing ethnographic data with the *Taoshu*'s account, Chapter 5 shows that potters in the past and present have responded to the challenges of making large-sized dragon bowls by adjusting porcelain stone-kaolin ratios, adding coarse inclusions, and managing the interdependence of decisions across successive production stages of forming and firing. These convergences persist even though the circumstances under which potters undertook this work and the channels through which their products circulated differed profoundly. Such evidence does not imply an unbroken tradition but indicates shared responses to the same material demands. In this regard, ethnographic observation and interviews capture the practical reasoning through which Ming-period potters arrived at specific raw material choices and production processes—reasoning that the *Taoshu* and other production treatises examined in this thesis documented only as outcomes.

But if the natural landscape grounds parallel, the cultural landscape marks its limits. The informants interviewed during this thesis's ethnographic fieldwork are owners of their own workshops, deciding what materials to source, which commissions to accept, and which potters to hire. Ming-period potters may have worked under varying degrees of government oversight, with access to resources shaped by the conditions of the workshops to which they were attached. Moreover, although both past and present potters produced dragon bowls, the two informants work toward a known product that they study and replicate by drawing on published scholarship and museum collections. Ming-period potters possessed no such retrospective knowledge. They were working at the edge of what was technically achievable with the raw materials available to them and the techniques they had developed, adapting both to meet the demands of new and challenging vessel forms.

The socio-economic settings of handicraft production in which modern potters work have, however, at times been projected uncritically onto understandings of historical production. From Chapter 2, we see that process specialisation in the context of Ming-period porcelain production in Jingdezhen is largely understood as potters confined to specific roles within production stages, where each role was assigned specific tasks and therefore required little knowledge of the full production sequence. This reading of labour division draws heavily on

modern ethnographic accounts. At the most extreme is the factory model developed after the 1950s. As Gillette (2016, pp. 64–71) documents, Jingdezhen's porcelain industry was reorganised from thousands of small, independently operated workshops into large state-owned and collective enterprises between 1953 and 1956. Within each factory, workers were allocated to narrowly defined tasks along the production line, and most hand-made forming processes were replaced by machinery (Gillette, 2016, p. 72). Such an arrangement was not an outgrowth of any longstanding craft tradition, but was imposed by a specific state planning regime that collectivised production and directed labour allocation for economic growth (Gillette, 2016, pp. 71–72).

Other ethnographic scenarios present different possibilities, where handicraft production relied on potters who possessed specialisations defined by specific tasks such as throwing, moulding, trimming, painting, glazing, and firing (Jiang, 1959, pp. 168–182; Fang, 2002, pp. 143–171). Before the 1950s, these potters typically worked within small, independently operated workshops employing around ten workers, either as apprentices or contract labourers attached to these workshops (Fang, 2002, p. 147; Liu, 2010, pp. 92–94). From the late 1970s onwards, a similar task-based division re-emerged under private market conditions, but under different employment arrangements. Workshop owners hire potters for specific skills, and these potters are usually paid by the piece and hired by the order (Gillette, 2016, pp. 125–126). In both cases, production is organised around potters who specialise in particular tasks but work within smaller units rather than along industrialised assembly lines.

While Chapter 5 reports an ethnographic study of modern potters specialised in coiling and moulding, no direct equivalence is drawn between them and Ming-period potters who excelled at particular skills that distinguished them as subgroups within the broader ceramic production communities. The methodology remains grounded in the shared physical processes through which ceramics are formed, but the ethnographic study makes its contribution by recording how forming methods leave observable production marks on dragon bowl bodies and how skills transmit between the two process specialisations through the shared use of certain techniques. Such evidence would be unrecoverable from Ming-period material alone. Using ethnographic observation to inform the production mark analysis, I have identified potential pathways through which Ming-period potters developed dragon bowl forming skills. Potters specialised in moulding porcelain vessels could extend their practices to larger vessels, or adapt their expertise to coiling. Potters specialised in coiling pottery or stoneware vessels could adapt

their expertise to coiling different body materials, or to moulding. These adaptation processes were not directed by administrators' initiatives in fulfilling imperial commissions, but made possible by Jingdezhen potters' knowledge of their materials and their accumulated expertise in working with them.

The parallel between past and present, then, is not a claim of continuity but a methodological approach. This approach is grounded in the constancy of material constraints and uses that constancy to recover potters' decisions, while remaining attentive to the different social worlds in which those decisions were made. It is on this basis that the following section proposes an alternative framework for understanding Jingdezhen's porcelain production, one that centres potters as agents within an integrated ceramic production system.

6.3 Reconsidering the local porcelain production system from a potter's perspective

The preceding sections have shown that the imperial versus non-imperial divide cannot be sustained when the material evidence is examined from the standpoint of potters' technological choices (Section 6.1), and that the constancy of material constraints provides a basis for recovering those choices through ethnographic parallel (Section 6.2). This section draws on both arguments to propose a maker-centred account of Jingdezhen's porcelain production, one that defines the production system through the materials, knowledge, and process specialisation that constituted production itself.

Archaeological approaches to craft production have long recognised that production systems are multidimensional. Costin (1991) proposed that the organisation of production be analysed through four parameters: context (the nature of control over production and distribution, from independent to attached), concentration (the geographic dispersal or aggregation of producers), scale (the size and composition of the production unit), and intensity (the amount of time spent on production). In a subsequent elaboration of this framework, Costin (2001) expanded these parameters into six constituent components of the production system and renamed the third parameter 'constitution', shifting emphasis from the size of the production unit to the relationships among producers and the internal structure of work groups. The value of such an approach, as Costin (2001, p. 277) argues, is that it permits greater flexibility and specificity in describing the organisation of production, as individual cases do not have to be fit into static types or categories.

Subsequent ethnoarchaeological and archaeological studies have tested, refined, and complicated these parameters. Regarding constitution, Underhill (2003) demonstrates that what is typically classified as 'household production' is not a stable unit with a fixed productive capacity but a changing composition of labour. Even where a single potter shaped all the vessels, production depended not on that individual alone but on the availability of family members to assist with time-consuming tasks such as clay preparation and to take over agricultural labour (Underhill, 2003, p. 206). Regarding context, Flad (2008) critiques the fixed association between product type and production organisation—prestige goods made by attached specialists, who are sponsored and supported by elites, and utilitarian goods made by independent specialists, who produce for a competitive, demand-driven market. His study of salt production at Zhongba in the Three Gorges region shows that the same utilitarian product, salt, was produced initially by small groups with no archaeological evidence of attachment, and later under the control of an emergent elite whose authority was based in part on ritual knowledge, even as the product itself remained a basic commodity (Flad, 2008, pp. 119–122). Regarding intensity, Hein *et al*. (2020, p. 69) show that within a single community of potters, intensity of production can vary considerably between individuals and even between years for the same individual, depending on seasonal constraints, family circumstances, market demand, and shifts in political-economic regime, calling into question common archaeological categories such as part-time or full-time production. Regarding concentration, Živković *et al*. (2021) show that even spatially concentrated production (defined as potters working in the same urban quarter, drawing on the same local clays) can encompass a plurality of technological choices, with individual potters sharing a common understanding of vessel morphology while exercising distinct decisions at different stages of the production sequence.

These studies share a common implication that production, even when bound to a given institution or geographic locale, is more internally varied than classificatory models of production organisation allow. The Jingdezhen case examined in this thesis points in the same direction, but from a different angle. The reason why the imperial versus non-imperial divide cannot be sustained is not that each category contains internal variation, but that neither category represents a distinct mode of production in the first place. The potters, materials, recipes, and manufacturing knowledge cross the boundary between them. A potter-centred redefinition of the production system must therefore begin not with the parameters that characterise individual production units, but with what potters across those units shared.

The first defining feature of Jingdezhen's production system is its material grounding in the local geological landscape. Chapter 4 has established that the raw materials for porcelain bodies derive from granitoid transformation, and that the intra- and inter-source variability these materials exhibit is an outcome of those geological processes that Ming-period potters navigated and that potters using local materials continue to navigate today. Chapter 5's analysis of past and present potters' decisions in balancing competing material properties further shows that the mineralogical and physical characteristics of these raw materials are the fundamental constraints shaping any given manufacturing process. Hein *et al*. (2020) emphasise the local environment as a precondition of production, a factor that conditions technological choices and organisational responses. The present study extends this insight by treating the geological landscape not only as a conditioning factor but as a constitutive feature of the production system itself, setting the terms of what porcelain production at Jingdezhen can be.

The second defining feature is that the system's capacity resides in Jingdezhen potters' accumulated, embodied knowledge and skills. Ingold's account of craft making helps clarify the distinctive character of such knowledge and its significance to the production system. For Ingold (2000), 'skill' is tacit, subjective, and practical, not stored in the mind as a set of rules but located at the interface between the skilled person and their surroundings. In the case of Ming-period dragon bowl production, for instance, this 'skill' was exercised when potters decided how many coarse inclusions to add to the paste, how much water to add to shape the coils, and to what extent the coils needed to be smoothed and dry before applying the next. As Gosden and Malafouris (2015) argue, such making entails a responsive interaction between bodies and materials, a form of intelligence that does not primarily involve meanings that can be put into words.

This understanding of technological knowledge and skills has direct implications for how historical textual accounts should be read. While specific body recipes and production processes could be recorded by an overseer or observer, as by the authors of the *Taoshu* and the *Taoshan*, only the potters as practitioners held the knowledge of *how*—knowledge exercised in the act of making. As Section 6.2 has shown, from past to present, the institutional arrangements under which potters worked, whether the Imperial Porcelain Workshop or state factories, could determine what materials were accessible to them or even the specific tasks they were assigned, but not the craft knowledge through which they responded to those

materials, knowledge that was generated only in the process of making. In a production system sustained by such expertise, the potters' embodied knowledge and skills constitute its operative core.

The third defining feature concerns how labour is organised by the principle of process specialisation, rather than by household, kinship group, or guild that structured production in other studied cases of craft production (e.g., Underhill, 2003; Yi, 2004; Eyferth, 2009). As Chapter 2 reports, Ming-period Jingdezhen potters who excelled at particular skills for certain production stages were recognised as subgroups within broader ceramic production communities. These subgroups were not rigid. Potters could possess more than one skill and move between groups. What made this form of organisation possible was the condition established by the preceding two features: potters within the same specialisation, whether throwers, moulders, painters, or kiln firers, faced the same production stages and therefore encountered the same materials, whether porcelain clay, glaze, or decorating pigments. The physical properties of these materials imposed common technical demands on each group, while the specific material behaviours that each stage had to navigate differed. Process specialisation was therefore not an arbitrary division of labour but one grounded in the material itself, with each task requiring its own accumulated expertise in responding to a common set of constraints.

In a production system organised by process specialisation, potters were mobile across different production units—not in the sense that they worked unattached to particular workshops or free from the labour obligation systems that could enlist them, but in the sense that their identity derived from what they could do, not from where they were employed. The same throwers, moulders, painters, or kiln firers might work for the Imperial Porcelain Workshop on one commission, for a local workshop on another, or produce within their own household. Process specialisation also structured how knowledge was transmitted. Ethnographic fieldwork (Section 5.2.3) has shown how potters skilled in one forming method, moulding, for example, could adapt their techniques to related methods such as coiling, and it was through such cross-method adaptation that dragon bowl forming skills developed (Section 5.3.3).

Taken together, these three features define a production system that is prior to and independent of specific production contexts. While different production activities, whether at the Imperial Porcelain Workshop or other local workshops, bear varied relationships between producers and

those who commission or consume their products, these contexts overlay one integrated production system rather than constituting separate ones. From a maker-centred perspective, the finished products of this system are understood as outcomes of resource investment and potters' choices within a shared field of technical possibility—choices about raw materials, paste recipes, forming techniques, and firing conditions that were made within the same material repertoire regardless of who commissioned the work. To be clear, this thesis does not claim that Jingdezhen potters operated autonomously. Rather, it shows that even under direct administrative oversight, the decisions to determine how porcelain was actually made remained with the potters, exercised through their embodied knowledge at the point of engagement with their materials. The maker-centred perspective applied in this thesis does not diminish the role of institutions but specifies what they could and could not control, and identifies where the productive capacity of the system actually resided.

At the same time, I fully acknowledge that blue-and-white porcelain production in Ming-period Jingdezhen was more broadly socially embedded—shaped not only by potters' interactions with their materials but by the social relationships that mediated between the makers and the objects they produced. The case of dragon bowl production is a vivid example. Imperial commissions for unprecedentedly large vessels drove potters to adapt their paste recipes, drawing on resource networks that extended beyond the small town through the intermediary of raw material suppliers. While this thesis has focused on what potters shared across the supposed imperial versus non-imperial divide, it has also uncovered complexity and variation within the production system—in different priorities of production volume or quality within a single manufacturing site, in the compositional variability of porcelain bodies, and in the different pathways through which forming skills developed.

Future research could therefore look past a straightforward division between producer and consumer to address the fuller range of social relationships and the mechanisms through which these relationships sustained production and mediated the ways potters directed their products toward different outlets. As just discussed, the integrated production system proposed in this thesis moves beyond the one-sided perspectives of administrative oversight and consumption-based classification. This maker-centred system provides a foundation from which the more complex and diverse interactions within and across the production communities can be investigated.

Chapter 7 Conclusion

This thesis has examined the extent to which the imperial and non-imperial divide can be sustained when applied to Ming-period blue-and-white porcelain production in Jingdezhen, what the new material evidence shows when examined on its own terms rather than through this framework, and what alternative approach can better account for the complexity of porcelain production across the supposed divide. The findings across Chapters 2 to 6 converge on a single conclusion: the imperial and non-imperial divide does not correspond to two distinct modes of production. The textual accounts, critically read, already show the interdependence of imperial and local manufacture. Treating the archaeological and archaeomaterial evidence of production as an independent source rather than a corroboration of these accounts, I have shown shared manufacturing practices, common raw material strategies, and comparable compositional variability in the finished wares across the supposed boundary. The material evidence shows further that imperial production depended on the wider world of local manufacture, a dependence visible not in administrative arrangements alone but in the shared practices of making themselves, grounded in the local materials as well as in the knowledge and skills developed through working with them.

On this basis, I have proposed an alternative framework centred on potters as agents within an integrated production system that offers a more adequate account of the evidence. This system, defined by its material grounding in the local geological landscape, knowledge-based practice, and process specialisation, reframes what has been treated as a categorical divide as variation within a single field of production shaped by different relationships between producers, sponsors, and consumers. This chapter considers what the Jingdezhen case contributes to wider discussions of craft production and identifies directions for future research.

Beyond the Jingdezhen case itself, this thesis creates an opportunity to examine more closely the relationship between attached production, task allocation, and production knowledge. Costin (2001) characterises the relationship between producers and consumers in terms of who is empowered to make decisions about the components of the production system: the means of production, the organisation of labour, the visual appearance of objects, and the principles and mechanisms of distribution. Some degree of attached production, she argues, occurs when the right to make decisions about any of these components is vested in individuals or institutions external to the production unit, though not all components need to be controlled directly, and

the locus and nature of control varies depending on which aspects can be controlled feasibly (*ibid*.). However, the Jingdezhen case suggests that the relationship between these components, particularly between the organisation of labour and the means of production, may be more entangled than this analytical separation implies, particularly when considered from the perspective of how specialist knowledge is developed and practised.

As I have shown, the task allocation practised at the Imperial Porcelain Workshop or any other production units where potters were attached was not only a top-down institutional assignment but in turn drew upon pre-existing groups whose social ties had formed through shared specialist knowledge and sustained mutual engagement in practice. Within these groups, specialisation deepened rather than restricted the knowledge practitioners held, even though their daily practice may have concentrated on a single stage. This knowledge formation process sits uneasily with Rice's (2015, pp. 540–541) influential model, which argues that the task confinement of process specialisation restricts artisans' knowledge when they perform narrowly defined tasks. The dragon bowl case shows that these two features need not go together: task confinement and knowledge restriction are not necessarily linked, since the material demands of a given stage may require practitioners to hold integrative knowledge that extends well beyond the task they perform. Potters specialised in one forming method held knowledge of how clay responded to specific techniques, and this knowledge could become the basis for adapting those techniques to another method, so that mastering one method entailed knowledge extending well beyond it.

That specialist knowledge developed beyond the reach of institutional control also means it lay beyond the reach of the textual accounts through which institutions documented production. Even accounts written not by production overseers but by general observers capture only the observable outputs of production, such as what raw materials were acquired, what labour divisions were in place, and what vessels were produced. These are outcomes shaped by institutional aims of constraining production costs, allocating workforce, and fulfilling specific consumption needs, not records of the embodied knowledge through which potters actually negotiated the properties and demands of their materials and translated institutional requirements into working practice. The gap between recorded procedure and embodied practice is not unique to ceramics. It is a structural feature of any craft tradition in which making involves the responsive negotiation of variable materials—a feature that historical texts,

however detailed in their documentation of procedures and organisational arrangements, are unlikely to capture.

This is where the methodological approach developed in the thesis makes its most distinctive contribution, and arguably its most transferable one to the study of craft production and material engagement. The methodology uses ethnographic observation to identify the material constraints inherent in Jingdezhen's raw materials, and treats these as the interpretive ground on which archaeological and compositional evidence of past production decisions can be read subject to specific social conditions. In doing so, it recovers the decision-making processes through which potters navigated these constraints—processes that constitute their embodied knowledge. While I have critically examined how different agendas, credibility, nuance, and context shaped what Ming-period textual accounts of porcelain production recorded and left out, the absence of such embodied knowledge is not a product of any particular agenda but is inevitable, because it does not exist as a set of stable propositions. It emerged from the responsive interaction between the potter's accumulated experience and the material's behaviour, a process in which thinking occurs through the transformation of material rather than prior to it.

The methodology developed in this thesis focuses on porcelain body compositions and the forming processes, but the same principle of reading production decisions grounded in material constraints applies equally to dimensions of porcelain production that this thesis has not addressed in depth. Glazes and decoration represent the most immediate extensions for future research. Body, glaze, and decoration are not independent domains but interdependent choices within a single production process. The body composition affects glaze behaviour during firing, while the colouring effect of cobalt decoration is shaped in part by the properties of the overlying glaze (Pinto *et al*., 2020). Recovering the decisions potters made in coordinating these domains would allow a substantially fuller account of the production cycle and of the material compromises involved, but the complexity and multifactorial nature of these mechanisms requires dedicated research beyond what this thesis could undertake.

At the same time, the compositional approach to body materials pursued in the thesis could be further refined. Major-element analysis, while effective in distinguishing broad raw material strategies and identifying distinctive paste recipes, cannot always resolve the question of whether observed compositional variation reflects the mixing of different raw material sources

or natural variability within a single source. Trace-element analysis and isotopic characterisation offer the potential to fingerprint raw materials with sufficient precision to recognise mixing unequivocally. Such work would require corresponding geological sampling of the raw material sources themselves, which represents a major undertaking with substantial potential to place the interpretation of production choices on firmer empirical ground.

The recognition that potters' knowledge is exercised in the act of making, rather than held as codifiable procedure, has direct implications for how the *chaîne opératoire* should be applied and interpreted. Santacreu (2014, pp. 57–59) argues that the *chaîne opératoire* should not be read as a sequence of independent stages, each carrying its own discrete significance, but as an interconnected process in which choices at one stage reshape the meaning and possibilities of choices at others. In practice, however, the framework has most commonly been applied as a way of organising the sequence of production stages, and the compromises it documents tend to be read as trade-offs between the technical demands of successive stages (*ibid*.).

The Ming-period Jingdezhen case demonstrates that some of the most consequential decisions in a production system may be driven by demands that originate in domains the production sequence does not capture, such as the pursuit of whiteness or monumental size that carry symbolic weight beyond functional necessity. These demands are realised through the production sequence, but they cannot be explained by it alone. As Santacreu (2014, p. 240) further argues, even when potters give a functional meaning to their technical behaviour, this does not preclude their practices having social significance. Technological choices, he suggests, should be seen as closely related to *habitus*, the unconscious schemes that individuals assimilate along their lives and that generate and regulate their practice (Bourdieu, 1990, p. 54; Santacreu, 2014, pp. 198–199). In the Jingdezhen case, these schemes were shaped by sustained engagement with specific materials, making the connection between practice and social formation visible in a concrete way. Potters navigated competing material demands through the sensorial and physical experience of making, and in doing so developed specialist skills that were shared within production groups. These shared skills in turn constituted the social tie that bound such groups together, sustaining the process specialisation that organised Jingdezhen's production system and reinforcing the very expertise on which it depended.

The broader applicability of this thesis's framework can be considered in relation to craft traditions beyond ceramics where similar dynamics may be at work. The principle that material

constraints provide a common ground for interpreting production choices applies wherever the physical properties of raw materials impose demands that artisans must navigate through accumulated skill. In Shang-period China, expertise in high-temperature ceramic firing became the basis for complex bronze casting—a case in which embodied knowledge developed through sustained engagement with one material was redirected to serve different social demands in another (Pollard and Gosden, 2023, p. 32). In iron smelting across sub-Saharan Africa, ethnoarchaeological studies have shown that smelters were perceived in many societies as different ontological categories of people, often with important ritual roles or as possessors of dangerous knowledge, and that the smelting process itself was understood through metaphors linking high-temperature transformation with human reproduction (for a summary of such research, see Lyons and David, 2019, p. 108). Their ontological distinctiveness was inseparable from their engagement with specific ores and the thermal processes those ores demanded. It was the technical processes shared through sustained interaction with these materials that constituted the social bond among smelters, a bond maintained across different societal contexts that perceived them as distinct categories of people.

What I contribute is not simply a further example of such dynamics but a methodology for recovering them. It grounds interpretation in independently measurable material constraints, so that the embodied knowledge through which artisans navigated those constraints can be identified in the material records rather than inferred from textual or ethnographic accounts alone. The social formations that emerged from shared practice become visible through the same evidence. Because the Jingdezhen case allows the trade-offs between the technical constraints of production and demands originating beyond the production sequence to be specified through analysis of compositional data and production marks, it demonstrates that this kind of argument can be tested against material evidence, not just proposed as a plausible reading. In doing so, I have sought to recover Jingdezhen's potters as agents whose knowledge and choices stood behind the objects that entered the global circulations of the early modern world. The methodology developed here offers one way of listening to what those objects have to say about the potters and the social world they inhabited.

Appendix A: Supplementary Materials for Chapter 3

Table A-1: Summary of archaeological site categories in Jingdezhen

Site Name	Period	Category	Archaeological Research Type(s)	Publication Status	Reference
Ciqishan (瓷器山)	Early Ming	Manufacturing site	Planned excavation	One preliminary excavation report	BPM *et al*., 2007
Guanyinge (觀音閣)	Middle–late Ming	Manufacturing site	Survey and planned excavation	Five preliminary excavation reports	SAM-PKU *et al*., 2009
Yuyaochang (御窯廠)	Ming	Manufacturing site	Survey, rescue excavation, and planned excavation	Five preliminary excavation reports	Jiang, 2020a
Luomaqiao (落馬橋)	Ming	Manufacturing site	Rescue excavation and planned excavation	Two preliminary excavation reports	JCARI *et al*., 2020
Hutian (湖田)	Ming	Manufacturing site	Survey and planned excavation	Full excavation report	JPICRA *et al*., 2007
Jinjianong (金家弄)	Ming	Manufacturing site	Rescue excavation	Survey records	Cao, 2020, cited from Gao, 2021, p. 17; Zhang, 2022
Yaoli (瑤裡)	Early–mid-Ming	Kiln waste disposal site	Survey	Survey records	Jiang, 2013a
Shibadu (十八渡)	Early–mid-Ming	Kiln waste disposal site	Survey	Survey records	Huang, 1986; Zhen, 1986
Situli (四圖裡)	Ming	Kiln waste disposal site	Survey	Survey records	Zhen, 1986; Bai, 2014
Yangfushan (旸府山)	Mid-Ming	Kiln waste disposal site	Survey	Survey records	Chen and Liu, 2016
Zhijiangchang (製醬廠)	Ming	Sherd disposal site	Survey	Survey records	Bai, 2014
Cidudaqiao (瓷都大橋)	Early–mid-Ming	Sherd disposal site	Survey	Survey records	Gao, 2021, p. 324
Chenjiajie (陳家街)	Mid-Ming	Sherd disposal site	Survey	Survey records	Huang, 1986

Dongjiawu (董家塢)	Mid-Ming–post 1620s	Sherd disposal site	Survey	Survey records	Jiang, 2013a
Yanghushuichang (洋湖水廠)	Ming	Sherd disposal site	Survey	Survey records	Zhen, 1986
Laoyatan (老鴉灘)	Ming	Sherd disposal site	Survey	Survey records	Zhen, 1986
Zhangshuxia (樟樹下)	Ming	Sherd disposal site	Survey	Survey records	Zhen, 1986
Di'sanzhongxue (第三中學)	Ming	Sherd disposal site	Survey	Survey records	Cao, 2020, cited from Gao, 2021, p. 17
Chayuantang (茶園塘)	Ming	Sherd disposal site	Survey	Survey records	Huang, 1986
Zhongdukou (中渡口)	Ming	Sherd disposal site	Survey	Survey records	Cao, 2020, cited from Gao, 2021, p. 17
Zhanjiashangnong (詹家上弄)	Ming	Sherd disposal site	Survey	Survey records	Bai, 2014
Laoluohandu (老羅漢肚)	Ming	Sherd disposal site	Survey	Survey records	Gao, 2021, pp. 16, 330
Qunyingtang (群英堂)	Ming	Sherd disposal site	Survey	Survey records	Bai, 2014
Daijianong (戴家弄)	Ming	Sherd disposal site	Survey	Survey records	Liu and Liu, 2008
Huayuanli (花園里)	Ming	Sherd disposal site	Survey	Survey records	Jiang, 2013b
Xiaogangzui (小港嘴)	Ming	Sherd disposal site	Survey	Survey records	Bai, 2014
Renmincichang (人民瓷廠)	Late Ming–post 1620s	Sherd disposal site	Survey	Survey records	Cao, 2004
Lianhualing (蓮花嶺)	Late Ming–post 1620s	Sherd disposal site	Survey	Survey records	Cao, 2004
Shenglilu (勝利路)	Late Ming–post 1620s	Sherd disposal site	Survey	Survey records	Cao, 2004
Lianshelu (蓮社路)	Late Ming–post 1620s	Sherd disposal site	Survey	Survey records	Bai, 2014; Jiang, 2013a
Guihuanong (桂花弄)	Late Ming–post 1620s	Sherd disposal site	Survey	Survey records	Cao, 2004

Shibaqiao (十八橋)	Late Ming–post 1620s	Sherd disposal site	Survey	Survey records	Cao, 2004
Saibaotan (賽寶坦)	Late Ming–post 1620s	Sherd disposal site	Survey	Survey records	Jiang, 2013a
Dongfengcichang (東風瓷廠)	Late Ming–post 1620s	Sherd disposal site	Survey	Survey records	Gao, 2021, p. 420
Zhushanxilu (珠山西路)	Late Ming–post 1620s	Sherd disposal site	Survey	Survey records	Jiang, 2013b
Zhejianglu (浙江路)	Late Ming–post 1620s	Sherd disposal site	Survey	Survey records	Cao, 2020, cited from Gao, 2021, p. 17
Chenjianong (陳家弄)	Late Ming–post 1620s	Sherd disposal site	Survey	Survey records	Cao, 2020, cited from Gao, 2021, p. 17
Diancichang (電瓷廠)	Late Ming–post 1620s	Sherd disposal site	Survey	Survey records	Cao, 2004
Sanlvmiao (三閭廟)	Late Ming–post 1620s	Sherd disposal site	Survey	Survey records	Bai, 2014

Table A-2: Geographic information on archaeological sites in Jingdezhen (detailed reference see Table A3-1)

Site Name	Geographic Location				Geographic Coordinates		Reference for Geo Coordinates
	Address	Village	Town	Country/District	Longitude	Latitude	
Ciqishan (瓷器山)	Ciqishan (瓷器山)	Pengjiacun (彭家村)	Liyang (麗陽鎮)	Changjiang (昌江區)	117.07492	29.08587	Estimated from google earth
Guanyinge (觀音閣)	Guanyinge Waterworks (觀音閣水廠)	/	/	Zhushan (珠山區)	117.202543	29.316686	Estimated from google earth
Yuyaochang (御窯廠)	Zhuashan Blvd (珠山大道)	/	/	Zhushan (珠山區)	117.206088	29.294556	Estimated from google earth
Luomaqiao (落馬橋)	Zhonghua S Rd (中華南路)	/	/	Zhushan (珠山區)	117.210517	29.281802	Estimated from google earth
Hutian (湖田)	/	Hutian (湖田村)	Jingcheng (竟成鎮)	Zhushan (珠山區)	117.255652	29.282544	Estimated from google earth
Jinjianong (金家弄)	Jinjia Ln (金家弄)	/	/	Zhushan (珠山區)	117.20719	29.284486	Estimated from google earth
Yaoli (瑤裡)	/	Yaolicun (瑤裡村)	Yaoli (瑤裡鎮)	Fuliang (浮梁縣)	117.583451	29.545101	Estimated from google earth
Shibadu (十八渡)	Yanjiang W Rd (沿江西路)	/	/	Changjiang (昌江區)	117.19656	29.284789	Estimated from google earth
Situli (四圖裡)	Qingtang Rd (青塘路)	/	/	Zhushan (珠山區)	117.200566	29.312569	Estimated from google earth
Yangfushan (旸府山)	Yangfu Mt (旸府山)	/	/	Changjiang (昌江區)	117.191894	29.318089	Estimated from google earth
Zhijiangchang (製醬廠)	Near Changjiang Blvd (近昌江大道)	/	/	Zhushan (珠山區)	117.204937	29.308587	Estimated from google earth
Cidudaqiao (瓷都大橋)	Northern of the Cidu Great Bridge (瓷都大橋北)	/	/	Zhushan (珠山區)	117.201636	29.3091	Estimated from google earth

Chenjiajie (陳家街)	Near Zhonghua S Rd (近中華南路)	/	/	Zhushan (珠山區)	117.211498	29.286852	Estimated from google earth
Dongjiawu (董家塢)	Xin'an Rd (新安路)	/	/	Zhushan (珠山區)	117.214262	29.316023	Estimated from google earth
Yanghushuichang (洋湖水廠)	Jingbei Blvd (景北大道)	/	/	Zhushan (珠山區)	117.21408	29.31587	Estimated from google earth
Laoyatan (老鴉灘)	Laoyatan Rd (老鴉灘路)	/	/	Zhushan (珠山區)	117.2237	29.281999	Estimated from google earth
Zhangshuxia (樟樹下)	Taoxichuan N Rd (陶溪川北路)	/	/	Zhushan (珠山區)	117.237939	29.298583	Estimated from google earth
Di'sanzhongxue (第三中學)	671 Zhongshan N Rd (中山南路 671 號)	/	/	Zhushan (珠山區)	117.203079	29.298942	Estimated from google earth
Chayuantang (茶園塘)	Near Zhonghua N Rd (近中華北路)	/	/	Zhushan (珠山區)	117.20393	29.303475	Estimated from google earth
Zhongdukou (中渡口)	Yanjiang E Rd (沿江西路)	/	/	Zhushan (珠山區)	117.202392	29.298186	Estimated from google earth
Zhanjiashangnong (詹家上弄)	Zhanjia upper Ln (詹家上弄)	/	/	Zhushan (珠山區)	117.204063	29.297037	Estimated from google earth
Laoluohandu (老羅漢肚)	Near Zhonghua N Rd (近中華北路)	/	/	Zhushan (珠山區)	117.20722	29.294937	Estimated from google earth
Qunyingtang (群英堂)	178 Lianshe N Rd (蓮社北路 178 號)	/	/	Zhushan (珠山區)	117.21102	29.29842	Estimated from google earth
Daijianong (戴家弄)	Daijia Ln (戴家弄)	/	/	Zhushan (珠山區)	117.2068	29.28652	Estimated from google earth
Huayuanli (花園里)	Zhongshan S Rd (中山南路)	/	/	Zhushan (珠山區)	117.20707	29.290941	Estimated from google earth
Xiaogangzui (小港嘴)	South of Shuguang Rd (曙光路南側)	/	/	Zhushan (珠山區)	117.215133	29.276141	Estimated from google earth
Renmincichang (人民瓷廠)	22 Doufu Ln (斗富弄 22 號)	/	/	Zhushan (珠山區)	117.20458	29.296574	Estimated from google earth

Lianhualing (蓮花嶺)	Northewest of Lianhuatang Rd (蓮花塘路西北側)	/	/	Zhushan (珠山區)	117.209003	29.300963	Estimated from google earth
Shenglilu (勝利路)	Shengli Rd (勝利路)	/	/	Zhushan (珠山區)	117.20972	29.296519	Estimated from google earth
Lianshelu (蓮社路)	Lianshe Rd (蓮社路)	/	/	Zhushan (珠山區)	117.218802	29.29408	Estimated from google earth
Guihuanong (桂花弄)	Guihua Ln (桂花弄)	/	/	Zhushan (珠山區)	117.206505	29.291882	Estimated from google earth
Shibaqiao (十八橋)	Near Mashi Ln (近麻石弄)	/	/	Zhushan (珠山區)	117.209791	29.290678	Estimated from google earth
Saibaotan (賽寶坦)	152 Jiefang Rd (解放路 152 號)	/	/	Zhushan (珠山區)	117.214283	29.291388	Estimated from google earth
Dongfengcichang (東風瓷廠)	Lianshe S Rd (蓮社南路)	/	/	Zhushan (珠山區)	117.214959	29.293484	Estimated from google earth
Zhushanxilu (珠山西路)	Near Zhushan Blvd (近珠山大道)	/	/	Changjiang (昌江區)	117.183688	29.27342	Estimated from google earth
Zhejianglu (浙江路)	Zhejiang Rd (浙江路)	/	/	Zhushan (珠山區)	117.207156	29.284431	Estimated from google earth
Chenjianong (陳家弄)	Chenjia Ln (陳家弄)	/	/	Zhushan (珠山區)	117.208075	29.287373	Estimated from google earth
Diancichang (電瓷廠)	North of Zhejiang Rd (浙江路北側)	/	/	Zhushan (珠山區)	117.211988	29.286	Estimated from google earth
Sanlvmiao (三閭廟)	Northeast of Nanjing E Rd (南京東路西北側)	/	/	Changjiang (昌江區)	117.192985	29.305764	Estimated from google earth

Appendix B: Supplementary Materials for Chapter 4

Table B-1: Overview of raw material sample information

No.	Raw material source (original romanisation)	Raw material source (standardised pinyin)	Sample condition	Sample provenance	Reference
RYL1	Siao-ly	Yaoli	Raw rock	Collected by Father Joseph Ly (1803–1854) from local potters in Jingdezhen	Ebelman and Salvetat, 1850
RYL2	Yaoli	Yaoli	Raw rock	Collected in Jingdezhen	Zhang, 1950
RYL3	Yaoli	Yaoli	Raw rock	Geological survey	JPCIRI, 1973
RYL4	Yaoli	Yaoli	Raw rock	Geological survey	Zhang, 1981
DYL3	Yaoli	Yaoli	Earth brick	Processed from geological sample	JPCIRI, 1973
PYL1	Siao-ly	Yaoli	Clay paste	Collected by Father Joseph Ly (1803–1854) from local potters in Jingdezhen	Ebelman and Salvetat, 1850
PYL3	Yaoli	Yaoli	Clay paste	Processed from geological sample	JPCIRI, 1973
RSBP1	San-pao-pong	Sanbaopeng	Raw rock	Collected by Father Joseph Ly (1803–1854) from local potters in Jingdezhen	Ebelman and Salvetat, 1850
RSBP2	Sang-bao-peng	Sanbaopeng	Raw rock	Not recorded	Nikulina and Taraeva, 1959
RSBP3	Sanbaopeng	Sanbaopeng	Raw rock	Collected in Jingdezhen	Zhou and Li, 1960
RSBP4	Sanbaopeng	Sanbaopeng	Raw rock	Geological survey	Yi, 1964
RSBP5	Sanbaopeng	Sanbaopeng	Raw rock	Geological survey	JPCIRI, 1973
RSBP6	Sanbaopeng	Sanbaopeng	Raw rock	Geological survey	Zhang, 1981
DSBP2	San-bao-peng	Sanbaopeng	Earth brick	Not recorded	Nikulina and Taraeva, 1959
DSBP5	Sanbaopeng	Sanbaopeng	Earth brick	Processed from geological sample	JPCIRI, 1973
PSBP1	San-pao-peng	Sanbaopeng	Clay paste	Collected by Father Joseph Ly (1803–1854) from local potters in Jingdezhen	Ebelman and Salvetat, 1850

RQM1	Khy-men-hien	Qimen	Raw rock	Collected by Father Joseph Ly (1803–1854) from local potters in Jingdezhen	Ebelman and Salvetat, 1850
RQM2	Chi-myn	Qimen	Raw rock	Not recorded	Efremov, 1956
RQM3	Chi-meng	Qimen	Raw rock	Not recorded	Nikulina and Taraeva, 1959
RQM4	Qimen	Qimen	Raw rock	Geological survey	Yi, 1964
DQM3	Chi-meng	Qimen	Earth brick	Not recorded	Nikulina and Taraeva, 1959
PQM1	Khy-men-hien	Qimen	Clay paste	Collected by Father Joseph Ly (1803–1854) from local potters in Jingdezhen	Ebelman and Salvetat, 1850
RSXW1	Shouxiwu	Shouxiwu	Raw rock	Collected in Jingdezhen	Zhou and Li, 1960
RSXW2	Shouxiwu	Shouxiwu	Raw rock	Geological survey	Yi, 1964
RNG1	Nan-kang	Nangang	Raw rock	Not recorded	Efremov, 1956
RNG2	Nang-kan	Nangang	Raw rock	Not recorded	Nikulina and Taraeva, 1959
RNG3	Nangang	Nangang	Raw rock	Collected in Jingdezhen	Zhou and Li, 1960
RNG4	Nangang	Nangang	Raw rock	Geological survey	Yi, 1964
RNG5	Nangang	Nangang	Raw rock	Geological survey	JPCIRI, 1973
RNG6	Nangang	Nangang	Raw rock	Geological survey	Zhang, 1981
DNG2	Nang-kan	Nangang	Earth brick	Not recorded	Nikulina and Taraeva, 1959
DNG5	Nangang	Nangang	Earth brick	Processed from geological sample	JPCIRI, 1973
PNG5	Nangang	Nangang	Clay paste	Processed from geological sample	JPCIRI, 1973
RYG1	Yugan	Yugan	Raw rock	Geological survey	Yi, 1964
RYG2	Yui-kan	Yugan	Raw rock	Not recorded	Nikulina and Taraeva, 1959
RYG3	Yugan	Yugan	Raw rock	Geological survey	JPCIRI, 1973
RYG4	Yugan	Yugan	Raw rock	Geological survey	Zhang, 1981
DYG3	Yugan	Yugan	Earth brick	Processed from geological sample	JPCIRI, 1973
RLJW1	Liujiawan	Liujiawan	Raw rock	Geological survey	Yi, 1964
RLJW2	Liujiawan	Liujiawan	Raw rock	Geological survey	Zhang, 1981
RMS1	Minsa	Mingsha	Raw kaolin	Not recorded	Efremov, 1957
RMS2	Mingsha	Mingsha	Raw kaolin	Geological survey	Yi, 1964

RMS3	Mingsha	Mingsha	Raw kaolin	Geological survey	JPCIRI, 1973
DMS3	Mingsha	Mingsha	Earth brick	Processed from geological sample	JPCIRI, 1973
PMS3	Mingsha	Mingsha	Clay paste	Processed from geological sample	JPCIRI, 1973
RDZ1	Dazhou	Dazhou	Raw kaolin	Geological survey	Yi, 1964
RDZ2	Dazhou	Dazhou	Raw kaolin	Geological survey	Yi, 1964
RDZ3	Dazhou	Dazhou	Raw kaolin	Geological survey	JPCIRI, 1973
DDZ3	Dazhou	Dazhou	Earth brick	Processed from geological sample	JPCIRI, 1973
PDZ3	Dazhou	Dazhou	Clay paste	Processed from geological sample	JPCIRI, 1973
RXZ1	Xingzi	Xingzi	Raw kaolin	Geological survey	JPCIRI, 1973
DXZ1	Xingzi	Xingzi	Earth brick	Geological survey	JPCIRI, 1973
PXZ1	Xingzi	Xingzi	Clay paste	Geological survey	JPCIRI, 1973

Table B-2: Geographic information of raw material sources

Source name	Geographic location					Geographic coordinates		Reference for geo coordinates
	Village	Town	County/District	City	Province	Longitude	Latitude	
Sanbaopeng	Sanbao (三寶村)	Jingcheng (竟成鎮)	Zhushan (珠山區)	Jingdezhen (景德鎮市)	Jiangxi (江西省)	117.278633	29.269807	Estimated from google earth
Yaoli	Yaoli (瑤里村)	Yaoli (瑤里鎮)	Fuliang (浮梁縣)	Jingdezhen (景德鎮市)	Jiangxi (江西省)	117.583451	29.545101	Estimated from google earth
Nangang	Dongliu (東流村)	Xianghu (湘湖鎮)	Fuliang (浮梁縣)	Jingdezhen (景德鎮市)	Jiangxi (江西省)	117.378446	29.286372	Estimated from google earth
Liujiawan	Liujiawan (柳家灣村)	Shouan (壽安镇)	Fuliang (浮梁縣)	Jingdezhen (景德鎮市)	Jiangxi (江西省)	117.32886	29.22584	Estimated from google earth
Shouxiwu	Shouxiwu (壽溪塢)	Shouan (壽安镇)	Fuliang (浮梁縣)	Jingdezhen (景德鎮市)	Jiangxi (江西省)	117.412415	29.426154	Estimated from google earth
Qimen	/	/	Qimen (祁門縣)	Huangshan (黃山市)	Anhui (安徽省)	117.634936	29.969314	Estimated from google earth
Yugan	/	/	Yugan (余乾县)	Shangrao (上饒市)	Jiangxi (江西省)	116.823407	28.480053	Estimated from google earth
Mingsha	Gaoling (高嶺村)	E'hu (鵝湖鎮)	Fuliang (浮梁縣)	Jingdezhen (景德鎮市)	Jiangxi (江西省)	117.543927	29.481117	Estimated from google earth
Dazhou	Dazhou (大洲村)	Huangtan (黃壇鄉)	Fuliang (浮梁縣)	Jingdezhen (景德鎮市)	Jiangxi (江西省)	117.085037	29.522092	Estimated from google earth
Xingzi	/	/	Lushan (廬山市)	Jiujiang (九江市)	Jiangxi (江西省)	116.061666	29.54565	Estimated from google earth

Table B-3: Raw material sample chemical composition in wt% (detailed reference see Table B-1)

No.	Analytical method	SiO_2	Al_2O_3	Fe_2O_3	TiO_2	CaO	MgO	K_2O	Na_2O	MnO	Loss on ignition	Sum
RYL1	Wet chemical fusion for oxides/alkalis	76.3	13.15	0.85	Not analysed	0	0	3.1	2.17	0.3	3.76	99.63
RYL2	Not recorded	80.5	14.45	0.85	0.07	0.38	0.46	3.54	0.19	0	Not recorded	100.44
RYL3	Major-element oxides measured by bulk chemical analysis; LOI by ignition	75.45	15.39	0.46	0	1.24	0.14	3.47	1.6	0	2.59	100.34
RYL4	Major-element oxides measured by bulk chemical analysis; LOI by ignition	74.48	15.01	0.61	Not analysed	1.47	0.62	3.24	1.46	Not analysed	2.95	99.84
DYL3	Major-element oxides measured by bulk chemical analysis; LOI by ignition	73.99	15.55	0.57	0	1.76	0.33	2.88	2.63	0	2.88	100.59
PYL1	Wet chemical fusion for oxides/alkalis	76.41	13.9	0.9	Not analysed	0.35	0	3	2.5	0	3.25	100.31
PYL3	Major-element oxides measured by bulk chemical analysis; LOI by ignition	72.9	15.66	0.48	0	1.57	0.09	2.98	2.47	0	3.31	99.5

RSBP1	Wet chemical fusion for oxides/alkalis	74.9	14	0.8	Not analysed	0	0	3	3.9	0.2	3.1	99.9
RSBP2	Not recorded	75.08	15.79	0.57	0.14	0.04	0.41	4.08	2.52	Not analysed	1.32	99.95
RSBP3	Major-element oxides measured by bulk chemical analysis; LOI by ignition	71.7	18.1	0.7	0	0.55	0.09	4.1	4.77	0	Not recorded	100.01
RSBP4	Major-element oxides measured by bulk chemical analysis; LOI by ignition	73.7	15.74	0.7	0	0.72	0.16	4.13	3.79	0.04	1.13	99.69
RSBP5	Major-element oxides measured by bulk chemical analysis; LOI by ignition	74.21	15.58	0.7	0	0.97	0.05	1.99	4.12	0	1.81	99.43
RSBP6	Major-element oxides measured by bulk chemical analysis; LOI by ignition	76.88	14.73	0.6	0	0.53	0.3	2.05	3.17	0.07	1.45	99.78
DSBP2	Not recorded	75	15.45	0.63	0.02	0.48	0.28	3.06	3.5	Not analysed	1.49	99.91
DSBP5	Major-element oxides measured by bulk chemical analysis; LOI by ignition	76.54	15.57	0.47	0	0.63	0.38	2.05	4.48	0	1.66	99.78

PSBP1	Wet chemical fusion for oxides/alkalis	75	14.15	0.1	Not analysed	0.12	0.15	3.1	3.04	0	3.05	98.71
RQM1	Wet chemical fusion for oxides/alkalis	76.2	13.6	0	Not analysed	0.12	3.28	3.28	5.05	0	2.94	100.19
RQM2	Not recorded	75.33	16.2	0.82	0.08	0	0.25	0.27	4.67	Not analysed	2.36	100.98
RQM3	Not recorded	75.64	15.89	0.56	0.06	0.54	0.13	3.35	2.62	Not analysed	1.61	100.4
RQM4	Major-element oxides measured by bulk chemical analysis; LOI by ignition	75.64	15.89	0.56	0.06	0.54	0.13	3.35	2.02	0	1.67	100.4
DQM3	Not recorded	75.42	15.78	0.7	0.08	0.38	0.15	3.2	2.5	Not analysed	1.7	99.91
PQM1	Wet chemical fusion for oxides/alkalis	76.26	14.2	0	Not analysed	0	0	3	4	0.35	3.05	100.86
RSXW1	Major-element oxides measured by bulk chemical analysis; LOI by ignition	77.7	16.2	1.18	0.13	0.08	0.24	3.97	0.56	0.04	Not recorded	100.05
RSXW2	Major-element oxides measured by bulk chemical analysis; LOI by ignition	78.11	15.11	0.83	0	0.4	0.66	2.72	0	0	2.39	100.22
RNG1	Not recorded	75.06	16.01	0.41	0.05	0.28	0.6	3.3	1.97	Not analysed	2.22	99.9
RNG2	Not recorded	74.26	16.93	0.62	0.09	0.87	0.36	3.15	0.3	Not analysed	3.68	100.26

RNG3	Major-element oxides measured by bulk chemical analysis; LOI by ignition	78.84	15.5	0.79	0	1.5	0	2.87	0.44	0.06	Not recorded	100
RNG4	Major-element oxides measured by bulk chemical analysis; LOI by ignition	76.12	14.97	0.76	0	1.43	0	2.77	0.42	0.06	3.71	100.26
RNG5	Major-element oxides measured by bulk chemical analysis; LOI by ignition	75.86	15.25	0.72	0.09	1.36	0.26	2.94	0.27	0.01	3.55	Not recorded
RNG6	Major-element oxides measured by bulk chemical analysis; LOI by ignition	76.82	14.18	0.61	0	1.1	0.31	2.24	0.68	0.04	3.61	99.59
DNG2	Not recorded	75.99	15.31	0.63	0	1.08	0.13	2.95	0.24	Not analysed	3.35	99.68
DNG5	Major-element oxides measured by bulk chemical analysis; LOI by ignition	69.56	19.88	0.56	0	1.2	0.54	3.5	0.96	0	4.27	Not recorded
PNG5	Major-element oxides measured by bulk chemical analysis; LOI by ignition	71.87	18.26	0.46	0	1.39	0.35	3.26	0.49	0	3.89	Not recorded

RYG1	Major-element oxides measured by bulk chemical analysis; LOI by ignition	77.5	14.72	0.43	0	0.37	0.8	2.65	0.24	0	3.72	99.81
RYG2	Not recorded	74.81	15.03	0.6	0	1.52	0.31	4.52	1.95	Not analysed	1.72	100.46
RYG3	Major-element oxides measured by bulk chemical analysis; LOI by ignition	75.47	14.6	0.59	0	1.13	0.3	3.93	1.74	0	2.6	100.34
RYG4	Major-element oxides measured by bulk chemical analysis; LOI by ignition	74.94	15.54	0.69	0	1.77	0.09	0.22	1.47	0.07	4.11	99.89
DYG3	Major-element oxides measured by bulk chemical analysis; LOI by ignition	74.62	15.68	0.65	0	1.12	0.51	3.67	0.23	0	3.64	100.12
RLJW1	Major-element oxides measured by bulk chemical analysis; LOI by ignition	72.24	17.65	0.25	0	1.69	0.57	2.77	1.61	0.23	3.23	100.1
RLJW2	Major-element oxides measured by bulk chemical analysis; LOI by ignition	77.54	14.62	0.43	0	0.35	0.15	3.1	0.34	0	1.45	99.72

RMS1	Not recorded	51.02	34.87	0.6	0.08	0	0.17	1.24	3.23	Not analysed	9.26	100.47
RMS2	Major-element oxides measured by bulk chemical analysis; LOI by ignition	47.69	36.01	0.99	0.04	0.4	0.25	2.51	0.95	0.14	11.12	100.1
RMS3	Major-element oxides measured by bulk chemical analysis; LOI by ignition	49.65	33.82	1.13	0.05	0.33	0.23	2.7	1.03	0	10.84	Not recorded
DMS3	Major-element oxides measured by bulk chemical analysis; LOI by ignition	48.08	36.43	0.65	0	0.53	0.17	1.93	1.44	0	11.48	100.71
PMS3	Major-element oxides measured by bulk chemical analysis; LOI by ignition	47.77	37.18	0.74	0	0.45	0.38	2.1	0.53	0	11.31	100.46
RDZ1	Major-element oxides measured by bulk chemical analysis; LOI by ignition	49.3	37.95	0.44	0	1.33	0	2.1	0	0	11.48	100.5
RDZ2	Major-element oxides measured by bulk chemical analysis; LOI by ignition	50.12	36.81	0.53	0	1.33	0	0	0	0	10.72	99.51

RDZ3	Major-element oxides measured by bulk chemical analysis; LOI by ignition	70.43	17.38	1.7	0	1.15	0	0.45	0.9	0	11.1	100.6
DDZ3	Major-element oxides measured by bulk chemical analysis; LOI by ignition	47.65	36.31	1.61	0	0.29	0.25	2.67	0.24	0	11.48	100.5
PDZ3	Major-element oxides measured by bulk chemical analysis; LOI by ignition	48.08	37.37	1.4	0	1.15	0	0.3	0.8	0	11.18	Not recorded
RXZ1	Major-element oxides measured by bulk chemical analysis; LOI by ignition	70.64	19.06	0.88	0	0.12	0.6	3.48	0.28	0.05	5.45	Not recorded
DXZ1	Major-element oxides measured by bulk chemical analysis; LOI by ignition	49.16	34.59	1.24	0	0.53	0.29	2.34	0.45	0	11.13	Not recorded
PXZ1	Major-element oxides measured by bulk chemical analysis; LOI by ignition	50.14	34.07	1.04	0	0.2	0.33	1.73	0.1	0	11.85	Not recorded

Table B-4: Modelled raw material sample mineral composition in wt% (original data from Table B-3)

No.	Sericite	Albite	Kaolinite	Quartz	Sum
RYL1	25.03	15.86	0.00	53.53	94.42
RYL2	28.58	1.61	5.76	62.73	98.68
RYL3	28.02	13.54	3.25	51.11	95.91
RYL4	26.16	12.35	4.55	51.13	94.19
DYL3	23.25	22.25	4.08	45.46	95.05
PYL1	24.22	21.15	0.10	50.33	95.81
PYL3	24.06	20.90	4.18	44.87	94.01
RSBP1	24.22	21.90	0.00	48.36	94.49
RSBP2	32.94	21.32	0.00	46.70	97.47
RSBP3	33.11	40.36	0.00	31.87	98.67
RSBP4	33.35	32.07	0.00	40.45	97.36
RSBP5	16.07	34.86	5.10	39.87	95.90
RSBP6	16.55	26.82	6.23	47.23	96.83
DSBP2	24.71	29.62	0.00	43.22	97.01
DSBP5	16.55	37.91	3.36	40.82	98.64
PSBP1	25.03	21.00	0.00	48.70	94.73
RQM1	26.48	15.17	0.00	53.22	94.87
RQM2	2.18	39.52	16.65	38.13	96.47
RQM3	27.05	22.17	1.53	46.75	97.50
RQM4	27.05	17.09	3.68	49.08	96.90
DQM3	25.84	21.15	2.78	47.13	96.90
PQM1	24.22	22.93	0.00	49.02	96.17
RSXW1	32.06	4.73	5.20	56.43	98.43
RSXW2	21.96	0.00	13.68	60.30	95.94
RNG1	26.65	16.67	4.47	48.55	96.34
RNG2	25.43	2.54	13.52	53.14	94.64
RNG3	23.17	3.72	11.89	58.87	97.65
RNG4	22.37	3.55	11.51	56.85	94.28
RNG5	23.74	2.28	11.46	56.84	94.32
RNG6	18.09	5.75	12.61	57.47	93.92
DNG2	23.82	2.03	11.62	57.02	94.49
DNG5	28.26	8.12	15.11	42.41	93.90
PNG5	26.32	4.15	14.96	48.45	93.88
RYG1	21.40	2.03	12.46	59.22	95.11

RYG2	36.50	16.50	0.00	49.53	96.31
RYG3	31.73	14.72	0.00	51.52	95.74
RYG4	1.78	12.44	27.03	50.92	92.17
DYG3	29.63	1.95	7.37	55.25	94.20
RLJW1	22.37	13.62	13.09	45.20	94.27
RLJW2	25.03	2.88	8.70	58.99	95.60
RMS1	10.01	27.33	55.62	0.00	90.36
RMS2	20.27	8.04	57.29	1.57	87.16
RMS3	21.80	8.72	50.89	5.80	87.20
DMS3	15.58	12.18	60.55	0.00	87.88
PMS3	16.96	4.49	64.24	1.90	87.58
RDZ1	16.96	0.00	67.82	4.57	89.35
RDZ2	0.00	0.00	80.19	6.74	86.93
RDZ3	3.63	7.62	31.45	46.46	89.16
DDZ3	21.56	2.03	59.35	3.93	86.87
PDZ3	2.42	6.77	76.42	0.94	86.55
RXZ1	28.10	2.37	15.90	47.09	93.46
DXZ1	18.89	3.81	57.19	6.65	86.54
PXZ1	13.97	0.85	61.63	9.60	86.40

Table B-5: Overview of blue-and-white porcelain sample information

No.	Original vessel form	Provenance	Site/collection name	Date	Assigned chronology	Reference for chronology	Classification	Reference
EM-I1	Bowl	Archaeological excavation	Yuyaochang (御窯廠遺址)	Hongwu	Early Ming	Li *et al.*, 1996	Imperial	Li *et al.*, 1996
EM-I2	Bowl	Archaeological excavation	Yuyaochang (御窯廠遺址)	Hongwu	Early Ming	Li *et al.*, 1996	Imperial	Li *et al.*, 1996
EM-I3	Bowl	Archaeological excavation	Yuyaochang (御窯廠遺址)	Hongwu	Early Ming	Li *et al.*, 1996	Imperial	Li *et al.*, 1996
EM-I4	Bowl	Archaeological excavation	Yuyaochang (御窯廠遺址)	Yongle	Early Ming	Li *et al.*, 1996	Imperial	Li *et al.*, 1996
EM-I5	Plate	Archaeological excavation	Yuyaochang (御窯廠遺址)	Yongle	Early Ming	Li *et al.*, 1996	Imperial	Li *et al.*, 1996
EM-I6	Plate	Archaeological excavation	Yuyaochang (御窯廠遺址)	Yongle	Early Ming	Li *et al.*, 1996	Imperial	Li *et al.*, 1996
EM-I7	Plate	Archaeological excavation	Yuyaochang (御窯廠遺址)	Yongle	Early Ming	Jiang *et al*, 2018	Imperial	Jiang *et al*, 2018
EM-I8	Plate	Archaeological excavation	Yuyaochang (御窯廠遺址)	Yongle	Early Ming	Jiang *et al*, 2018	Imperial	Jiang *et al*, 2018
EM-I9	Vase	Archaeological excavation	Yuyaochang (御窯廠遺址)	Xuande	Early Ming	Li *et al.*, 1996	Imperial	Li *et al.*, 1996
EM-I10	Plate	Archaeological excavation	Yuyaochang (御窯廠遺址)	Xuande	Early Ming	Li *et al.*, 1996	Imperial	Li *et al.*, 1996
EM-I11	Plate	Archaeological excavation	Yuyaochang (御窯廠遺址)	Xuande	Early Ming	Li *et al.*, 1996	Imperial	Li *et al.*, 1996
EM-I12	Plate	Archaeological excavation	Yuyaochang (御窯廠遺址)	Xuande	Early Ming	Li *et al.*, 1996	Imperial	Li *et al.*, 1996
EM-I13	Plate	Archaeological excavation	Yuyaochang (御窯廠遺址)	Xuande	Early Ming	Jiang *et al*, 2018	Imperial	Jiang *et al*, 2018
EM-I14	Bowl	Archaeological excavation	Yuyaochang (御窯廠遺址)	Unspecified	Early Ming	Li *et al.*, 1996	Imperial	Li *et al.*, 1996
EM-IC1	Large plate	Private collection	Not recorded	Xuande	Early Ming	Zhou and Li, 1960b	Imperial	Zhou and Li, 1960b
MM-I1	Bowl	Archaeological excavation	Yuyaochang (御窯廠遺址)	Chenghua	Mid-Ming	Chen *et al.*, 1978	Imperial	Chen *et al.*, 1978

MM-I2	Bowl	Archaeological excavation	Yuyaochang (御窯廠遺址)	Chenghua	Mid-Ming	Li *et al.*, 1996	Imperial	Li *et al.*, 1996
MM-I3	Bowl	Archaeological excavation	Yuyaochang (御窯廠遺址)	Chenghua	Mid-Ming	Li *et al.*, 1996	Imperial	Li *et al.*, 1996
MM-I4	Plate	Archaeological excavation	Yuyaochang (御窯廠遺址)	Chenghua	Mid-Ming	Li *et al.*, 1996	Imperial	Li *et al.*, 1996
MM-I5	Plate	Archaeological excavation	Yuyaochang (御窯廠遺址)	Chenghua	Mid-Ming	Li *et al.*, 1996	Imperial	Li *et al.*, 1996
MM-I6	Plate	Archaeological excavation	Yuyaochang (御窯廠遺址)	Chenghua	Mid-Ming	Jiang *et al*, 2018	Imperial	Jiang *et al*, 2018
MM-I7	Plate	Archaeological excavation	Yuyaochang (御窯廠遺址)	Chenghua	Mid-Ming	Jiang *et al*, 2018	Imperial	Jiang *et al*, 2018
MM-I8	Plate	Archaeological excavation	Yuyaochang (御窯廠遺址)	Chenghua	Mid-Ming	Jiang *et al*, 2018	Imperial	Jiang *et al*, 2018
MM-I9	Plate	Archaeological excavation	Yuyaochang (御窯廠遺址)	Chenghua	Mid-Ming	Jiang *et al*, 2018	Imperial	Jiang *et al*, 2018
MM-I10	Plate	Archaeological excavation	Yuyaochang (御窯廠遺址)	Chenghua	Mid-Ming	Jiang *et al*, 2018	Imperial	Jiang *et al*, 2018
MM-I11	Plate	Archaeological excavation	Yuyaochang (御窯廠遺址)	Chenghua	Mid-Ming	Jiang *et al*, 2018	Imperial	Jiang *et al*, 2018
MM-IC1	Plate	Private collection	Not recorded	Chenghua	Mid-Ming	Zhou and Li, 1960b	Imperial	Zhou and Li, 1960b
LM-IC1	Jar	Private collection	Not recorded	Jiajing	Late Ming	Zhou and Li, 1960b	Imperial	Zhou and Li, 1960b
LM-IC2	Small vessel	Public collection	The Palace Museum, Beijing (故宮博物院)	Jiajing	Late Ming	Chen *et al.*, 1978	Imperial	Chen *et al.*, 1978
LM-IC3	Box	Private collection	Not recorded	Wanli	Late Ming	Zhou and Li, 1960b	Imperial	Zhou and Li, 1960b
LM-IC4	Plate	Private collection	Not recorded	Wanli	Late Ming	Zhou and Li, 1960b	Imperial	Zhou and Li, 1960b
MM-N1	Small vessel	Archaeological excavation	Yaoli (瑤里遺址)	Unspecified	Mid-Ming	Wang *et al.*, 2023	Non-imperial	Wang *et al.*, 2023
MM-N2	Small vessel	Archaeological excavation	Yaoli (瑤里遺址)	Unspecified	Mid-Ming	Wang *et al.*, 2023	Non-imperial	Wang *et al.*, 2023

MM-N3	Small vessel	Archaeological excavation	Yaoli (瑤里遺址)	Unspecified	Mid-Ming	Wang *et al.*, 2023	Non-imperial	Wang *et al.*, 2023
MM-N4	Small vessel	Archaeological excavation	Yaoli (瑤里遺址)	Unspecified	Mid-Ming	Wang *et al.*, 2023	Non-imperial	Wang *et al.*, 2023
MM-N5	Small vessel	Archaeological excavation	Yaoli (瑤里遺址)	Unspecified	Mid-Ming	Wang *et al.*, 2023	Non-imperial	Wang *et al.*, 2023
MM-N6	Small vessel	Archaeological excavation	Yaoli (瑤里遺址)	Unspecified	Mid-Ming	Wang *et al.*, 2023	Non-imperial	Wang *et al.*, 2023
MM-N7	Small vessel	Archaeological excavation	Yaoli (瑤里遺址)	Unspecified	Mid-Ming	Wang *et al.*, 2023	Non-imperial	Wang *et al.*, 2023
MM-N8	Small vessel	Archaeological excavation	Yaoli (瑤里遺址)	Unspecified	Mid-Ming	Wang *et al.*, 2023	Non-imperial	Wang *et al.*, 2023
MM-N9	Small vessel	Archaeological excavation	Yaoli (瑤里遺址)	Unspecified	Mid-Ming	Wang *et al.*, 2023	Non-imperial	Wang *et al.*, 2023
MM-N10	Small vessel	Archaeological excavation	Yaoli (瑤里遺址)	Unspecified	Mid-Ming	Wang *et al.*, 2023	Non-imperial	Wang *et al.*, 2023
MM-N11	Small vessel	Archaeological excavation	Yaoli (瑤里遺址)	Unspecified	Mid-Ming	Wang *et al.*, 2023	Non-imperial	Wang *et al.*, 2023
MM-N12	Small vessel	Archaeological excavation	Yaoli (瑤里遺址)	Unspecified	Mid-Ming	Wang *et al.*, 2023	Non-imperial	Wang *et al.*, 2023
MM-N13	Small vessel	Archaeological excavation	Yaoli (瑤里遺址)	Unspecified	Mid-Ming	Wang *et al.*, 2023	Non-imperial	Wang *et al.*, 2023
MM-N14	Small vessel	Archaeological excavation	Yaoli (瑤里遺址)	Unspecified	Mid-Ming	Wang *et al.*, 2023	Non-imperial	Wang *et al.*, 2023
MM-N15	Small vessel	Archaeological excavation	Yaoli (瑤里遺址)	Unspecified	Mid-Ming	Wang *et al.*, 2023	Non-imperial	Wang *et al.*, 2023
MM-N16	Small vessel	Archaeological excavation	Yaoli (瑤里遺址)	Unspecified	Mid-Ming	Wang *et al.*, 2023	Non-imperial	Wang *et al.*, 2023
MM-N17	Small vessel	Archaeological excavation	Yaoli (瑤里遺址)	Unspecified	Mid-Ming	Wang *et al.*, 2023	Non-imperial	Wang *et al.*, 2023
MM-N18	Small vessel	Archaeological excavation	Yaoli (瑤里遺址)	Unspecified	Mid-Ming	Wang *et al.*, 2023	Non-imperial	Wang *et al.*, 2023
MM-N19	Small vessel	Archaeological excavation	Yaoli (瑤里遺址)	Unspecified	Mid-Ming	Wang *et al.*, 2023	Non-imperial	Wang *et al.*, 2023
MM-N20	Small vessel	Archaeological excavation	Yaoli (瑤里遺址)	Unspecified	Mid-Ming	Wang *et al.*, 2023	Non-imperial	Wang *et al.*, 2023

MM-N21	Small vessel	Archaeological excavation	Yaoli (瑤里遺址)	Unspecified	Mid-Ming	Wang *et al.*, 2023	Non-imperial	Wang *et al.*, 2023
LM-N1	Plate/Bowl	Archaeological excavation	Nan'ao No.1 Shipwreck (南澳一號沈船)	Wanli	Late Ming	Chen, 2018	Non-imperial	Li *et al.*, 2016
LM-N2	Plate/Bowl	Archaeological excavation	Nan'ao No.1 Shipwreck (南澳一號沈船)	Wanli	Late Ming	Chen, 2018	Non-imperial	Li *et al.*, 2016
LM-N3	Plate/Bowl	Archaeological excavation	Nan'ao No.1 Shipwreck (南澳一號沈船)	Wanli	Late Ming	Chen, 2018	Non-imperial	Li *et al.*, 2016
LM-N4	Plate/Bowl	Archaeological excavation	Nan'ao No.1 Shipwreck (南澳一號沈船)	Wanli	Late Ming	Chen, 2018	Non-imperial	Li *et al.*, 2016
LM-N5	Plate/Bowl	Archaeological excavation	Nan'ao No.1 Shipwreck (南澳一號沈船)	Wanli	Late Ming	Chen, 2018	Non-imperial	Li *et al.*, 2016
LM-N6	Plate/Bowl	Archaeological excavation	Nan'ao No.1 Shipwreck (南澳一號沈船)	Wanli	Late Ming	Chen, 2018	Non-imperial	Li *et al.*, 2016
LM-N7	Plate/Bowl	Archaeological excavation	Nan'ao No.1 Shipwreck (南澳一號沈船)	Wanli	Late Ming	Chen, 2018	Non-imperial	Li *et al.*, 2016
LM-N8	Plate/Bowl	Archaeological excavation	Nan'ao No.1 Shipwreck (南澳一號沈船)	Wanli	Late Ming	Chen, 2018	Non-imperial	Li *et al.*, 2016
LM-N9	Plate/Bowl	Archaeological excavation	Nan'ao No.1 Shipwreck (南澳一號沈船)	Wanli	Late Ming	Chen, 2018	Non-imperial	Li *et al.*, 2016
LM-N10	Plate/Bowl	Archaeological excavation	Nan'ao No.1 Shipwreck (南澳一號沈船)	Wanli	Late Ming	Chen, 2018	Non-imperial	Li *et al.*, 2016
LM-N11	Plate/Bowl	Archaeological excavation	Nan'ao No.1 Shipwreck (南澳一號沈船)	Wanli	Late Ming	Chen, 2018	Non-imperial	Li *et al.*, 2016

LM-N12	Plate/Bowl	Archaeological excavation	Nan'ao No.1 Shipwreck (南澳一號沈船)	Wanli	Late Ming	Chen, 2018	Non-imperial	Xiong *et al.*, 2019
LM-N13	Plate/Bowl	Archaeological excavation	Nan'ao No.1 Shipwreck (南澳一號沈船)	Wanli	Late Ming	Chen, 2018	Non-imperial	Xiong *et al.*, 2019
LM-N14	Small vessel	Archaeological survey	The bank of the River Mandovi, Old Goa	Unspecified	Late Ming	Tripati, 2017	Non-imperial	Tripati, 2017
LM-N15	Small vessel	Archaeological survey	The bank of the River Mandovi, Old Goa	Unspecified	Late Ming	Tripati, 2017	Non-imperial	Tripati, 2017
LM-N16	Small vessel	Archaeological survey	The bank of the River Mandovi, Old Goa	Unspecified	Late Ming	Tripati, 2017	Non-imperial	Tripati, 2017
LM-N17	Small vessel	Archaeological survey	The bank of the River Mandovi, Old Goa	Unspecified	Late Ming	Tripati, 2017	Non-imperial	Tripati, 2017
LM-N18	Small vessel	Archaeological survey	The bank of the River Mandovi, Old Goa	Unspecified	Late Ming	Tripati, 2017	Non-imperial	Tripati, 2017
LM-N19	Small vessel	Archaeological survey	The bank of the River Mandovi, Old Goa	Unspecified	Late Ming	Tripati, 2017	Non-imperial	Tripati, 2017
LM-N20	Small vessel	Archaeological survey	The bank of the River Mandovi, Old Goa	Unspecified	Late Ming	Tripati, 2017	Non-imperial	Tripati, 2017
LM-N21	Small vessel	Archaeological survey	The bank of the River Mandovi, Old Goa	Unspecified	Late Ming	Tripati *et al.*, 2017	Non-imperial	Tripati *et al.*, 2017
LM-N22	Small vessel	Archaeological survey	The bank of the River Mandovi, Old Goa	Unspecified	Late Ming	Tripati *et al.*, 2017	Non-imperial	Tripati *et al.*, 2017
LM-N23	Small vessel	Archaeological survey	The bank of the River Mandovi, Old Goa	Unspecified	Late Ming	Tripati *et al.*, 2017	Non-imperial	Tripati *et al.*, 2017

LM-N24	Small vessel	Archaeological survey	The bank of the River Mandovi, Old Goa	Unspecified	Late Ming	Tripati *et al.*, 2017	Non-imperial	Tripati *et al.*, 2017
LM-N25	Small vessel	Archaeological survey	The bank of the River Mandovi, Old Goa	Unspecified	Late Ming	Tripati *et al.*, 2017	Non-imperial	Tripati *et al.*, 2017
LM-N26	Small vessel	Archaeological survey	The bank of the River Mandovi, Old Goa	Unspecified	Late Ming	Tripati *et al.*, 2017	Non-imperial	Tripati *et al.*, 2017
LM-N27	Small vessel	Archaeological survey	The bank of the River Mandovi, Old Goa	Unspecified	Late Ming	Tripati *et al.*, 2017	Non-imperial	Tripati *et al.*, 2017
PM-N1	Small vessel	Public collection	Ashmolean Museum	Tianqi	Post 1620s	Wood, 1983	Non-imperial	Wood, 2021
PM-N2	Small vessel	Public collection	Ashmolean Museum	Tianqi	Post 1620s	Wood, 1983	Non-imperial	Wood, 2021
PM-N3	Small vessel	Public collection	Ashmolean Museum	Tianqi	Post 1620s	Wood, 1983	Non-imperial	Wood, 2021
PM-N4	Small vessel	Public collection	Ashmolean Museum	Tianqi	Post 1620s	Wood, 1983	Non-imperial	Wood, 2021
PM-N5	Small vessel	Public collection	Ashmolean Museum	Tianqi	Post 1620s	Wood, 1983	Non-imperial	Wood, 2021
PM-N6	Small vessel	Public collection	Ashmolean Museum	Tianqi	Post 1620s	Wood, 1983	Non-imperial	Wood, 2021
PM-N7	Small vessel	Public collection	Ashmolean Museum	Tianqi	Post 1620s	Wood, 1983	Non-imperial	Wood, 2021
PM-N8	Small vessel	Public collection	Ashmolean Museum	Tianqi	Post 1620s	Wood, 1983	Non-imperial	Wood, 2021
PM-N9	Small vessel	Public collection	Ashmolean Museum	Tianqi	Post 1620s	Wood, 1983	Non-imperial	Wood, 2021

Table B-6: Blue-and-white porcelain sample chemical composition in wt% (detailed reference see Table B-5)

No.	Analytical method	Sample preparation method	Original lab no.	SiO_2	Al_2O_3	Fe_2O_3	TiO_2	CaO	MgO	K_2O	Na_2O	MnO	Sum
EM-I1	Not recorded	Not recorded	MH2	75.11	18.92	0.91	0.07	0.27	0.24	3.41	0.18	0.046	99.159
EM-I2	Not recorded	Not recorded	MH3	75.92	18.50	0.95	0.09	0.24	0.23	3.27	0.86	0.10	100.15
EM-I3	Not recorded	Not recorded	MH4	75.20	19.18	1.00	0.10	0.27	0.25	2.79	1.38	0.12	100.29
EM-I4	Not recorded	Not recorded	MY1	75.32	19.90	0.92	0.12	0.11	0.16	2.97	0.64	0.11	100.25
EM-I5	Not recorded	Not recorded	MY2	74.56	19.48	0.94	0.10	0.32	0.16	3.10	1.34	0.06	100.06
EM-I6	Not recorded	Not recorded	MY3	73.95	19.55	0.97	0.11	0.53	0.20	3.22	1.94	0.07	100.54
EM-I7	EDXRF	Not recorded	YL-1	72.79	22.35	0.48	0.04	0.33	0.30	2.01	1.33	0.02	99.65
EM-I8	EDXRF	Not recorded	YL-2	72.30	23.57	0.44	0.04	0.04	0.59	1.72	0.94	0.01	99.65
EM-I9	Not recorded	Not recorded	MX1	74.89	20.28	1.10	0.10	0.11	0.19	3.03	0.44	0.03	100.17
EM-I10	Not recorded	Not recorded	MX2	74.63	20.43	0.95	0.09	0.34	0.19	2.79	1.05	0.04	100.51
EM-I11	Not recorded	Not recorded	MX4	72.43	21.65	1.19	0.09	0.38	0.20	2.92	1.23	0.04	100.13
EM-I12	Not recorded	Not recorded	MX5	72.97	21.12	0.95	0.10	0.39	0.20	3.03	1.06	0.04	99.86
EM-I13	EDXRF	Not recorded	YL-3	74.08	21.78	0.48	0.03	0.26	0.36	1.89	1.02	0.02	99.92
EM-I14	Not recorded	Not recorded	MHJY1	75.32	19.50	0.81	0.08	0.07	0.16	3.17	0.41	0.03	99.55
EM-IC1	Not recorded	Not recorded	M1	73.58	20.05	0.90	0.00	0.53	0.14	2.87	2.01	0.00	100.08
MM-I1	Not recorded	Not recorded	M-1	73.66	21.24	0.59	0.09	0.12	0.15	3.12	0.60	0.02	99.59
MM-I2	Not recorded	Not recorded	MXC1	71.91	22.83	0.95	0.09	0.09	0.21	3.56	0.39	0.02	100.05
MM-I3	Not recorded	Not recorded	MC1	75.92	19.97	0.57	0.09	0.10	0.20	2.59	0.65	0.02	100.11

MM-I4	Not recorded	Not recorded	MC2	73.21	22.51	0.85	0.09	0.16	0.24	2.31	0.82	0.02	100.21
MM-I5	Not recorded	Not recorded	MC3	73.05	21.87	0.85	0.04	0.21	0.21	2.36	1.09	0.03	99.71
MM-I6	EDXRF	Not recorded	XD-1	68.44	26.95	0.50	0.06	0.09	0.44	2.31	0.62	0.01	99.42
MM-I7	EDXRF	Not recorded	CH-1	75.71	21.44	0.38	0.03	0.04	0.34	1.55	0.42	0.00	99.91
MM-I8	EDXRF	Not recorded	CH-2	75.21	21.61	0.42	0.05	0.02	0.34	1.67	0.51	0.01	99.84
MM-I9	EDXRF	Not recorded	CH-3	70.85	25.21	0.46	0.03	0.20	0.28	2.16	0.64	0.02	99.85
MM-I10	EDXRF	Not recorded	CH-4	70.26	25.31	0.44	0.04	0.10	0.38	2.14	1.13	0.01	99.81
MM-I11	EDXRF	Not recorded	CH-5	68.89	25.87	0.42	0.04	0.06	0.81	2.01	1.78	0.01	99.89
MM-IC1	Not recorded	Not recorded	M6	63.46	23.59	1.05	0.10	0.77	0.44	3.24	2.28	0.09	95.02
LM-I1	Not recorded	Not recorded	M5	73.99	18.90	1.08	0.12	1.19	0.27	3.05	1.69	0.03	100.32
LM-I2	Not recorded	Not recorded	M-4	73.38	18.49	1.24	0.19	1.01	0.18	3.30	1.00	0.49	99.28
LM-I3	Not recorded	Not recorded	M3	71.69	20.69	1.26	0.00	1.01	0.28	3.37	1.55	0.05	99.90
LM-I4	Not recorded	Not recorded	M4	74.00	20.40	0.97	0.00	0.50	0.51	2.69	1.11	0.00	100.18
MM-N1	EDXRF	Cut, ultrasonically cleaned, oven-dried (120 °C)	YL-01	73.03	19.94	1.27	0.05	0.53	0.33	3.43	0.42	0.02	99.02
MM-N2	EDXRF	Cut, ultrasonically cleaned, oven-dried (120 °C)	YL-02	70.44	22.31	1.37	0.06	0.32	0.42	3.29	0.80	0.02	99.03
MM-N3	EDXRF	Cut, ultrasonically cleaned, oven-dried (120 °C)	YL-03	70.97	20.66	1.57	0.14	0.86	0.61	3.92	0.26	0.02	99.01
MM-N4	EDXRF	Cut, ultrasonically cleaned, oven-dried (120 °C)	YL-04	70.25	21.30	2.03	0.14	0.40	0.64	3.86	0.38	0.01	99.01
MM-N5	EDXRF	Cut, ultrasonically	YL-05	73.05	20.01	1.17	0.15	0.39	0.43	3.25	0.55	0.02	99.02

		cleaned, oven-dried (120 °C)											
MM-N6	EDXRF	Cut, ultrasonically cleaned, oven-dried (120 °C)	YL-06	72.29	19.95	1.36	0.10	0.30	0.48	3.13	0.89	0.02	98.52
MM-N7	EDXRF	Cut, ultrasonically cleaned, oven-dried (120 °C)	YL-07	74.45	18.86	1.12	0.06	0.55	0.50	3.04	0.43	0.02	99.03
MM-N8	EDXRF	Cut, ultrasonically cleaned, oven-dried (120 °C)	YL-08	70.82	20.40	1.81	0.08	0.34	0.18	4.28	1.09	0.01	99.01
MM-N9	EDXRF	Cut, ultrasonically cleaned, oven-dried (120 °C)	YL-09	71.08	21.47	1.63	0.08	0.20	0.30	4.02	0.22	0.02	99.02
MM-N10	EDXRF	Cut, ultrasonically cleaned, oven-dried (120 °C)	YL-10	72.42	20.58	1.48	0.10	0.27	0.25	3.44	0.44	0.01	98.99
MM-N11	EDXRF	Cut, ultrasonically cleaned, oven-dried (120 °C)	YL-11	68.34	23.65	2.30	0.22	0.16	0.56	3.55	0.43	0.02	99.23
MM-N12	EDXRF	Cut, ultrasonically cleaned, oven-dried (120 °C)	YL-12	72.93	20.22	1.30	0.12	0.47	0.26	3.66	0.03	0.01	99.00
MM-N13	EDXRF	Cut, ultrasonically cleaned, oven-dried (120 °C)	YL-13	73.50	18.83	1.51	0.15	0.35	0.54	3.69	0.43	0.02	99.02
MM-N14	EDXRF	Cut, ultrasonically cleaned, oven-dried (120 °C)	YL-14	73.01	19.67	1.19	0.10	0.29	0.51	3.60	0.64	0.01	99.02

MM-N15	EDXRF	Cut, ultrasonically cleaned, oven-dried (120 °C)	YL-15	69.29	22.74	1.84	0.10	0.34	0.79	3.21	0.69	0.01	99.01
MM-N16	EDXRF	Cut, ultrasonically cleaned, oven-dried (120 °C)	YL-16	71.33	20.75	1.21	0.08	0.18	0.47	3.44	1.53	0.01	99.00
MM-N17	EDXRF	Cut, ultrasonically cleaned, oven-dried (120 °C)	YL-17	71.27	20.52	1.64	0.16	0.49	1.08	3.26	0.58	0.03	99.03
MM-N18	EDXRF	Cut, ultrasonically cleaned, oven-dried (120 °C)	YL-18	70.16	21.49	1.86	0.07	0.46	0.64	4.28	0.03	0.03	99.02
MM-N19	EDXRF	Cut, ultrasonically cleaned, oven-dried (120 °C)	YL-19	69.24	21.90	1.93	0.12	0.39	0.45	4.94	0.03	0.02	99.02
MM-N20	EDXRF	Cut, ultrasonically cleaned, oven-dried (120 °C)	YL-20	70.61	20.56	1.80	0.08	0.47	0.36	4.65	0.47	0.01	99.01
MM-N21	EDXRF	Cut, ultrasonically cleaned, oven-dried (120 °C)	YL-21	70.41	20.57	1.84	0.10	0.46	0.37	4.81	0.43	0.02	99.01
LM-N1	EDXRF	Not recorded	J-001a	70.80	20.11	2.60	0.04	0.94	0.01	3.05	1.37	Not analysed	98.92
LM-N2	EDXRF	Not recorded	J-001b	70.50	20.68	2.64	0.06	0.88	0.13	2.77	1.78	Not analysed	99.44
LM-N3	EDXRF	Not recorded	J-001c	70.55	20.23	2.57	0.06	0.93	0.01	2.99	1.57	Not analysed	98.91
LM-N4	EDXRF	Not recorded	J-001d	68.52	20.93	2.80	0.06	1.46	0.27	2.99	1.95	Not analysed	98.98
LM-N5	EDXRF	Not recorded	J-002a	69.71	20.64	2.45	0.05	1.57	0.01	3.03	1.49	Not analysed	98.95

LM-N6	EDXRF	Not recorded	J-002b	69.32	20.54	2.40	0.05	1.87	0.02	3.13	1.67	Not analysed	99.00
LM-N7	EDXRF	Not recorded	J-002c	68.19	21.89	2.45	0.05	1.09	0.70	3.02	1.57	Not analysed	98.96
LM-N8	EDXRF	Not recorded	J-002d	70.96	19.80	2.58	0.04	1.21	0.22	2.78	1.42	Not analysed	99.01
LM-N9	EDXRF	Not recorded	J-002e	70.69	19.75	2.42	0.05	0.82	0.19	3.18	1.87	Not analysed	98.97
LM-N10	EDXRF	Not recorded	J-003	70.31	19.70	2.37	0.04	1.33	0.11	3.55	2.66	Not analysed	100.07
LM-N11	EDXRF	Not recorded	J-004	72.06	19.65	2.48	0.04	0.29	0.18	3.16	1.39	Not analysed	99.25
LM-N12	EDXRF	Not recorded	青花-5	70.93	23.97	0.78	0.07	0.86	0.41	2.33	0.62	0.04	100.01
LM-N13	EDXRF	Not recorded	青花-6	70.95	24.39	0.92	0.02	0.43	0.63	2.40	0.23	0.04	100.01
LM-N14	WDXRF	Cleaned, powdered, flux-fused (~1000 °C)	MING-1	74.07	18.55	1.27	0.15	0.79	0.28	3.51	1.27	0.05	99.94
LM-N15	WDXRF	Cleaned, powdered, flux-fused (~1000 °C)	MING-2	74.33	18.19	1.32	0.14	0.77	0.31	3.37	1.47	0.04	99.94
LM-N16	WDXRF	Cleaned, powdered, flux-fused (~1000 °C)	MING-4	69.02	21.87	1.80	0.18	1.24	0.35	4.16	1.24	0.08	99.94
LM-N17	WDXRF	Cleaned, powdered, flux-fused (~1000 °C)	MING-7	72.72	19.79	1.25	0.12	0.68	0.27	3.37	1.69	0.05	99.94
LM-N18	WDXRF	Cleaned, powdered, flux-fused (~1000 °C)	MING-9	68.80	23.19	1.49	0.14	0.90	0.28	3.53	1.50	0.08	99.91
LM-N19	WDXRF	Cleaned, powdered, flux-fused (~1000 °C)	MING-10	71.68	20.20	1.74	0.18	0.92	0.36	3.32	1.47	0.06	99.93

LM-N20	WDXRF	Cleaned, powdered, flux-fused (~1000 °C)	MING-11	72.68	19.83	1.27	0.12	0.69	0.27	3.55	1.48	0.06	99.95
LM-N21	WDXRF	Cleaned, powdered, flux-fused (~1000 °C)	MING-14	70.71	21.41	1.22	0.12	1.19	0.26	3.27	1.68	0.07	99.93
LM-N22	WDXRF	Cleaned, powdered, flux-fused (~1000 °C)	MING-15	67.70	23.27	1.62	0.13	1.72	0.28	2.75	2.34	0.10	99.91
LM-N23	WDXRF	Cleaned, powdered, flux-fused (~1000 °C)	MING-19	74.59	17.73	1.23	0.13	1.14	0.31	3.36	1.41	0.05	99.95
LM-N24	WDXRF	Cleaned, powdered, flux-fused (~1000 °C)	MING-20	70.13	21.17	1.49	0.14	1.36	0.26	3.44	1.82	0.09	99.90
LM-N25	WDXRF	Cleaned, powdered, flux-fused (~1000 °C)	MING-21	64.98	26.09	1.87	0.20	1.43	0.33	3.12	1.77	0.12	99.91
LM-N26	WDXRF	Cleaned, powdered, flux-fused (~1000 °C)	MING-22	67.92	24.93	1.35	0.12	0.85	0.22	3.24	1.20	0.08	99.91
LM-N27	WDXRF	Cleaned, powdered, flux-fused (~1000 °C)	MING-23	69.24	21.69	1.85	0.19	1.31	0.36	4.01	1.20	0.07	99.92
PM-N1	AAS	Not recorded	101.18	67.70	26.05	0.80	0.07	0.63	0.11	3.02	1.57	0.04	99.99
PM-N2	AAS	Not recorded	101.18	67.80	25.71	0.86	0.07	0.36	0.12	3.04	1.97	0.04	99.97
PM-N3	AAS	Not recorded	101.18	67.60	25.61	0.89	0.10	0.69	0.13	2.84	2.09	0.05	100.00
PM-N4	AAS	Not recorded	101.18	66.60	27.05	1.18	0.10	0.59	0.18	3.47	0.83	0.04	100.04
PM-N5	AAS	Not recorded	101.18	67.80	25.65	1.03	0.10	0.62	0.16	3.16	1.39	0.04	99.95
PM-N6	AAS	Not recorded	101.18	65.80	26.83	1.21	0.10	0.95	0.20	3.60	1.23	0.05	99.97

PM-N7	AAS	Not recorded	101.19	65.00	28.27	0.94	0.07	0.45	0.10	3.16	1.94	0.05	99.98
PM-N8	AAS	Not recorded	101.19	64.40	28.15	1.00	0.07	1.01	0.15	3.22	1.98	0.05	100.03
PM-N9	AAS	Not recorded	101.19	66.50	27.16	0.72	0.04	0.43	0.12	3.00	2.01	0.04	100.02

Table B-7: Modelled blue-And-white porcelain sample mineral composition in wt% (original data from Table B-6)

No.	Sericite	Albite	Kaolinite	Quartz	Sum
EM-I2	26.40	7.28	14.09	50.78	98.55
EM-I3	22.53	11.68	17.10	47.24	98.55
EM-I4	23.98	5.42	20.05	49.38	98.83
EM-I5	25.03	11.34	15.71	46.41	98.48
EM-I6	26.00	16.42	12.86	43.39	98.66
EM-I7	16.23	11.25	29.70	41.29	98.48
EM-I8	13.89	7.95	35.81	40.88	98.53
EM-I9	24.47	3.72	21.17	49.28	98.64
EM-I10	22.53	8.88	21.01	46.48	98.90
EM-I11	23.58	10.41	22.10	42.14	98.23
EM-I12	24.47	8.97	20.78	43.97	98.18
EM-I13	15.26	8.63	30.42	44.46	98.77
EM-I14	25.60	3.47	18.59	50.75	98.40
EM-1C1	23.17	17.01	16.17	42.16	98.51
MM-I1	25.19	5.08	22.05	46.30	98.62
MM-I2	28.75	3.30	23.15	43.49	98.69
MM-I3	20.91	5.50	22.85	49.86	99.13
MM-I4	18.65	6.94	29.76	43.50	98.85
MM-I5	19.06	9.22	27.04	43.05	98.37
MM-I6	18.65	5.25	40.15	34.27	98.32
MM-I7	12.52	3.55	34.24	48.81	99.12
MM-I8	13.48	4.32	33.44	47.76	99.00
MM-I9	17.44	5.42	37.35	38.66	98.86
MM-I10	17.28	9.56	35.95	36.05	98.84
MM-I11	16.23	15.06	35.76	31.50	98.55
MM-1C1	26.16	19.29	20.30	26.82	92.57
LM-I1	24.63	14.30	13.54	45.16	97.63
LM-I2	26.65	8.46	13.35	47.71	96.17
LM-I3	27.21	13.12	15.68	41.29	97.30
LM-I4	21.72	9.39	21.43	45.65	98.20
MM-N1	27.70	3.55	17.67	47.90	96.82
MM-N2	26.57	6.77	22.46	41.04	96.84
MM-N3	31.65	2.20	16.35	45.61	95.81
MM-N4	31.17	3.22	17.73	43.67	95.79

MM-N5	26.24	4.65	18.63	47.33	96.86
MM-N6	25.27	7.53	18.13	45.33	96.26
MM-N7	24.55	3.64	18.04	50.55	96.78
MM-N8	34.56	9.22	10.26	42.55	96.59
MM-N9	32.46	1.86	17.55	44.92	96.79
MM-N10	27.78	3.72	18.92	46.46	96.88
MM-N11	28.66	3.64	24.87	38.80	95.97
MM-N12	29.55	0.25	18.05	48.98	96.84
MM-N13	29.79	3.64	13.38	49.64	96.45
MM-N14	29.07	5.42	15.09	47.35	96.92
MM-N15	25.92	5.84	24.36	39.81	95.93
MM-N16	27.78	12.95	15.39	40.94	97.05
MM-N17	26.32	4.91	19.56	44.84	95.63
MM-N18	34.56	0.25	16.43	44.72	95.96
MM-N19	39.89	0.25	12.66	43.31	96.11
MM-N20	37.55	3.98	10.21	44.56	96.29
MM-N21	38.84	3.64	9.24	44.50	96.22
LM-N1	24.63	11.59	17.32	41.79	95.33
LM-N2	22.37	15.06	19.08	39.22	95.73
LM-N3	24.14	13.28	17.29	40.62	95.34
LM-N4	24.14	16.50	17.46	36.29	94.39
LM-N5	24.47	12.61	18.19	39.61	94.87
LM-N6	25.27	14.13	16.62	38.64	94.66
LM-N7	24.38	13.28	20.70	36.30	94.67
LM-N8	22.45	12.02	18.38	42.12	94.96
LM-N9	25.68	15.82	13.83	40.16	95.49
LM-N10	28.66	22.51	8.27	36.78	96.22
LM-N11	25.52	11.76	15.47	43.51	96.26
LM-N12	18.81	5.25	33.51	40.28	97.85
LM-N13	19.38	1.95	35.33	41.31	97.97
LM-N14	28.34	10.75	11.03	47.28	97.40
LM-N15	27.21	12.44	10.52	47.19	97.36
LM-N16	33.59	10.49	13.77	38.44	96.29
LM-N17	27.21	14.30	13.22	42.84	97.57
LM-N18	28.50	12.69	20.17	35.65	97.02
LM-N19	26.81	12.44	15.25	42.17	96.67
LM-N20	28.66	12.52	12.78	43.57	97.54

LM-N21	26.40	14.22	17.49	38.96	97.07
LM-N22	22.20	19.80	22.85	31.20	96.06
LM-N23	27.13	11.93	9.80	48.23	97.09
LM-N24	27.78	15.40	15.26	38.12	96.56
LM-N25	25.19	14.98	28.42	27.37	95.96
LM-N26	26.16	10.15	27.09	33.88	97.29
LM-N27	32.38	10.15	14.58	39.02	96.14
PM-N1	24.38	13.28	29.76	30.91	98.34
PM-N2	24.55	16.67	27.44	29.86	98.52
PM-N3	22.93	17.68	28.21	29.31	98.14
PM-N4	28.02	7.02	31.41	31.50	97.95
PM-N5	25.52	11.76	28.54	32.18	98.00
PM-N6	29.07	10.41	28.57	29.41	97.46
PM-N7	25.52	16.42	32.28	24.16	98.37
PM-N8	26.00	16.75	31.45	23.55	97.75
PM-N9	24.22	17.01	30.74	26.70	98.67

Table B-8: Modelled kaolin addition ratios for porcelain body paste recipes using refractory porcelain stone in wt% (original data from Table B-7)

No.	Porcelain stone ratio	Kaolin addition ratio
EM-I1	97.16	2.84
EM-I4	90.30	9.70
EM-I9	88.16	11.84
EM-I14	93.08	6.92
MM-I1	86.49	13.51
MM-I2	84.39	15.61
MM-I6	51.99	48.01
MM-I7	63.26	36.74
MM-I8	64.78	35.22
MM-I9	57.33	42.67
MM-N1	94.84	5.16
MM-N3	97.35	2.65
MM-N4	94.72	5.28
MM-N5	93.01	6.99
MM-N7	94.13	5.87
MM-N9	95.06	4.94
MM-N10	92.45	7.55
MM-N11	81.11	18.89
MM-N12	94.11	5.89
MM-N13	103.01	-3.01
MM-N14	99.75	0.25
MM-N17	91.23	8.77
MM-N18	97.20	2.80
MM-N19	104.38	-4.38
MM-N20	109.05	-9.05
MM-N21	110.90	-10.90
LM-N12	64.65	35.35
LM-N13	61.18	38.82

Table B-9: Modelled kaolin addition ratios for porcelain body paste recipes using fusible porcelain stone in wt% (original data from Table B-7)

No.	Porcelain stone ratio	Kaolin addition ratio
EM-I3	75.94	24.06
EM-I5	78.03	21.97
EM-I6	82.33	17.67
EM-I7	56.93	43.07
EM-IC1	77.34	22.66
MM-I11	47.78	52.22
MM-IC1	71.11	28.89
MM-N16	78.52	21.48
LM-IC1	81.31	18.69
LM-IC3	78.08	21.92
LM-N1	75.60	24.40
LM-N2	72.95	27.05
LM-N3	75.65	24.35
LM-N4	75.39	24.61
LM-N5	74.29	25.71
LM-N6	76.66	23.34
LM-N7	70.50	29.50
LM-N8	74.00	26.00
LM-N9	80.87	19.13
LM-N10	89.26	10.74
LM-N11	78.39	21.61
LM-N15	85.86	14.14
LM-N17	81.79	18.21
LM-N18	71.30	28.70
LM-N19	78.73	21.27
LM-N20	82.45	17.55
LM-N21	75.35	24.65
LM-N22	67.26	32.74
LM-N23	86.95	13.05
LM-N24	78.71	21.29
LM-N25	58.86	41.14
PM-N1	56.83	43.17
PM-N2	60.33	39.67
PM-N3	59.17	40.83

PM-N5	58.68	41.32
PM-N7	53.03	46.97
PM-N8	54.28	45.72
PM-N9	55.36	44.64

Appendix C: Supplementary Materials for Chapter 5

Table C-1: Summary of dragon bowls produced in Ming-period Jingdezhen

No.	Date	Rim diameter (cm)	Foot diameter (cm)	Height (cm)	Decoration method	Collection/ Excavation site	Accession no.	Excavation no.	Reference
1	Xuande period	Not available			Underglaze blue	British Museum	PDF.655	Not applicable	The British Museum, see: https://www.britishmuseum.org/collection/object/A_PDF-655?selectedImageId=1613776838
2	Xuande period	59.6	40.0	27.6	Underglaze blue	Jingdezhen Ceramic Archaeological Research Institute (景德鎮市陶瓷考古研究所)/Yuyaochang Site (御窯廠遺址)	Not available	Not available	Cao, 2008
3	Zhengtong period	75.0	61.0	75.5	Underglaze blue	Jingdezhen Imperial Kiln Museum (御窯博物館)/Yuyaochang Site (御窯廠遺址)	Not available	Not available	BPM *et al*., 2019, pp. 34–35
4	Zhengtong period	56.5	51.0	65.5	Underglaze blue	Shanghai Museum (上海博物館)	Not available	Not applicable	Shanghai Museum, see: https://www.shanghaimuseum.net/mu/frontend/pg/article/id/P00005128#image
5	Zhengtong–Tianshun periods	42.0	25.0	22.0	Underglaze blue	Jingdezhen Ceramic Archaeological Research Institute (景德鎮市陶瓷考古研究所)/Yuyaochang Site (御窯廠遺址)	Not available	Not available	BPM *et al*, 2019, p. 36

6	Zhengtong–Tianshun periods	51.0	25.0	25.0	Underglaze blue	Jingdezhen Ceramic Archaeological Research Institute (景德鎮市陶瓷考古研究所)/Yuyaochang Site (御窯廠遺址)	Not available	Not available	BPM *et al*, 2019, p. 37
7	Zhengtong–Tianshun periods	60.0	30.0	30.0	Underglaze blue	Jingdezhen Ceramic Archaeological Research Institute (景德鎮市陶瓷考古研究所)/Yuyaochang Site (御窯廠遺址)	Not available	Not available	BPM *et al*, 2019, pp. 38–39
8	Jiajing period	48.0	35.5	42.5	Underglaze blue	Shexian Museum (歙縣博物館)	Not available	Not applicable	Chen, 2019
9	Jiajing period	49.5	36.5	45.5	Underglaze blue	Shexian Museum (歙縣博物館)	Not available	Not applicable	Chen, 2019
10	Jiajing period	70.0	58.0	69.7	Underglaze blue	Dingling Museum (定陵博物館)/Dingling Tomb Site (定陵遺址)	Not available	2009-歷	IACASS *et al*., 1990, p.184; Ming Tombs Special District Office, 2006, p. 246
11	Jiajing period	70.0	58.0	69.0	Underglaze blue	Dingling Museum (定陵博物館)/Dingling Tomb Site (定陵遺址)	Not available	2029-靖	IACASS *et al*., 1990, p. 184; Ming Tombs Special District Office, 2006, p. 247
12	Jiajing period	71.1	58.5	70.0	Underglaze blue	Dingling Museum (定陵博物館)/Dingling Tomb Site (定陵遺址)	Not available	2020-端	IACASS *et al*., 1990, p. 184; Ming Tombs Special District Office, 2006, p. 248
13	Jiajing period	74.5	Not available		Underglaze blue	The Art Museum, the Chinese University of Hong Kong (文物館)	2009.240	Not applicable	Li, 2012, pp. 132–133
14	Jiajing period	38.5	Not available		Underglaze blue	The Art Museum, the Chinese University of Hong Kong (文物館)	Not available	Not applicable	Li, 2012, pp. 134–135
15	Jiajing period	76.6	Not available	41.2	Underglaze blue	The Art Museum, the Chinese University of Hong Kong (文物館)	2010.550	Not applicable	Li, 2012, pp. 224–225

16	Jiajing period	69.5	Not available	62.5	Underglaze blue	The University Museum and Art Gallery, The University of Hong Kong (香港大學美術博物館)	Not available	Not applicable	Cao, 2008
17	Jiajing period	61.0	41.0	34.0	Underglaze blue	Jingdezhen Ceramics Museum (景德鎮陶瓷館)	Not available	Not applicable	Cao, 2008
18	Jiajing period	68.5	55.0	42.0	Underglaze blue	Langfang Cultural Relics Management Office (廊坊市文物管理所)	Not available	Not applicable	Zhang, 1997
19	Jiajing period	68.0	52.0	38.5	Underglaze blue	Langfang Cultural Relics Management Office (廊坊市文物管理所)	Not available	Not applicable	Zhang, 1997
20	Jiajing period	69.5	54.5	57.5	Underglaze blue	Capital Museum (首都博物館)	Not available	Not applicable	Pei, 2019; Li *et al*., 2020
21	Jiajing period	66.0	48.0	54.5	Underglaze blue	The Palace Museum (故宮博物院)	Not available	Not applicable	BPM *et al.*, 2018, pp. 90–91
22	Jiajing period	68.6	53.5	32.6	Underglaze blue	Arthur M. Sackler Museum of Art and Archaeology, Peking University (北京大學塞克勒考古與藝術博物館)	L91.05	Not applicable	The Arthur M. Sackler Museum of Art and Archaeology at Peking University, see: https://www.amsm.pku.edu.cn/zpxs/yc/14546.htm
23	Jiajing period	77.0	52.0	39.5	Underglaze blue	National Museum of China (中國國家博物館)	Not available	Not applicable	The National Museum of China, see: https://www.chnmuseum.cn/zp/zpml/201812/t20181218_23814.shtml
24	Jiajing period	59.1	42.0	29.3	Underglaze blue	Shanghai Museum (上海博物館)	Not available	Not applicable	Lu, 2007, p. 158
25	Jiajing period	71.7	53.0	35.0	Underglaze blue	Shanghai Museum (上海博物館)	Not available	Not applicable	Lu, 2007, p. 158
26	Jiajing period	79.0	49.0	39.0	Underglaze blue	Shanghai Museum (上海博物館)	Not available	Not applicable	Lu, 2007, p. 46

27	Jiajing period	65.5	Not available	38.8	Underglaze blue	Art Gallery of New South Wales	EC4.1964	Not applicable	Art Gallery of New South Wales, see: https://www.artgallery.nsw.gov.au/collection/works/EC4.1964/
28	Longqing period	55.2	Not available	37.8	Underglaze blue and overglaze wucai	British Museum	PDF 778	Not applicable	The British Museum, see: https://www.britishmuseum.org/collection/object/A_PDF-778?selectedImageId=1613255279
29	Longqing period	69.0	52.5	35.6	Underglaze blue	National Museum of China (中國國家博物館)	Not available	Not applicable	The National Museum of China, see: https://www.chnmuseum.cn/zp/zpml/csp/201812/t20181218_27744.shtml
30	Longqing period	56.2	Not available	36.2	Underglaze blue and overglaze wucai	Tokyo Fuji Art Museum	Not available	Not applicable	Tokyo Fuji Art Museum, see: https://www.fujibi.or.jp/en/collection/artwork/01549/
31	Wanli period	61.5	41.0	32.0	Underglaze blue	The Palace Museum (故宮博物院)	Not available	Not applicable	BPM *et al*, 2018, p. 469
32	Wanli period	58.5	Not available	30.0	Underglaze blue and overglaze wucai	The Victoria and Albert Museum	C.189-1933	Not applicable	The V&A, see: https://collections.vam.ac.uk/item/O437261/bowl-unknown/
33	Wanli period	Not available	Not available	39.0	Underglaze blue and overglaze yellow	British Museum	PDF 728	Not applicable	The British Museum, see: https://www.britishmuseum.org/collection/object/A_PDF-728
34	Wanli period	40.9	25.8	30.2	Underglaze blue	Shanghai Museum (上海博物館)	Not available	Not applicable	Lu, 2007, p. 55

35	Wanli period	52.0	19.5	41.8	Underglaze blue	Shandong Museum (山東博物館)	Not available	Not applicable	Internal data from museum curator

Catalogue A: Summary of Archaeological Fieldwork at Yuyaochang

This catalogue records individual instances of archaeological fieldwork (surveys, rescue excavations, and planned excavations) conducted within and adjacent to the Yuyaochang National Archaeological Site Park (御窯廠國家考古遺址公園) between 1973 and 2024, focusing on materials dating to the Ming period. The site is bounded to the east by North Zhonghua Road (中華北路), to the west by Dongsiling Lane (東司嶺), to the north by Doufu Lane (斗富弄), and to the south by Zhushan Boulevard (珠山大道). Twenty-nine surveys, rescue excavations, and planned excavations have been conducted at the site, recovering ceramic production remains spanning the Song, Yuan, Ming, and Qing periods. Each numbered entry (e.g., No.1, No.2) represents a single fieldwork event, namely a survey or excavation carried out at a specific location within or near the site. Entries are arranged in chronological order, and the numbers correspond to those marked on the site map (Figure 3-3) to facilitate cross-referencing.

Each entry provides: date, fieldwork type, location, responsible institution(s), data source, state of publication, and principal findings of individual fieldwork projects. Where available, principal findings include information on excavation units, stratigraphic layers, relative chronology, and descriptions of features and artefacts. Feature identifiers retain the original excavation numbers assigned in published reports and appear as sub-entries under the relevant entry. Complete feature references in the thesis follow the format: site abbreviation (YYC), catalogue entry number, and feature identifier—for example, kiln 04JYIY6 from entry No.20a is referenced as YYC-20a-04JYIY6. For the description of porcelain artefacts, this catalogue retains the original classification of ‘imperial’ and ‘non-imperial’ porcelain as assigned in the excavation reports, which calls for further examination.

No.1

Year: 1973

Fieldwork type: rescue excavation carried out prior to infrastructure projects

Location: east of the Pearl Hill 珠山

Research institution: Jingdezhen Ceramic Archaeological Research Institute 景德鎮陶瓷考古研究所

Data source: Liu, 1993

State of publication: mentioned

Findings: porcelain sherds, dating to the Chenghua period

No.2

Year: 1979

Fieldwork types: survey and rescue excavation conducted prior to historic building preservation

Location: near the eastern wall of the Pearl Hill 珠山

Research institution: Jingdezhen Ceramic Archaeological Research Institute 景德鎮陶瓷考古研究所

Data source: Liu, 1996; Jiang, 2020b

State of publication: mentioned

Findings: sherds of blue-and-white porcelain and red glazed porcelain, dating to the late Yuan–early Ming periods

No.3

Year: 1982

Fieldwork types: survey and rescue excavation carried out during underground electrical cable installation

Location: near the eastern wall of the Pearl Hill 珠山

Research institution: Jingdezhen Ceramic Archaeological Research Institute 景德鎮陶瓷考古研究所

Data source: Liu, 1996; Jiang, 2020b

State of publication: mentioned

Findings: white glazed porcelain sherds, including one remanent foot base of a stem cup stamped with Yongle reign mark[31] on the inner bottom, dating to the Yongle period

No.4a

Year: 1982

Fieldwork type: rescue excavation carried out prior to road resurfacing

Location: east of the Zhushan Blvd 珠山大道

Research institution: Jingdezhen Ceramic Archaeological Research Institute 景德鎮陶瓷考古研究所

Data source: Liu, 1996; Jiang, 2020b

State of publication: mentioned with some details

Findings: the deposition of three excavation units (180 m^2 in total) was summarised into five stratigraphic layers

layer 1 modern-day roadbed

layer 2 sherds of red glazed porcelain and celadon glazed porcelain, all remanent foot bases found inscribed with Xuande reign marks[32], dating to the Xuande period

layer 3 mainly deposit of sandy white clay (likely waste from clay levigation), containing 17 white glazed porcelain corner titles, dating to the Yongle period

layer 4 mainly deposit of pale-red coloured clay (likely used for saggar making), containing a few sherds of white glazed porcelain and blue-and-white porcelain; several stem cups' remanent foot bases stamped with Yongle reign marks on the inner bottom, dating to the Yongle period

layer 5 sherds of white glazed porcelain, including ewers, bowls, plates with flattened rim; more then 70 out of 110 stem cups' remanent foot bases stamped with Yongle reign marks on the inner bottom, dating to the Yongle period

No.4b

Year: 1982

Fieldwork type: rescue excavation carried out prior to road resurfacing

Location: west of the Zhushan Blvd 珠山大道

[31] If unspecified, Yongle reign mark refers to the inscription 'Made in the years of Yongle' (永樂年制).

[32] If unspecified, Xuande reign mark refers to the inscription 'Made in the years of Xuande of the Great Ming' (大明宣德年制).

Research institution: Jingdezhen Ceramic Archaeological Research Institute 景德鎮陶瓷考古研究所

Data source: Liu, 1996; Jiang, 2020b

State of publication: mentioned

Findings: sherds of white glazed, red glazed, monochrome glazed, polychrome glazed, and blue-and-white underglaze red porcelain; two stem cups' remanent foot bases stamped with Yongle reign marks on the inner bottom, dating to the Yongle period

No.5

Year: 1983–1985

Fieldwork type: rescue excavation prior to the reconstruction of the Dragon Pearl Pavilion 龍珠閣 at the Pearl Hill 珠山

Location: Pearl Hill 珠山

Research institutions: Jiangxi Provincial Archaeological Research Team 江西省文物工作隊 and Jingdezhen Ceramic History Museum 景德鎮市陶瓷歷史博物館

Data source: Jiangxi and JCARI *et al.*, 1989

State of publication: preliminary report

Findings: two large excavation units, T1 (at the back hall of the historic Dragon Pearl Pavilion) and T2 (at the middle hall of the historic Dragon Pearl Pavilion), containing about 23,000 pieces of porcelain sherds and kiln furniture; some porcelain sherds inscribed with imperial reign periods, dating to the Ming and Qing periods

No.6

Year: 1987

Fieldwork type: survey

Location: Dongsiling Lane 東司嶺, west of the Archaeological Site Park

Research institution: Jingdezhen Ceramic Archaeological Research Institute 景德鎮陶瓷考古研究所

Data source: Jiang, 2020b

State of publication: mentioned

Findings: two sherds of underglaze red porcelain vases, one with the inscription ‘Offerings made in the first (year) of Yongle’ (永樂元供養), the other with the inscription ‘Offerings made in the fourth year of Yongle’ (永樂四年供養), dating to the Yongle period

No.7

Year: 1987

Fieldwork type: rescue excavation carried out prior to infrastructure projects

Location: northeast of the Pearl Hill 珠山

Research institution: Jingdezhen Ceramic Archaeological Research Institute 景德鎮陶瓷考古研究所

Data source: Jiang, 2020b

State of publication: mentioned

Findings: sherds of yellow glazed porcelain and blue-and-white porcelain, mostly bowls and plates, dating to the Hongzhi period

No.8

Year: 1987

Fieldwork type: rescue excavation carried out prior to infrastructure projects

Location: east of the Pearl Hill 珠山

Research institution: Jingdezhen Ceramic Archaeological Research Institute 景德鎮陶瓷考古研究所

Data source: Jiang, 2020b

State of publication: mentioned

Findings: sherds of polychrome glazed or painted porcelain, most of which could be reassembled into original form, dating to the Zhengde period

No.9

Year: 1987

Fieldwork type: rescue excavation carried out prior to infrastructure projects

Location: Pearl Hill 珠山

Research institution: Jingdezhen Ceramic Archaeological Research Institute 景德鎮陶瓷考古研究所

Data source: Jiang, 2020b

State of publication: mentioned

Findings: porcelain sherds dating from the Chenghua to Jiajing periods; the pieces dating to the Jiajing period with coarse bodies

No.10

Year: 1988

Fieldwork type: rescue excavation carried out prior to infrastructure projects

Location: north of the Pearl Hill 珠山, middle of Fengjing Road 風景路

Research institution: Jingdezhen Ceramic Archaeological Research Institute 景德鎮陶瓷考古研究所

Data source: Jiang, 2020b

State of publication: mentioned

Findings: sherds of white glazed porcelain, blue glazed porcelain, turquoise glazed porcelain, and blue-and-white porcelain, dating to the Yuan period

No.11

Year: 1988

Fieldwork type: rescue excavation carried out prior to gas line installation

Location: middle of North Zhonghua Road 中華北路, east of the Archaeological Site Park

Research institution: Jingdezhen Ceramic Archaeological Research Institute 景德鎮陶瓷考古研究所

Data source: Liu, 1996

State of publication: mentioned

Findings: porcelain sherds were found under a layer of sandy white clay deposit, dating to the early Ming period

No.12

Year: 1988

Fieldwork type: rescue excavation carried out prior to infrastructure projects

Location: Dongsiling Lane 東司嶺, southwest of the Archaeological Site Park

Research institution: Jingdezhen Ceramic Archaeological Research Institute 景德鎮陶瓷考古研究所

Data source: Jiang, 2020b

State of publication: mentioned

Findings: 5 firing kilns; large quantities of large-sized porcelain fishbowl sherds that could be reassembled into original form, dating to the Zhengtong period

No.13

Year: 1987–1988

Fieldwork type: rescue excavation carried out prior to reconstruction of the Dragon Pearl Pavilion 龍珠閣 at the Pearl Hill 珠山

Location: northeast of the Pearl Hill 珠山

Research institution: Jingdezhen Ceramic Archaeological Research Institute 景德鎮陶瓷考古研究所

Data source: Jiang, 2020b

State of publication: mentioned with some details

Findings: three pits dating to the Chenghua period

87H1

sherds of blue-and-white porcelain, doucai[33] porcelain, yellow and green glazed porcelain, and turquoise glazed porcelain; vessel forms mainly including flowerpot, incense burner, stem cup, and large lidded jar; most sherds found bearing Chenghua reign marks[34]

87H2

sherds of blue-and-white porcelain and polychrome glazed or painted porcelain, mostly bowls and plates

87H3

sherds of doucai porcelain, blue-and-white porcelain, blue-and-white underglaze red porcelain, and polychrome glazed or painted porcelain

[33] Doucai (鬥彩) is a porcelain decorating technique involve multiple stages of painting and firing. After parts of the decoration are painted in underglaze blue, the porcelain is glazed and fired. The decoration is then completed by applying coloured overglaze enamels (typically red, yellow, green, and brown) and fired again at a lower temperature of about 850°C

[34] If unspecified, Chenghua reign mark refers to the inscription 'Made in the years of Chenghua of the Great Ming' (大明成化年制).

No.14

Year: 1990

Fieldwork types: survey and rescue excavation during the reconstruction of the Dragon Pearl Pavilion 龍珠閣 at the Pearl Hill 珠山

Location: east of the Pearl Hill 珠山

Research institution: Jingdezhen Ceramic Archaeological Research Institute 景德鎮陶瓷考古研究所

Data source: Liu, 1996

State of publication: mentioned

Findings: large quantities of fragmented architectural porcelain and kiln furniture, dating to the Hongwu period, including a saggar fragment inscribed with 'The saggar for official use' (官匣) and porcelain roof tiles inscribed with names of workers and production supervisors

No.15

Year: 1990

Fieldwork type: survey

Location: middle of North Zhonghua Road 中華北路, east of the Archaeological Site Park

Research institution: Jingdezhen Ceramic Archaeological Research Institute 景德鎮陶瓷考古研究所

Data source: JCARI *et al.*, 2019

State of publication: mentioned

Findings: porcelain sherds dating to the Hongwu period (1368–1398)

No.16

Year: 1993

Fieldwork type: rescue excavation carried out prior to infrastructure projects

Location: middle of North Zhonghua Road 中華北路, east of the Archaeological Site Park

Research institution: Jingdezhen Ceramic Archaeological Research Institute 景德鎮陶瓷考古研究所

Data source: Jiang, 2020b

State of publication: mentioned

Findings: large quantities of porcelain sherds, including porcelain plate fragments previously used for testing cobalt-blue pigments, dating to the Xuande period

No.17

Year: 1994

Fieldwork type: rescue excavation carried out prior to building construction

Location: middle of North Zhonghua Road 中華北路, east of the Archaeological Site Park

Research institution: Jingdezhen Ceramic Archaeological Research Institute 景德鎮陶瓷考古研究所

Data source: Liu, 1996

State of publication: mentioned with some details

Findings: the deposition of excavation units (360 m^2 in total) summarised into nine stratigraphic layers

layer 1 modern-day roadbed, containing porcelain sherds dating to the late 19th and early 20th centuries

layer 2 blue-and-white porcelain bowl sherds, including the ones inscribed with Wanli reign marks[35], dating to the Wanli period

layer 3 blue-and-white porcelain sherds, including the ones inscribed with Jiajing reign marks[36]; yellow glazed porcelain wine cup sherds; trimming tools, dating to the Jiajing period

layer 4 white glazed porcelain sherds, including one remanent foot base of a stem cup stamped with Yongle reign mark, dating to the Yongle period; qingbai porcelain[37] sherds and kiln furniture, dating to the Song and Yuan periods

layer 5 sherds of blue-and-white porcelain and red glazed porcelain, dating to the early Ming period

layer 6 sherds of porcelain roof tiles and bricks and saggar fragments, dating to the early Ming period

layer 7 a few porcelain roof tile sherds, including one inscribed with names of workers and production supervisors, dating to the Hongwu period

[35] If unspecified, Wanli reign mark refers to the inscription 'Made in the years of Wanli of the Great Ming' (大明萬曆年制).

[36] If unspecified, Jiajing reign mark refers to the inscription 'Made in the years of Jiajing of the Great Ming' (大明嘉靖年制).

[37] Qingbai porcelain (*qingbai ci* 青白瓷) refers to a type of Chinese porcelain with a white glaze that has a blue-greenish tint.

layer 8 deposit of purified white clay with good plasticity, including a few coarse porcelain sherds, dating to the Yuan period

layer 9 qingbai porcelain sherds and kiln furniture (mostly ring-shaped kiln support tools), dating to the Song period

No.18

Year: 1999

Fieldwork type: rescue excavation carried out prior to infrastructure projects

Location: Dongsiling Lane 東司嶺, southwest of the Archaeological Site Park

Research institution: Jingdezhen Ceramic Archaeological Research Institute 景德鎮陶瓷考古研究所

Data source: Jiang, 2020b

State of publication: mentioned

Findings: a pit (4.6m in length, 2.3m in width) filled with sherds of blue-and-white porcelain, blue-and-white underglaze red porcelain, white glazed porcelain tiles, and black glazed porcelain, including a black glazed incense burner with the inscription 'On an auspicious day in the 21st year of the Yongle period, seeking blessings from the Hukeng Bridge' (永樂貳拾壹年歲次癸卯吉日喜捨湖坑大橋求), dating to the Yongle period

No.19

Year: 2000

Fieldwork type: rescue excavation carried out prior to infrastructure projects

Location: north of the Pearl Hill 珠山

Research institution: Jingdezhen Ceramic Archaeological Research Institute 景德鎮陶瓷考古研究所

Data source: Jiang, 2020b

State of publication: mentioned

Findings: blue-and-white porcelain bowl sherds bearing Hongzhi reign marks[38], most of which could be reassembled into original form, dating to the Hongzhi period

[38] If unspecified, Hongzhi reign mark refers to the inscription 'Made in the years of Hongzhi of the Great Ming' (大明弘治年制).

No.20a

Year: 2002–2004

Fieldwork type: planned excavation

Location: north of the Pearl Hill 珠山

Research institutions: School of Archaeology and Museology at Peking University 北京大學考古文博學院, Jiangxi Provincial Institute of Cultural Relics and Archaeology 江西省文物考古研究所, Jingdezhen Ceramic Archaeological Research Institute 景德镇市陶瓷考古研究所

Data source: Liu *et al.*, 2004; SAM-PKU *et al.*, 2005; 2007

State of publication: preliminary excavation reports

Findings: uncovering features of 7 gourd-shaped firing kilns (with 04JYIY6 described in detail); yielding porcelain sherds deposited in three ways, including pits (labelled as K), small piles (labelled as D), and large piles (labelled as P)

02JYIK8

described in detail; 0.63m in diameter, with a maximum depth of 0.13m; in excavation unit 02JYIT0501, breaking through stratigraphic layer no.7 and situated under layers no.5 and no.6; containing porcelain sherds that could be reassembled into 6 vessels, including 1 blue-and-white underglaze red vase decorated with cloud and dragon motifs, 1 underglaze red vase decorated with dragon motif, 1 red glazed vase incised with dragon decoration, 1 red glazed vase, and 2 underglaze red bowls decorated with dragon-chasing-pearls motif; all porcelains found with no written or stamped inscription; dating to the Yongle period

02JYIK12

in excavation unit 02JYIT0501, breaking through stratigraphic layer no.7 and situated under layers no.5 and no.6; containing porcelain sherds that could be reassembled into 1 underglaze red meiping vase, dating to the Yongle period

02JYIK2

in excavation unit 02JYIT0501, breaking through stratigraphic layer no.7 and situated under layers no.5 and no.6; containing porcelain sherds that could be reassembled into aubergine glazed porcelain, black glazed porcelain, and underglaze red porcelain; 1 fragmented underglaze red stem cup inscribed with Yongle reign mark on the inner bottom; dating to the Yongle period

03JYIK12

described in detail; 0.58m in diameter, with a maximum depth of 0.23m; in excavation unit 02JYIT0501, breaking through stratigraphic layer no.7 and situated under layers no.5 and no.6; containing porcelain sherds that could be reassembled into 34 vessels, including 4 underglaze red meiping vases, 2 underglaze red bowls, 1 red glazed meiping vases, 5 red glazed bowls, 21 red glazed plates, and 1 red glazed stem cup; all porcelains found with no written or stamped inscription; dating to the Yongle period

03JYIK14

described in detail; 0.2m in depth, with a maximum diameter of 0.6m; in excavation unit 02JYIT0501, breaking through stratigraphic layer no.7 and situated under layers no.5 and no.6; containing porcelain sherds that could be reassembled into 28 vessels, including 17 red glazed plates, 3 red glazed bowls, 6 red glazed stem cups, and 2 underglaze red stem cups; dating to the Yongle period

02JYIK6

in excavation unit 02JYIT0501, breaking through stratigraphic layer no.7 and situated under layers no.5 and no.6; containing sherds that could be reassembled into red glazed porcelains and underglaze red porcelains; 1 red glazed stem cup and 1 underglaze red bowl inscribed with Yongle reign marks on the inner bottom; dating to the Yongle period

02JYIK4

in excavation unit 02JYIT0501, breaking through stratigraphic layer no.7 and situated under layers no.5 and no.6; containing porcelain sherds that could be reassembled into a red glazed plate and an underglaze red bowl, both without inscription; dating to the Xuande period

02JYIH2

in excavation unit 02JYIT0501, breaking through stratigraphic layer no.7 and situated under layers no.5 and no.6; containing porcelain sherds that could be reassembled into 8 vessels, including 1 red glazed stem cup, 2 red glazed bowls, 1 red glazed plate, and 4 ge-type[39] glazed small jars; all porcelains found with the inscription Xuande reign marks, except for one small jar; dating to the Xuande period

03JYIP3

containing porcelain sherds that could be reassembled into a doucai bowl bearing Chenghua reign mark; dating to the Chenghua period

[39] Ge-type glaze is a cream-grey glaze with crackles on porcelain surface. Ge-type glazed porcelain was made in Jingdezhen from the Xuande period onwards.

03JYIP4

containing porcelain sherds that could be reassembled into 1 blue-and-white vase with long and slim neck, 1 ge-type glazed vase with two handles, and 1 doucai cup bearing Chenghua reign mark; dating to the Chenghua period

03JYIP5

described in detail; 9m in length, 2.6m in width, with a maximum height of 0.25m; in excavation unit 03JYIT0403, between stratigraphic layers no.7d no.8; containing 87 sherds of white glazed porcelain, blue-and-white porcelain, unfinished doucai porcelain, and ge-type glazed gu vase; foot bases of 17 ge-type glazed porcelains, 8 white glazed porcelains, and 3 unfinished doucai porcelains bearing Chenghua reign marks; dating to the Chenghua period

03JYIK16

containing porcelain sherds of yellow glazed plates inscribed with Hongzhi reign marks on the foot base

04JYIVK31

containing porcelain sherds that could be reassembled into 1 underglaze red bowl and 1 underglaze stem cup, both decorated with dragon motif and inscribed with Yongle reign marks on the inner bottom; dating to the Yongle period

04JYIVK18

described in detail; 0.15m in depth, 0.56-0.72m in diameter; in excavation unit 04JYIVT0501, breaking through stratigraphic layer no.5b and situated under layer no.5a; containing porcelain sherds that could be reassembled into 7 blue-and-white plates and small quantities of white glazed, red glazed, and ge-type glazed porcelain sherds; dating to the Xuande period

04JYIVK20

in excavation unit 04JYIVT0501, situated under stratigraphic later no.5a; containing porcelain sherds that could be reassembled into a blue-and-white plate; dating to the Xuande period

04JYIVK21

described in detail; 0.1-0.27m in depth, 0.66-0.81m in diameter; in excavation unit 04JYIVT0501, breaking through stratigraphic layer no.5c and situated under later no.5a; containing porcelain sherds that could be reassembled into 17 vessels, including 3 red glazed bowls, 8 red glazed plates, 2 red glazed stem cups, 2 white glazed bowls, 1 white glazed plate, and 1 ge-type glazed bowl; all porcelains inscribed with Xuande reign marks on the foot base; dating to the Xuande period

04JYIVP10

described in detail; 1.8m in length, 1.2m in width, and 0.08-0.29m in height; in excavation unit 04JYIVT0501, situated between stratigraphic layers no.5c and no.5d; containing porcelain sherds that could be reassembled in 26 vessels, including 1 blue-and-white fishbowl, 1 blue glazed fishbowl, 7 white glazed plates, 5 white glazed bowls, 1 white glazed ewer, 3 ge-type glazed plates, 2 ge-type glazed basins, 4 ge-type glazed bowls, 1 ge-type glazed stem cup, and 1 stem cup with only white glaze in the interior; most porcelains found inscribed with Xuande reign marks on the foot base; dating to the Xuande period

04JYIP8

containing porcelain sherds that could be reassembled into a blue-and-white plate decorated with dragon motif and inscribed with Hongzhi reign marks written on the foot base; dating to the Hongzhi period

04JYIY6

situated below layer 6 of excavation unit 04JYIT0404 and layer 10 of excavation unit 03JYIT0403; one of seven kilns forming a kiln complex; gourd-shaped; constructed with wedge-shaped bricks; consisting of front area, kiln door, firebox, front kiln chamber, rear kiln chamber, and protective wall

kiln door 0.7m in width, preserved height 0.6m; flaring outward

firebox semi-circular; 1m in depth and 3.2m in maximum width; behind firebox a brick assistant wall 0.4m in thickness, only two ends preserved

kiln chamber sloping from lower at front to higher at rear at 8-10°; overall length (from kiln door to rear chamber) 10.66m, front chamber approximately 2.28-3.2m in width, rear chamber 2.14-2.28m in width; front chamber and firebox forming a circular space 1.46m in depth; rear chamber 6.9m in length

protective wall built outside kiln wall, approximately 0.14-0.44m in width; constructed with broken bricks, tiles, and saggar fragments; bricks mostly laid in vertical orientation at an angle, presenting horizontal herringbone pattern on the elevation; saggar pieces stacked horizontally, with porcelain fragments, broken brick pieces, and red earth sandwiched between

dating to Hongwu and Yongle periods

No.20b

Year: 2004

Fieldwork type: planned excavation

Location: south of the Pearl Hill 珠山

Research institutions: School of Archaeology and Museology at Peking University 北京大學考古文博學院, Jiangxi Provincial Institute of Cultural Relics and Archaeology 江西省文物考古研究所, Jingdezhen Ceramic Archaeological Research Institute 景德镇市陶瓷考古研究所

Data source: SAM-PKU *et al.*, 2005; 2007

State of publication: preliminary excavation reports

Findings: uncovering features of 14 horseshoe-shaped firing kilns (with 04JYIIY14 described in detail), yielding porcelain sherds deposited in small piles (labelled as D, with 04JYIID1 and 04JYIID3 described in detail)

04JYIID1

0.19m in height, with a maximum length of 0.7m and a maximum width of 0.55m; in excavation unit 04JYIIT2404, situated between stratigraphic layers no.3a and no.3b; containing sherds that could be reassembled into 25 vessels, including turquoise glazed porcelain with underglaze blue decoration (1 meiping vase, 1 ewer, 3 plates, 8 bowls, 2 small dishes, and 1 stem cup), power blue glazed porcelain decorated with dragon-motif decoration(1 large jar, 1 bowl, 1 small bowl, 2 plates, and 1 small dish), blue glazed porcelain (2 plates), and 1 red glazed porcelain bowl; all porcelains found bearing Xuande reign marks written on the foot base; dating to the Xuande period

04JYIID3

0.2m in height, with a maximum length of 0.3m and a maximum width of 0.25m; in excavation unit 04JYIIT2404, situated between stratigraphic layers no.3a and no.3b; containing sherds that could be reassembled into 20 vessels, including turquoise glazed porcelain (2 bowls, 3 plates, and 7 dishes), blue glazed porcelain (2 bowls), powder blue glazed porcelain decorated with dragon motif (1 bowl, 4 plates, and 1 small bowl); all porcelains found bearing Xuande reign marks written on the foot base; dating to the Xuande period

04JYIIY14

opening below layer 5 of excavation unit 04JYIIIT2304 (containing large quantities of 'non-imperial' blue-and-white porcelain sherds); one of 15 kilns forming a kiln complex; horseshoe-shaped; constructed with small rectangular bricks, level kiln bed; consisting of front area, kiln door, firebox, kiln chamber, flue, smoke vents, chimney, and protective wall; total length (excluding front working area) approximately 4m

kiln door 0.54m in width, preserved height 0.48m; flaring outward; bottom level with firebox bottom

firebox semi-circular in plan; 0.46m in depth, 2.02m in maximum width; 0.42-0.52m lower than kiln bed surface; left and right corners sealed with bricks to facilitate fire flow
kiln chamber horizontally elongated rectangular in plan; 1.38m in length, 2.02m in width; left and right walls relatively straight
flue brick-built, located at kiln chamber rear wall; 0.22m in depth, same width as kiln chamber; connecting with smoke vents below rear wall
smoke vents 6 holes arranged in a row below rear wall; two on left and right slightly larger (0.16m in width, 0.12m in height), four in middle all 0.12m in width and height; hole bottoms level with flue bottom
chimney located behind rear wall; horizontally elongated rectangular in plan with arc-shaped outer corners; 0.35m in length, 2.02m in width
protective wall built outside kiln wall; poorly preserved
dating to Xuande and Wanli periods

No.21

Year: 2013

Fieldwork type: rescue excavation carried out prior to cable line installation

Location: North Zhonghua Road 中華北路

Research institution: Jingdezhen Ceramic Archaeological Research Institute 景德鎮陶瓷考古研究所

Data source: JCARI *et al.*, 2018

State of publication: preliminary excavation report

Findings: excavation unit 2013JYG separated into five stratigraphic layers
layer 1 deposit of modern construction waste, 0.6m in depth
layer 2 deposit of red clay, 0.1m in depth
layer 3 deposit of brown clay, 0.07-0.1m in depth
layer 4 15m in length, with a maximum depth of 50cm; mainly deposit of purified white clay with good plasticity; containing 1 deformed white glazed porcelain, 1 unglazed porcelain kiln supporting tool with eight feet, 4 sherds of unglazed porcelain (biscuit fired), 1 fragmented unglazed porcelain saggar, and 1 fragmented porcelain gutter tile; dating to the early Ming period
layer 5 containing 1 remanent foot base of unglazed stoneware (biscuit fired), 4 sherds of green glazed stoneware, and one fragmented funnel-shaped saggar

No.22

Year: 2014–2015

Fieldwork type: planned excavation

Location: south of the Pearl Hill 珠山, north of the Jingdezhen Imperial Kiln Museum, and east of the Dongsiling Lane 東司嶺

Research institutions: Jingdezhen Ceramic Archaeological Research Institute 景德鎮陶瓷考古研究所, School of Archaeology and Museology at Peking University 北京大學考古文博學院, Jiangxi Provincial Institute of Cultural Relics and Archaeology 江西省文物考古研究所, Beijing Palace Museum 故宮博物院

Data source: JCARI *et al.*, 2017a

State of publication: preliminary excavation report

Findings: 16 excavation units in total (for their relative locations, see Figure B-1, with units TN30W14 and TN33W16 described in detail); uncovering features of 12 house ruins (F6 described in detail), 10 walls (Q2 described in detail), 3 pottery wheel installations, and 30 pits of deposited porcelain sherds (H6, H20, and H26 described in detail)

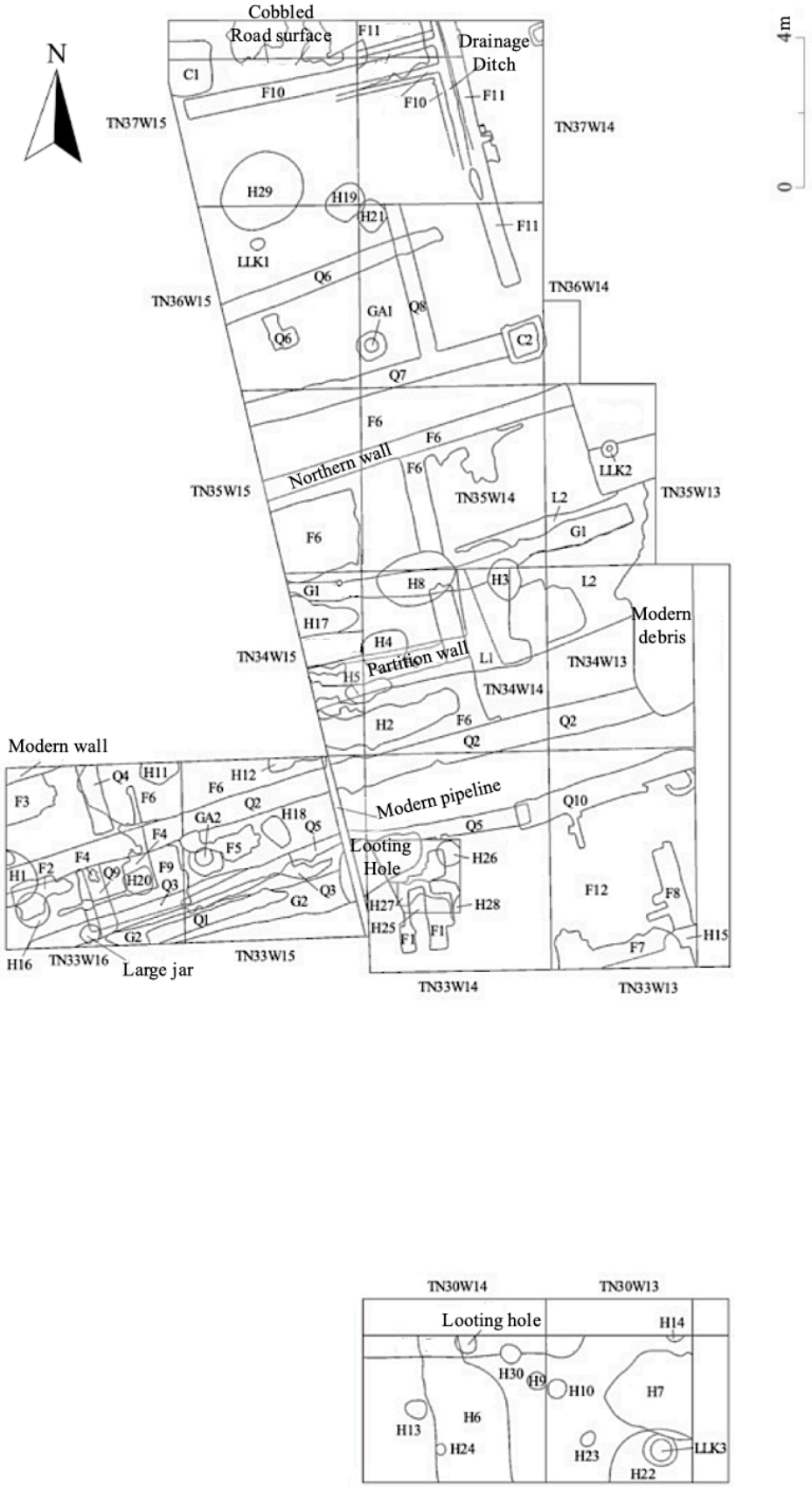


Figure B-1: Distribution of excavation units and features during the 2014–2015 planned excavation. Redrawn after JCARI *et al.*, 2017a, Figure 3.

TN30W14

layers 1-3 disrupted by modern human activities

layer 4 0.04-0.24m in depth; disrupted by modern water pond; containing small quantities of kiln furniture (including saggars and inner saggars[40]) and sherds of blue-and-white porcelain, underglaze red porcelain, and qingbai porcelain; dating from the late Yuan to early Ming periods

layer 5 0.26-0.48m in depth; containing large quantities of kiln furniture and porcelain sherds of blue-and-white stem cups, white glazed stem cups, and qingbai glazed bowls; ash pits H6, H9, H13, H30 situated under layer 5; dating to the Yuan period

layer 6 0.2-0.4m in depth; mainly deposit of yellow clay soil; containing small quantities of qingbai porcelain sherds; dating to the Yuan period

TN33W16

layers 1-2 modern occupation debris

layer 3-4d stratigraphic layers dating to the Qing period

layer 4e 0-0.06m in depth; containing small quantities of 'non-imperial' blue-and-white porcelain sherds; dating to the late Ming and post-1620s periods

layer 4f 0-0.02m in depth; containing small quantities of 'non-imperial' blue-and-white porcelain sherds; dating to the late Ming and post-1620s periods

layer 4g 0.06-0.16m in depth; containing mostly 'non-imperial' blue-and-white porcelain sherds; small quantities of blue-and-white bowls' remanent foot bases bearing Jiajing and Longqing reign marks[41], blue-and-white fishbowl sherds, yellow glazed titles, and aubergine glazed porcelain sherds also found; dating to the late Ming and post-1620s periods

layer 4h 0.06-0.16m in depth; containing small quantities of 'non-imperial' blue-and-white porcelain sherds; dating to the late Ming and post-1620s periods

layer 4i 0-0.06m in depth; deposit of sandy soil; dating to the late Ming and post-1620s periods

layer 5 0-0.12m in depth; containing small quantities of 'non-imperial' blue-and-white porcelain sherds; dating to the late Ming and post-1620s periods

layer 6a 0.02-0.98m in depth; containing large quantities of fragmented saggars, bricks, and 'non-imperial' blue-and-white porcelain sherds; containing porcelain sherds of blue-and-white

[40] Saggars and inner saggars constitute a two-part system in the porcelain firing process. The outer saggar (*xiabo* 匣鉢), typically made of coarse clay, functions as a protective case. Inside this fits the inner saggar (*taobo* 套鉢), usually made of porcelain, which directly holds porcelain pieces for firing. While saggars can be used alone during firing, inner saggars should be used inside coarse saggars.

[41] If unspecified, Longqing reign mark refers to the inscription 'Made in the years of Longqing of the Great Ming' (大明隆慶年制).

fishbowl bearing Jiajing reign marks and unglazed titles decorated with dragon motif; dating to the late Ming and post-1620s periods; walls (Q2 and Q4) and pit H11 situated under layer 6a

layer 6b 0-0.02m in depth; containing large quantities of fragmented saggars and 'non-imperial' blue-and-white porcelain sherds; dating to the late Ming and post-1620s periods

layer 6c 0.08-0.12m in depth; containing small quantities of kiln furniture and 'non-imperial' blue-and-white porcelain sherds; dating to the late Ming and post-1620s periods

layer 6d 0-0.08m in depth; containing small quantities of 'non-imperial' blue-and-white porcelain sherds; dating to the late Ming and post-1620s periods; F6 situated under layer 6d

layer 6e 0-0.06m in depth; deposit of pink sandy soil with large quantities of quartz-like inclusions; dating to the late Ming and post-1620s periods

layer 7a 0-0.1m in depth; containing large quantities of 'non-imperial' blue-and-white porcelain sherds and small quantities of 'imperial' porcelain sherds; dating to the late Ming and post-1620s periods

layer 7b 0-0.08m in depth; containing large quantities of 'imperial' and 'non-imperial' porcelain sherds, mostly blue-and-white; few 'imperial' porcelain bearing Jiajing reign marks; dating to the late Ming and post-1620s periods

layer 7c 0-0.07m in depth; containing large quantities of 'non-imperial' blue-and-white porcelain sherds; dating to the late Ming and post-1620s periods

layer 7d 0-0.05m in depth; containing large quantities of 'imperial' porcelain sherds bearing Jiajing reign marks and small quantities of kiln furniture; dating to the Jiajing period; house ruins F9 situated under layer 7d

layer 7e 0.08-0.16m in depth; situated on the southern side of wall Q2; containing large quantities of porcelain sherds and small quantities of kiln furniture used for firing large-sized vessels; dating to the Jiajing period

layer 8a 0-0.24m in depth; situated on the southern side of wall Q2; containing kiln furniture, white glazed porcelain sherds, 'imperial' porcelain sherds (yellow glazed, green glazed, doucai, and monochrome glazed), and 'non-imperial' porcelain sherds; dating to the Jiajing period; pit H16 situated under layer 8a

layer 8b 0.02-0.07m in depth; situated on the southern side of wall Q2; containing kiln furniture and porcelain sherds, mostly 'non-imperial' blue-and-white, small quantities of 'imperial' porcelain sherds bearing Jiajing reign marks; dating to the Jiajing period

layer 8c 0-0.04m in depth; situated on the southern side of wall Q2; containing small quantities of porcelain sherds, mostly 'non-imperial' blue-and-white, few 'imperial' porcelain sherds bearing Jiajing reign marks; dating to the Jiajing period

layer 9 0-0.08m in depth; situated on the southern side of wall Q2; containing large quantities of kiln furniture (including saggars and inner saggars); containing porcelain sherds, mostly white glazed porcelain, unfinished monochrome glazed porcelain, and blue-and-white porcelain; some monochrome glazed porcelain sherds bearing Jiajing reign marks also found; dating to the Jiajing period

layer 10a 0-0.16m in depth; situated on the southern side of wall Q2; containing kiln furniture (including saggars and inner saggars) and 'imperial' porcelain sherds bearing Zhengde reign marks[42]; dating to the Zhengde period;

layer 10b 0-0.02m in depth; situated on the southern side of wall Q2; containing kiln furniture (including saggars and inner saggars) and 'imperial' porcelain sherds bearing Zhengde reign marks; dating to the Zhengde period; pit H20 situated under layer 10a

layer 10c 0-0.15m in depth; situated on the southern side of wall Q2; not fully-excavated in protection of walls Q2 and Q9; findings unearthed from the surface similar to layers 10a and 10b;

layer 11 0-0.38m in depth; situated on the southern side of wall Q2, western side of wall Q9; containing kiln furniture (including saggars and inner saggars) and 'imperial' porcelain sherds bearing Hongzhi and Zhengde reign marks; dating to the Zhengde period

layer 12 0-0.38m in depth; situated on the southern side of wall Q2, western side of wall Q9; containing kiln furniture (including saggars and inner saggars) and 'imperial' porcelain sherds bearing Hongzhi and Zhengde reign marks; dating to the Zhengde period

layer 13 0-0.02m in depth; situated on the southern side of wall Q2, western side of wall Q9; containing kiln furniture (including saggars and inner saggars) and 'imperial' porcelain sherds bearing Hongzhi and Zhengde reign marks; dating to the Zhengde period

layer 14 0-0.02m in depth; situated on the southern side of wall Q2, western side of wall Q9; containing kiln furniture (including saggars and inner saggars) and 'imperial' porcelain sherds bearing Hongzhi and Zhengde reign marks; dating to the Zhengde period

[42] If unspecified, Zhengde reign mark refers to the inscription 'Made in the years of Zhengde of the Great Ming' (大明正德年制).

layer 15 0-0.02m in depth; situated on the southern side of wall Q2, western side of wall Q9; containing kiln furniture (including saggars and inner saggars) and 'imperial' porcelain sherds bearing Hongzhi and Zhengde reign marks; dating to the Zhengde period

layer 16 0.04-0.12m in depth; situated on the southern side of wall Q2, situated on the southern side of wall Q2; mainly deposit of fine-grained white sandy clay; dating to the Zhengde period

layer 17 0-0.08m in depth; situated on the southern side of wall Q2, situated on the southern side of wall Q2; mainly deposit of fine-grained pink sandy soil with large quantities of quartz-like inclusions; containing small quantities of white glazed porcelain sherds; dating to the Zhengde period

layer 18 0-0.01m in depth; situated on the southern side of wall Q2, situated on the southern side of wall Q2; mainly deposit of fine-grained brown clay; containing small quantities of white glazed porcelain sherds; dating to the Zhengde period

layer 19 0-0.06m in depth; situated on the southern side of wall Q2, situated on the southern side of wall Q2; mainly deposit of fine-grained orange-brown clay; containing small quantities of white glazed porcelain sherds; dating to the Zhengde period

layer 20 situated on the southern side of wall Q2, situated on the southern side of wall Q2; surface areas of cobbled road; dating to the Zhengde period

F6

situated in the same stratigraphic layer as walls Q2 and Q5, with similar orientation; row house structure, two rooms deep and at least three rooms wide suggesting from exposed surface; ground surface paved with a single layer of bricks with varying shapes and sizes, some bricks with traces of kiln sweat; defective kiln waste also used for surfacing; traces of porcelain stone found on the brock-paved floor in the northeast corner of excavation unit TN33W15; dating to the Zhengde and Jiajing periods

Q2

northeast-southwest orientation; crossing five excavation units (TN33W16, TN33W15, TN33W14, TN34W14, TN33W13) from west to east, at an angle of 80°; in units TN33W14, TN34W14, and TN34W13, situated on layer 5; in units TN33W15 and TN33W16, situated on layer 10c, breaking through wall Q9; exposed portion measuring 17.4m in length, 0.62-0.9m in width, with a maximum preserved height of 0.74m; built from ground level; wall foundation reinforced with red clay mixed with broken saggars, brick fragments, and tile pieces; main body constructed with rectangular bricks and large saggar fragments, saggar fragments laid in vertical orientation at an angle, presenting horizontal herringbone pattern on the elevation;

brick pillars constructed at intervals along the wall, with two still preserved; the western portion of the wall better preserved than the eastern portion; likely used as the southern wall by house F6, subsequently reused as the northern exterior wall of house F9; dating to the Zhengde and Jiajing periods

H6

irregular north-south oriented elongated shape; located in the middle of excavation unit TN30W14, situated below stratigraphic layer 5, breaking through layer 6 and the natural soil layer; exposed portion measuring 4m north-south, 1.06-2.08m east-west, and 0.72m in depth; consisting of 3 layers

layer 1 containing large quantities of saggars, stacked kiln waste, and qingbai porcelain bowl sherds; some fragmented blue-and-white porcelain stem cup and several eggshell white glazed stem cups with impressed decoration also found

layer 2 containing large quantities of saggars, stacked kiln waste, and qingbai porcelain bowl sherds; a qingbai porcelain stem cup also found

layer 3 a mixed later of white clay suitable for porcelain making and yellow clay soil; containing several saggars; groundwater visible below; a kiln waste pit dating to the mid–late Yuan period (early–mid fourteenth century)

H20

situated in the eastern part of TN33W16; containing large quantities of semi-finished products of polychrome glazed or painted porcelain that could be reassembled into original form, including those fired with blue-and-white decoration but not yet painted with other colours; porcelain types including a considerable number of white glazed dishes incised with dragon patterns, yellow glazed bowls and dishes decorated with green dragon patterns, and bowls and dishes with green decoration on red ground; almost all vessels found bearing blue-and-white Zhengde reign marks; used as a burial pit for defective semi-finished products dating to the Zhengde period

H26

located in the northeast part of the TN33W14, situated below layer 4f, breaking through layer 5; oval-shaped, measuring 0.7m north-south, 0.64m east-west, with a maximum depth of 0.24m; containing porcelain types including yellow glazed bowl and dish fragments (some decorated with green dragon patterns), white glazed bowl fragments decorated with yellow dragon patterns, blue-and-white fragments, and biscuit-fired bowl fragments; most found bearing blue-

and-white Hongzhi and Zhengde reign marks; used as a burial pit for defective semi-finished products dating to the Hongzhi and Zhengde periods

No.23

Year: 2016

Fieldwork type: rescue excavation carried out prior to infrastructure projects

Location: North Zhonghua Road 中華北路

Research institution: Jingdezhen Ceramic Archaeological Research Institute 景德鎮陶瓷考古研究所

Data source: JCARI *et al.*, 2019

State of publication: mentioned

Findings: porcelain roof tiles inscribed with names of workers and production supervisors, dating to the Hongwu period

No.24

Year: 2017

Fieldwork type: rescue excavation carried out prior to museum construction

Location: outside the north-eastern corner of the Archaeological Site Park

Research institution: Jingdezhen Ceramic Archaeological Research Institute 景德鎮陶瓷考古研究所

Data source: Jiang, 2020b

State of publication: mentioned

Findings: covering an area of approximately 200 square meters, uncovering a series of features dating from the Yuan period to the Republican era; main features including road surfaces dating to the Yuan period and walls located on eastern and northern sides of the Archaeological Site Park dating to the Ming period

No.25

Year: 2018

Fieldwork type: rescue excavation carried out prior to infrastructure projects

Location: Dongsiling Lane 東司嶺

Research institution: Jingdezhen Ceramic Archaeological Research Institute 景德鎮陶瓷考古研究所

Data source: Jiang, 2020b

State of publication: mentioned

Findings: uncovering features including walls located on the western side of the Archaeological Site Park, firing kilns, and pits of deposited porcelain sherds, dating to the Ming period

No.26

Year: 2021

Fieldwork type: planned excavation

Location: outside the north-western corner of the Archaeological Site Park

Research institutions: Jiangxi Provincial Institute of Cultural Relics and Archaeology 江西省文物考古研究院, Jingdezhen Ceramic Archaeological Research Institute 景德鎮市陶瓷考古研究所, Beijing Palace Museum 故宮博物院, School of Archaeology and Museology at Peking University 北京大學考古文博學院, Institute of Archaeology at Chinese Academy of Social Sciences 中國社會科學院考古研究所, School of Archaeology and Museology at Jingdezhen Ceramic University 景德鎮陶瓷大學考古文博學院, School of Humanities at Jingdezhen College 景德鎮學院人文學院

Data source: JPICRA *et al.*, 2024a; 2024b

State of publication: preliminary excavation reports

Findings: an overall excavation area of 442m^2 (see Figure B-2), including six 10m × 10m excavation units (T2 and T4 described in detail); uncovering features of walls (Q1-Q5, with Q1 described in detail), firing kilns, and water ponds; yielding several tons of porcelain sherds dating from the late Northern Song period to the Republican era (late eleventh–early twentieth centuries)

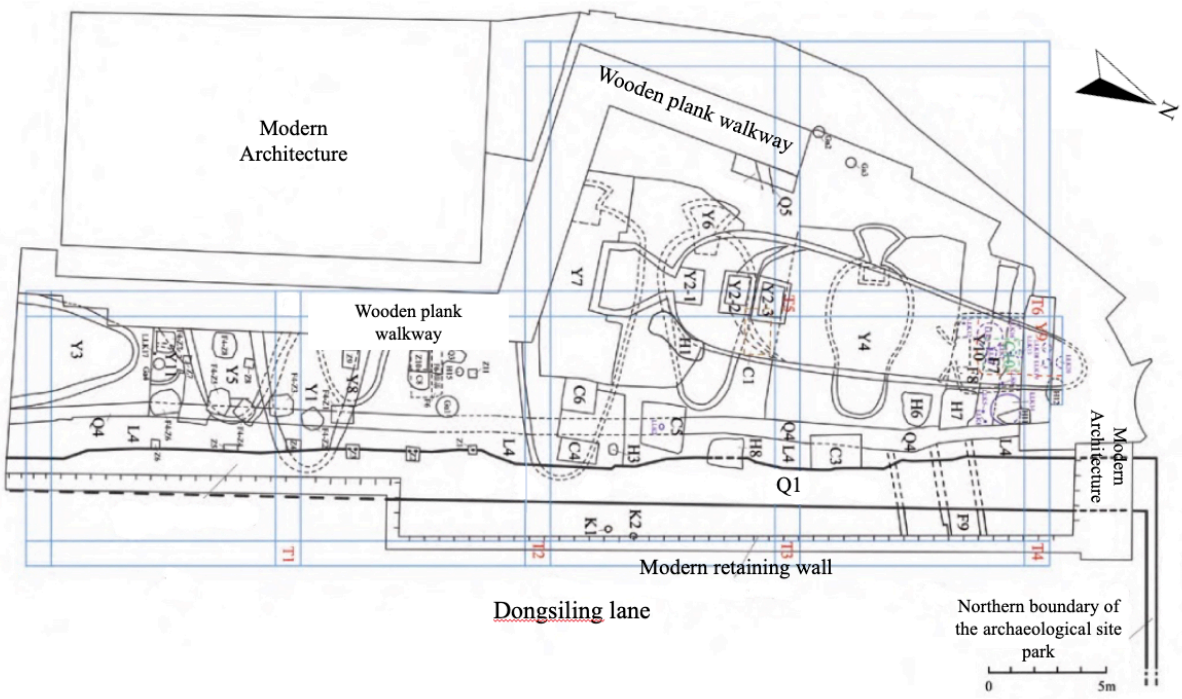


Figure B-2: Distribution of excavation units and features during the 2021 planned excavation. Redrawn after JPICRA *et al.*, 2024a, Figure 2.

T2

layer 1-11 dating to post-Yuan periods

layer 12-13 deposits of small quantities of qingbai porcelain sherds and kiln furniture; dating to the Yuan period

layer 14-24 deposits of large quantities of qingbai porcelain sherds and kiln furniture; dating to the Southern Song period

layer 25 deposits of large quantities of qingbai porcelain sherds and fragmented saggars; dating to the late Northern Song period

T4

layers 1a-1b modern occupation debris

layers 1c waste deposits dating to the late Qing period and Republican era

layers 2a 1.71-1.8m in depth; containing small quantities of kiln furniture and porcelain sherds of underglaze red, red glazed, and white glazed bowls and plates; dating to the early Ming period

layers 2a 0-0.2m in depth; containing large quantities of saggars and small quantities of sherds, including architectural porcelain and underglaze red, red glazed, and white glazed porcelain; dating to the early Ming period

layers 3 0.05-0.07m in depth; situated in the middle of excavation units; containing small quantities of white glazed porcelain sherds, saggars and inner saggars, and architectural porcelain sherds; dating to the early Ming period; Q1 situated above layer 3

layers 4a 0.25-0.27m in depth; situated in the middle of T4; containing large quantities of fragmented saggars and sherds of blue-and-white porcelain; green glazed porcelain, and red-and-green enamelled porcelain; dating to the late Yuan–early Ming periods

layers 4b-9 deposits of fragmented saggars, kiln furniture, blue-and-white porcelain sherds, and qingbai porcelain sherds; dating to the Yuan period

Q1

situated under modern retaining walls on the eastern side of excavation units T1, T2, T3, and T4; within the excavation area, wall foundation unearthed 41m in length, 0.8-1.3m in width, with a preserved hight of 0.8-1.2m; in T1 and T2, two wall sections bonded together, with a width of 0.8m; in the northern section of T3 and T4, three wall sections bonded together, with a width of 1.3m; wall foundation built in sections from ground level, primarily using discarded saggars, with porcelain roof tiles and other architectural porcelain sherds used as filling material; wall built using rectangular bricks and large saggar fragments; portions with bricks laid horizontally, portions with bricks and saggars laid in vertical orientation at an angle, presenting horizontal herringbone pattern on the elevation; within the wall foundation, a small number of 'imperial' porcelain sherds dating to the Yongle period found; intersecting stratigraphic relationships between wall Q1 and kilns Y1 and Y7; below the wall foundation in T2 and T3, situated a levelling layer containing white porcelain fragments and architectural porcelain sherds dating to the Hongwu period; constructed during the Yongle period and abandoned at the end of the Qing period

No.27

Year: 2024

Fieldwork type: planned excavation

Location: middle of North Zhonghua Road 中華北路, outside the Archaeological Site Park's east gate

Research institutions: Beijing Palace Museum 故宫博物院, Jiangxi Provincial Institute of Cultural Relics and Archaeology 江西省文物考古研究院, Jingdezhen Ceramic Archaeological Research Institute 景德鎮陶瓷考古研究所

Data source: BPM *et al*., 2024a

State of publication: preliminary excavation report

Findings: an overall excavation area of over 160m^2 (see Figure B-3), including a 3m × 19m north-south oriented trench (2024JYETG1) and an 8m × 6m east-west oriented trench (2024JYETG2); uncovering features of 4 walls (Q3 and Q4 described in detail), 4 roads, and 13 drainage ditches (G11 and G12 described in detail); yielding large quantities of porcelain sherds dating from the Yuan period to Republican era

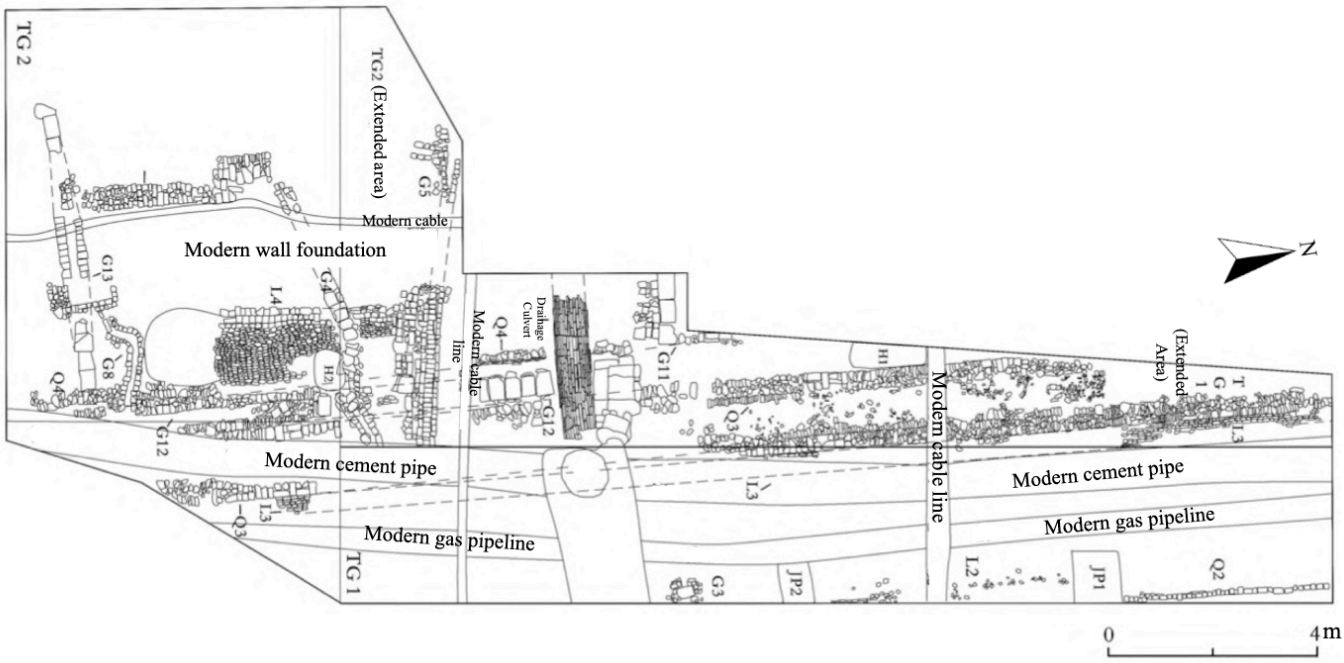


Figure B-3: Distribution of excavation units and features during the 2024 planned excavation outside the Archaeological Site Park's east gate. Redrawn after BPM *et al*., 2024a, Figure 5.

Q3

running north-south, oriented at 335°; exposed length of 22.5m within the excavation area, with a preserved height of 0.06-0.52m and depth of 0.65-1.60 m; built from ground level using rectangular bricks and large saggar fragments, filled with yellowish-brown clay mixed with miscellaneous material lacking orderly (saggar fragments, porcelain sherds, brick fragments, and broken porcelain title pieces)

northern end eastern side built with three parallel rows of bricks, saggar fragments, small amounts of white porcelain fragments and architectural porcelain sherds

western side primarily single row of flat saggars, outer western elevation showing 5 layers of saggar fragments in horizontal herringbone pattern

southern section preserving 1-3 layers primarily in two parallel rows, eastern side with bricks laid flat in staggered pattern

a small number of porcelain sherds found within the wall structure, mainly fragments of white porcelain bowls and plates, qingbai porcelain bowls and plates, blue-and-white porcelain, and underglaze red porcelain; some porcelain pieces bearing Xuande reign marks; constructed during the early Ming period

Q4

running north-south on inner side of drainage ditch (G12), west of Q3; opening beneath modern road surface; main body built with saggar fragments laid in vertical orientation at an angle, presenting horizontal herringbone pattern on the elevation, preserving 1-5 layers with height of 0.12-0.80m; preserved length of 13.7m within excavation area, width of 0.20-0.25m; overlying white porcelain clay deposit layers, and cutting kiln waste deposits of the Xuande period kiln production deposits; served as protective wall on inner side of G12; constructed during the mid-Ming period

G11

oriented from west to east towards wall Q3, laid directly on a layer of broken saggars connected with the horizontally laid saggar layer of Q3's wall foundation; used as a drainage channel leading from western side (inner side) of Q3 to the eastern side (outer side)

G12

situated in the south of G11, with the same orientation as Q3; its retaining wall breaking through deposit layers of the Xuande period, therefore dating no earlier than the Xuande period; used together with G11 as part of a drainage system

No.28

Year: 2024

Fieldwork type: planned excavation

Location: inside the Archaeological Site Park's west gate

Research institutions: Beijing Palace Museum 故宫博物院, Jiangxi Provincial Institute of Cultural Relics and Archaeology 江西省文物考古研究院, Jingdezhen Ceramic Archaeological Research Institute 景德鎮陶瓷考古研究所

Data source: BPM *et al*., 2024b

State of publication: preliminary excavation report

Findings: an overall excavation area of over 80m^2 (see Figure B-4), including three excavation units (JYWT1, JYWT2, JYWT3, with JYWT1 described in detail); uncovering features of firing kilns (Y1, Y2, with Y1 described in detail), water pond (C1, described in detail), and pottery wheel installations (LLK1, LLK2, with LLK1 described in detail); yielding porcelain sherds dating from the Yuan period to Republican era

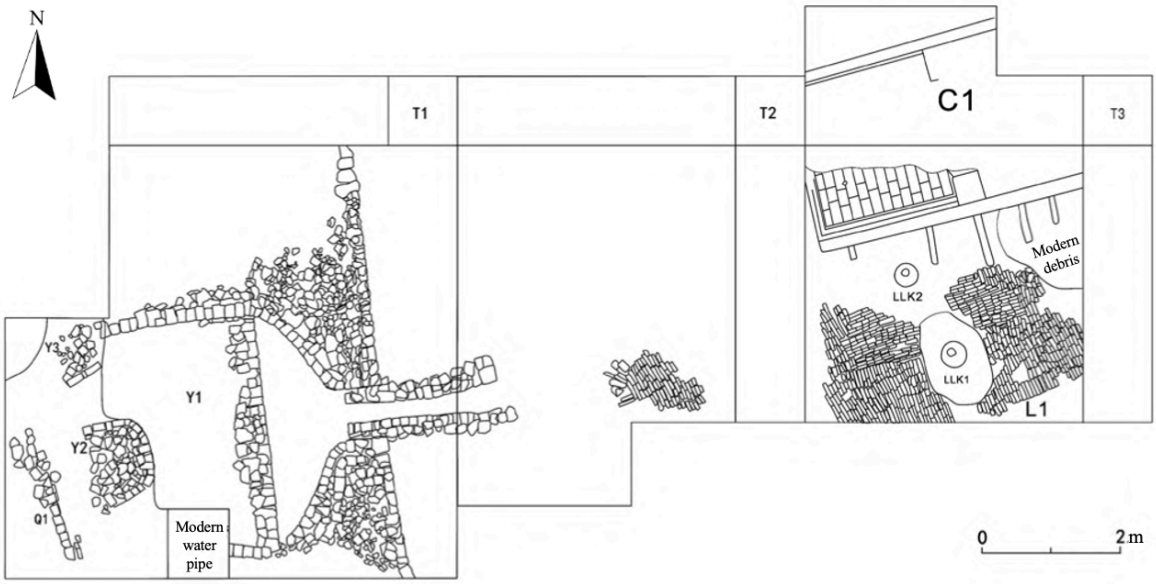


Figure B-4: Distribution of excavation units and features during the 2024 planned excavation inside the Archaeological Site Park's west gate. Redrawn after BPM *et al*., 2024b, Figure 2.

JYWT1

layer 1-2 disturbed by modern human occupation

layer 3a distributed in the western part of JYWT1; 0.18-0.4m in depth; containing small quantities of kiln furniture and blue-and-white porcelain sherds; dating to the early Qing period (early–mid eighteenth century)

layer 3b distributed in the western part of JYWT1; 0.15-0.3m in depth; containing large quantities of tile fragments and kiln furniture and small quantities of blue-and-white porcelain sherds; dating to the late Ming and post-1620s periods; kilns Y2 and Y3 and wall Q1 situated under layer 3b

layer 4a distributed in the western part of JYWT1; in the area surrounding kilns Y2 and Y3; 0.22-0.3m in depth; containing small quantities of porcelain sherds; dating to the mid-Ming period

layer 4b distributed in the western part of JYWT1; consisting of a trampled surface of red and black soil with compact texture; 0.02-0.2m in depth; kilns Y2 and Y3 situated on layer 4b

layer 5 distributed in the southern part of JYWT1; situated on top of kiln Y1; containing small quantities of kiln furniture and small quantities of porcelain sherds, primarily consisting of white glazed and qingbai porcelain; some white glazed porcelain sherds found bearing Xuande reign marks; dating to no earlier than the Xuande period

layer 6 distributed in the northern part of JYWT1; situated on the protective wall of kiln Y1; bottom not reached during excavation; containing large amounts of clay for making porcelain bodies; containing kiln furniture and qingbai porcelain sherds dating to the Yuan periods; interpreted as a foundation layer formed during the construction of kiln Y1, using transported soil from nearby areas

Y1

situated in the southern part of JYWT1, opening below layer 5 and breaking through layer 6; damaged; overall preserved length 5.75m; east-west orientated, with the kiln door facing east; consisting of ventilation channel, kiln door, firebox, kiln chamber, and protective wall

kiln door rectangular in shape, constructed with rectangular kiln bricks laid horizontally in staggered pattern; approximately 0.7m in width

firebox semi-circular; approximately 1.11m in depth and 3.15m in maximum width

kiln chamber rising from east to west with an average slope of 9°; constructed with rectangular kiln bricks laid in a staggered pattern; a fused surface discovered in the kiln chamber; approximately 3.20m in maximum width, damaged length approximately 1.92m; not fully exposed

protective wall built with saggar fragments and bricks; saggar fragments laid in vertical orientation at an angle, presenting horizontal herringbone pattern on the elevation; bricks laid horizontally in staggered pattern; a large saggar fragment (more than 0.6m in diameter) found; numerous firing test samples for qingbai porcelain and white glazed porcelains found, along with fragments of saggars and inner saggars fused together

dating to the early Ming period

No.29

Year: 2024

Fieldwork type: planned excavation

Location: inside the Archaeological Site Park’s east gate

Research institutions: Beijing Palace Museum 故宫博物院, Jiangxi Provincial Institute of Cultural Relics and Archaeology 江西省文物考古研究院, Jingdezhen Ceramic Archaeological Research Institute 景德鎮陶瓷考古研究所

Data source: BPM *et al*., 2025

State of publication: preliminary excavation report

Findings: an overall excavation area of three excavation units (T1, T2, T3); uncovering features of water ponds (C1-C4), walls (Q1-Q10), and pottery wheel installations (LLK1-LLK4, with LLK1 described in detail); yielding porcelain sherds dating from the early Ming period to early twentieth century

LLK1

located in the western part of the north of excavation unit T2, opening below layer 3c; only inner circle saggar and bottom hole preserved; saggar with diameter of 0.29m and depth of 0.2m; white clay deposit of approximately 0.02m thickness at bottom of saggar; shaft hole in centre with diameter of 0.1m and depth of approximately 0.26m; saggar filled with yellow soil containing red brick fragments, saggar fragments, clay suitable for porcelain bodies, and porcelain sherds

Catalogue B: Summary of Archaeological Fieldwork at Guanyinge

This catalogue records two archaeological fieldwork projects conducted at the Guanyinge Site (觀音閣遺址) in 2007 (entry No.1) and 2024 (entry No.2), focusing on materials dating to the Ming period. The site is located in Changjiang Village (昌江新村), connecting northward to Fuliang County and southward to North Zhongshan Road (中山北路) leading to Jingdezhen's city centre. The two planned excavations uncovered ceramic production remains around the Guanyin Temple (觀音寺), Yangtianwu (秧田塢), and the Guanyinge Waterworks (觀音閣水廠), with deposits spanning the late Southern Song, Yuan, and Ming dynasties (Figure 3-4).

Each entry provides: date, fieldwork type, location, responsible institution(s), data source, state of publication, and principal findings. Where available, principal findings include information on excavation units, stratigraphic layers, relative chronology, and descriptions of features and artefacts. Feature identifiers retain the original excavation numbers assigned in published reports and appear as sub-entries under the relevant entry. Complete feature references in the thesis follow the format: site abbreviation (GYG), catalogue entry number, and feature identifier—for example, pottery wheel installation SLLK1 from entry No.1 is referenced as GYG-1-SLLK1.

No.1

Year: 2007

Fieldwork types: survey and systematic archaeological excavation

Locations: two areas located between the Guanyin Temple 觀音閣 and Yangtianwu 秧田塢 (see N and S, Figure 3-4); one area located near the Guanyinge Waterworks (see Y, Figure 3-4)

Research institutions: School of Archaeology and Museology at Peking University 北京大學考古文博學院, Jiangxi Provincial Institute of Cultural Relics and Archaeology 江西省文物考古研究所, and Jingdezhen Ceramic Archaeological Research Institute 景德鎮市陶瓷考古研究所

Data source: SAM-PKU *et al.*, 2009

State of publication: preliminary excavation report

Findings: covering a total area of 547 m^2; uncovering features of 1 house ruins (NF1), 2 pottery wheel installations (SLLK1 and SLLK2, both described in detail), 10 large jars (SG1, NG1-6, YG1-3), 1 pond (SC1), 1 road surface (YL1), 1 kiln waste pit (SK1), and 1 tomb (YM1); yielding large quantities of porcelain sherds and kiln furniture dating to the middle, late Ming, and post-1620s periods

SLLK1

located in the south-eastern part of excavation unit ST01, opening below layer 2a; built with two circles of bricks; outer circle built with five layers of stacked bricks, with external diameter of 1.3m, internal diameter of 1.1m; inner circle partially preserved, made of stone bricks, with a maximum depth of 0.36m from the surface of SLLK1; shaft hole found in the centre of inner circle, with diameter of 0.15m and depth of 0.15m; filled with white clay suitable for porcelain bodies; dating to the late Ming and post-1620s periods

SLLK2

located in the central part of the western extension area of excavation unit ST01, opening below layer 2c; built with inner and outer circles of bricks separated by 0.12m; outer circle with external diameter of approximately 1m and internal diameter of approximately 0.8m, most complete section preserving four layers of bricks, deepest layer 0.16m from ground surface; inner circle with external diameter of 0.55m and internal diameter of 0.34m, preserving 4-5 layers of bricks, 0.34m from ground surface; shaft hole with diameter of 0.1m and depth of 0.24m; both circles of bricks quite damaged; pit filled with white clay suitable for porcelain bodies; dating to the late Ming and post-1620s periods

SG1

located in the south-western area of excavation unit ST01, opening below layer 2a; sandy stoneware jar with contracted mouth, sloping body, and small flat base; internal rim diameter of 0.84m, external diameter of 1.0m, maximum body diameter approximately 1.0m, internal base diameter approximately 0.3m, with a depth of 0.8m; relatively well-preserved except for some cracks and slight damage on the northern edge; outer side of rim protected by brick construction; brick wall found on eastern side, measuring 1.1m long and 0.25m wide, primarily built with stone bricks in two parallel rows, with a northeast orientation of approximately 25°; smoothed stone found at the southeastern corner of SG1, with a surface slightly lower than the jar's mouth; two additional brick rows situated in the east, one with a preserved corner, same height as SG1' opening; dating to the late Ming and post-1620s periods

SC1

located in the central-western part of excavation unit ST01, opening below layer 2e; rectangular brick structure, measuring 2.18m long and 1.14m wide, with interior dimensions of 1.62m long and 0.66m wide; constructed using rectangular bricks measuring 25.5cm long, 10.5cm wide, and 5cm thick, with many broken bricks filling the gaps; brick dimensions similar to those used in SLLK's bottom layer; filled with yellow clay soil, hard and dense in texture, approximately 0.26m in depth; containing small quantities of porcelain sherds and brick fragments; numerous traces of grayish-white clay suitable for making porcelain bodies remaining on SC1's walls; bottom made of leveled red sandy soil mixed with sand particles, without brick paving; inferred as a clay levigating pond dating to the late Ming and post-1620s periods

No.2

Year: 2024

Fieldwork type: systematic archaeological excavation

Locations: southwest of Yangtianwu 秧田塢 (see excavation units TG1-TG8, Figure 3-4)

Research institutions: National Centre for Archaeology 國家文物局考古研究中心, Jiangxi Provincial Institute of Cultural Relics and Archaeology 江西省文物考古研究院, Jingdezhen Ceramic Archaeological Research Institute 景德鎮市陶瓷考古研究所

Data source: NCA *et al.*, 2024a; 2024b; 2024c; 2024d

State of publication: preliminary excavation reports

Findings: uncovering features of 11 walls (Q1-Q11), 12 pillar bases (ZC1-ZC12), 5 pottery wheel installations (LLK1-LLK5), 3 work stands (GZT1-GZT3), 1 brick stand (ZT1), 5 large

jars (GA1-GA5), 1 ash pond (HC1), 6 ponds (C1-C6), 1 drying furnace (HPL1), 1 preserved brick road surface (L1), 14 pits (H1-H14), 1 saggar pile (XBD1), and 1 porcelain stone raw material pile (SLD1); yielding large quantities of porcelain sherds and kiln furniture dating from the late Southern Song through Yuan periods, middle, late Ming, and post-1620s periods.

TG2

layer 1-2 modern occupation debris

layer 3 kiln waste fill layer; distributed throughout most of the trench except the south-eastern portion; 0.18-0.25m in depth; containing large quantities of porcelain sherds, saggars, spacer discs, tile fragments, and bricks; porcelain consisting mainly of blue-and-white bowls and plates with small quantities of white porcelain; dating to the Jiajing and Wanli periods

layer 4 fill layer; distributed throughout most of the trench except part of the H1 area in the south-eastern corner; 0.35-0.45m in depth; containing small quantities of blue-and-white porcelain sherds, dating to no later than the late Ming period; the upper surface inferred to represent a workshop area with features including walls and pillar bases, dating to the Jiajing and Wanli periods

layer 5 deposit of kiln waste; 0.5-0.58m in depth; containing large quantities of large saggar fragments, large porcelain sherds, spacer discs, and kiln slag; interpreted as a deposit of mid-Ming kiln waste formed in a single depositional event

layer 6 fill layer; 0.85-1m in depth; containing small quantities of blue-and-white porcelain sherds, small brick fragments, saggar fragments, and spacer pieces; interpreted as a deposit of mid-Ming kiln waste formed in a single depositional event

layer 7 deposit of kiln waste; 1.15-1.3m in depth; containing large quantities of large saggar fragments, spacer discs, large porcelain sherds, and black kiln slag; interpreted as a deposit of mid-Ming kiln waste formed in a single depositional event;

TG3

layer 1 modern occupation debris

layer 2 disturbed by modern human occupation; containing small quantities of blue-and-white porcelain sherds, dating to the late Ming and post-1620s periods and kiln furniture (mostly porcelain spacer discs[43])

layer 3 fill layer; 0.24-0.4m in depth; containing small quantities of blue-and-white porcelain sherds, white porcelain sherds, and kiln furniture (mostly porcelain spacer discs), dating to the

[43] Spacer discs (*dianbing* 墊餅) are used to support porcelain pieces being fired in a kiln and separate them from each other when stacked during firing. Porcelain spacer discs are made from the same raw materials used for porcelain bodies, in contrast to pottery spacer discs made from coarse clay.

late Wanli and Chongzhen periods; wall Q2 and three stone stands (GZT1-GZT3) situated under layer 3

layer 4 fill layer; distributed in the southeast corner of TG3; 0.45-0.8m in depth; containing small quantities of porcelain sherds (mostly blue-and-white porcelain bowls and plates) and kiln furniture dating to the Jiajing and Wanli periods

layer 5 kiln waste deposit; 0.56-0.8m in depth; containing large quantities of porcelain sherds, mostly blue-and-white bowls, plates, and cups, containing large quantities of kiln furniture, including funnel-shaped saggars made of coarse refractory clay, pottery spacer discs, and porcelain spacer discs; dating to the Jiajing and Wanli periods

layer 6 fill layer; containing relatively few inclusions; the upper surface inferred to represent a workshop area, uncovering features including one ash pit (H2), one large jar (GA2), and two pillar bases (ZC1, ZC2)

TG6

layer 1-2 modern occupation debris

layer 3 0.17-0.71 in depth; secondary deposit containing porcelain sherds dating to different periods of the Ming period

layer 4 fill layer; distributed throughout the entire area; containing small blue-and-white porcelain sherds, saggar fragments, and brick fragments

layer 5 distributed throughout the entire area; 0.85-1.25m in depth; containing large quantities of bricks and small quantities of blue-and-white porcelain sherds; some porcelain sherds found bearing inscriptions of 'Made in the great Ming period' (大明年造), 'Made in the years of Chenghua of the Great Ming' (大明成化年制), 'Made in the years of Xuande' (宣德年造) and studio names *Baiyu zhai* 白玉齋, *Baixiang zhai* 百香齋, *Yuxiang zhai* 雨香齋; inferred to be formed by the abandonment of a porcelain production workshop

layer 6a distributed in the central area of TG6; 1.05-1.3m in depth; containing small quantities of blue-and-white porcelain sherds; upper surface flat, compact, mixed with clay suitable for making porcelain bodies; pottery wheel installations LLK1-LLK4 situated under layer 6a; inferred to present a workshop area with features of pottery wheel installations (LLK1-LLK4), dating to the late Ming and post-1620s periods

layer 6b distributed throughout the entire area; upper surface containing clay suitable for making porcelain bodies; inferred to present a workshop area with features including a pottery wheel installation (LLK5), walls (Q4, Q10), pillar bases (ZC8, ZC9, ZC12), dating to the late

Ming and post-1620s periods; no further excavation conducted below this layer for protection purposes

TG7

layer 1-2 modern occupation debris

layer 3 fill layer; distributed throughout the entire area, thinner in the east and thicker in the west; 0.1-0.25m in depth; containing large quantities of bricks, tiles, large jar fragments, saggar fragments, spacer discs, and kiln slags; clay pits H3-H6 breaking through this layer; inferred as a surface area for a porcelain workshop with features of walls, pillar bases, large jars, dating to the Wanli and Chongzhen periods

layer 4 fill layer; discontinuously distributed in a wave pattern; 0.15-0.45m in depth; containing kiln waste, including large quantities of saggars, kiln slag, black charcoal, spacer discs, kiln props, and fired porcelain fused with kiln furniture (mostly blue-and-white bowls or white porcelain bowls fused with kiln furniture); containing blue-and-white porcelain sherds, mostly bowls, plates, and stemmed cups; dating to the Wanli and Chongzhen periods

layer 5 fill layer; distributed in the western part of TG7, containing large quantities of saggar fragments, blue-and-white porcelain sherds, and small quantities of grey-white glazed porcelain sherds; dating to the Wanli and Chongzhen periods; a drying furnace (HPL1) and two ponds (C3, C4) situated below layer 5

layer 6 fill layer; mainly distributed in the western part of TG7; 0.4-0.55m in depth; containing large quantities of blue-and-white porcelain sherds and small quantities of qingbai porcelain sherds; dating to the Jiajing and Wanli periods; pond C5 exposed below this layer

layer 7 fill layer; 0.53-0.58m in depth; containing small quantities of blue-and-white porcelain sherds dating to the mid-Ming period and more qingbai porcelain sherds dating to the Southern Song and Yuan periods

layer 8-15 deposits of kiln waste; containing large quantities of qingbai porcelain sherds and kiln furniture, dating to the Southern Song and Yuan periods

TG8

layer 1-2 modern occupation debris

layer 3 0.2-0.78m in depth; deposit of kiln waste; connected with layer 3 of TG6

layer 4 fill layer; 0.45-1m in depth; connected with layer 4 of TG6

layer 5 fill layer; distributed in the western part of TG8; 0.17-0.5m in depth; containing blue-and-white porcelain sherds, saggars, brick fragments, and stones; large jars GA4 and GA5 situated under this layer

layer 6 fill layer; distributed in the western part of TG8; 0.5-0.75m in depth; containing small quantities of porcelain sherds and stones

layer 7 0.75-0.95m in depth; deposit of kiln waste; connected layer 5 of TG6

layer 8 connected with layer 6b of TG6; inferred to present a workshop area with features include pillar bases (ZC10, ZC11), a pond (C6), a raw material pile (SLD1), and other features visible on the upper surface; dating to the late Ming and post-1620s periods; no further excavation conducted below this layer for protection purposes

H1

located in the south-eastern part of TG2, situated below layer 2, with the bottom of the pit breaking through layer 7; the exposed upper portion roughly rectangular in shape, with an east-west length of approximately 2.6m at the opening and a depth of approximately 0.97m; the lower portion nearly circular with hard and smooth walls; cross-section showing a rounded-bottom pit shape; pit fill consisting of two layers

layer 1 grayish-brown silty sand, containing porcelain sherds, brick and tile fragments, saggar fragments, and spacer disc fragments

layer 2 yellowish-white sand, containing small quantities of porcelain sherds, raw materials for porcelain bodies and glazes, and large quantities of gravel and sandy waste from clay levigation dating to the Jiajing and Wanli periods

Q2

orientated southeast-northwest at an angle of 110°; located in the northern part of TG3, under layer 3; rectangular plan measuring 3.5m in length and approximately 0.47m in width; preserved height of 0.23m above the foundation trench, with a total preserved height of 0.4m; construction method involving initial excavation of a foundation trench filled with large stones and discarded kiln walls, with upper portions built using kiln bricks, stone bricks, fired kiln waste, and large stones; interior spaces filled with discarded brick fragments and small stones; foundation trench measuring approximately 0.97-1.02m in width and 0.4-0.52m in depth, filled with compact yellow clay soil; upper portion of wall severely damaged and poorly preserved; dating to the Jiajing and Wanli periods

Q4

oriented northeast-southwest at an angle of 40°; located in the eastern part of TG6, all other remains located on Q4's western side, including a surface of white clay suitable for porcelain making; exposed at 0.95m from ground surface; 8.2m in length, 0.6m in width, with a remaining height of 0.05-0.5m above ground; built on layer 6b of TG6, with foundation trench

approximately 0.8m wide and 0.3m deep, filled with yellowish-brown clay; upper portions built with stone slabs (mostly slender with rough surfaces), rocks, discarded kiln walls, small quantities of kiln waste (mid-Ming blue-and-white porcelain bowls fused with saggars and spacer discs); wall gaps filled with yellow clay soil, porcelain sherds, and fragmented kiln furniture; other remains located on western side of Q4; inferred as the western wall for a porcelain workshop area; dating to the late Ming and post-1620s periods

Q10

oriented northwest-southeast at an angle of 130°; located in the southern part of central TG6, perpendicular to wall Q4; mostly situated on layer 6a of TG6, not exposed in layer 6b of TG6; slightly tilted due to collapse; preserved length of 3.3m, width of 0.1-0.25m; built with horizontally laid bricks; square stone pillar bases (ZC8, ZC12, ZC9) found at the eastern and western ends and in the middle of Q10; divided into eastern and western sections by ZC12; for eastern section, approximately 1.6m long, double-row brick structure with two layers of bricks preserved; for western section, approximately 1.7m long, single-row brick wall located between pottery wheel installations LLK2 and LLK3, with three layers of bricks preserved; inferred as an interior partition wall or a base for wooden racks within a porcelain workshop area; dating to the late Ming and post-1620s periods

GZT1, GZT2, GZT3

located in the northern part of TG3, situated under layer 3, breaking through layer 5; all positioned south of wall Q2 in a curved arrangement; GZT1, GZT2, and GZT3 situated at distances of 2.8m, 2.6m, and 2.1m respectively from Q2; similar in form and size; built on circular pits approximately 0.1-0.2m in depth, with bottoms lined with a layer of yellowish-brown clay approximately 0.05-0.1m thick; large cobblestones stacked on top of the yellowish-brown clay layer in two circles, with the outer circle of stones concentrically arranged around the inner circle; covered with a yellowish soil layer approximately 0.03-0.05m thick, containing white clay suitable for porcelain making and sandy waste from clay levigation; dating to the Jiajing and Wanli periods

C6

located in the east of TG8, below layer 7; opening at 1.1m from ground surface; rectangular in plan, with slightly concave eastern wall; interior dimensions of 1.85m long and 1.2m wide; exterior dimensions of 2.25m long and 1.65m wide; preserved height of 1.15m; brick-built structure with upper brick walls damaged; walls preserved at varying heights, higher in the west and lower in the east; lower portion better preserved; bottom floor paved with bricks;

walls built with double rows of red kiln bricks laid, with some stone bricks incorporated; small square hole in the middle of the southern wall; containing mostly kiln waste deposit, including large quantities of blue-and-white porcelain sherds, spacer discs, and saggar fragments; layer of white clay suitable for porcelain bodies (0.05m thick) preserved at the bottom; inferred as a pond for water or clay storage during porcelain production, above which wooden racks for drying unfired porcelain were likely placed, dating to the late Ming and post-1620s periods

LLK4

located under layer 6a of TG6; opening 1.05m from surface, built on kiln waste deposit layer; circular brick structure at opening built with bricks and kiln bricks laid horizontally and vertically, preserving four layers of horizontal bricks, with diameter of 0.55m; narrowing slightly downward; platform at 0.5m depth from opening with circular groove in center for shaft hole; shaft hole with opening diameter of 0.25m, bottom diameter of 0.2m, and depth of 0.25m; inner wall edges preserve significant remnants of white clay suitable for porcelain bodies; dating to the late Ming and post-1620s periods

LLK5

located in the north-eastern part of TG6, situated on layer 6b; opening at 1.1m from ground surface; well-formed structure with nearly circular opening; external diameter of approximately 0.65m at the opening, internal diameter of 0.52m; built with horizontally laid bricks; 8 layers preserved, top three layers partially missing; a platform found at a depth of 0.4m from the opening, with an shaft hole at the center (0.08m in diameter and 0.35m in depth); containing deposit of yellow soil; blue-and-white porcelain sherds dating to the late Ming and post-1620s periods

SLD1

located in the north-western part of TG8, situated on the surface of layer 8; a 0.8m-high pile of large-sized raw materials suitable for making porcelain bodies and glazes, unprocessed; inferred as a raw material storage place within a porcelain workshop area, dating to the Jiajing and Wanli periods

HPL1

located in the southern part of TG7, situated below layer 5; rectangular pit-shaped structure; measuring 1.95m in length (north-south), 1.1m in width (east-west), 0.4m in depth, with walls 0.09-0.16m thick; walls and interior bottom floors plastered with mud, showing reddened soil from repeated heating but no charcoal traces; upper layer containing kiln waste similar as layer 4 of TG7, including large quantities of saggar fragments, spacer discs, and porcelain sherds;

lower layer containing small quantities of kiln waste; preliminarily identified as a furnace to facilitate drying unfired porcelain bodies, dating to the Jiajing and Wanli periods

Catalogue C: Summary of Archaeological Fieldwork at Luomaqiao

This catalogue records two archaeological fieldwork projects conducted at the Luomaqiao Site (落馬橋遺址) in 2012–2013 (entry No.1) and 2023–2024 (entry No.2), focusing on materials dating to the Ming period. The site is located within the Hongguang Porcelain Factory (紅光瓷廠) on South Zhonghua Road (中華南路). The 2012–2013 rescue excavations were conducted during infrastructure development, and the 2023–2024 planned excavations built on these earlier findings to provide more comprehensive documentation of the remaining archaeological deposits, spanning the Song, Yuan, Ming, and Qing dynasties (Figure 3-6).

Each entry provides: date, fieldwork type, location, responsible institution(s), data source, state of publication, and principal findings. Where available, principal findings include information on excavation units, stratigraphic layers, relative chronology, and descriptions of features and artefacts. Feature identifiers retain the original excavation numbers assigned in published reports and appear as sub-entries under the relevant entry. Complete feature references in the thesis follow the format: site abbreviation (LMQ), catalogue entry number, and feature identifier—for example, firing kiln Y1 from entry No.1 is referenced as LMQ-1-Y1.

No.1

Year: 2012–2013

Fieldwork type: rescue excavation

Location: within the Hongguang Porcelain Factory 紅光瓷廠, west of South Zhonghua Road 中華南路

Research institutions: Jingdezhen Ceramic Archaeological Research Institute 景德鎮市陶瓷考古研究所, School of Archaeology and Museology at Peking University 北京大學考古文博學院, Jiangxi Provincial Institute of Cultural Relics and Archaeology 江西省文物考古研究所

Data source: JCARI *et al.*, 2017b; 2020

State of publication: preliminary excavation report

Findings: a total of 30 excavation units laid out (for their relative locations, see Figure 3-5; T17 described in detail), uncovering features of 1 firing kiln (Y1, described in detail), 8 house ruins (with F14 described in detail), 9 ponds (with C11 described in detail), 8 pottery wheel installations, 5 glaze jars, 6 drainage ditches, 4 road surfaces, 8 walls, and 48 pits (with T17H5 and T27H1 described in detail); yielding porcelain sherds dating to the Ming and Qing periods

T17

layer 1a-1b modern occupation debris

layer 2a-2b deposits of porcelain sherds and kiln furniture dating to the Qing period

layer 3a distributed throughout T17; 0.2-0.28m in thickness; containing numerous blue-and-white porcelain sherds and small quantities of brick and tile fragments, coal slag, and kiln furniture; dating to the late Ming and post-1620s periods

layer 3b distributed throughout T17; 0.1-0.2m in thickness; containing numerous porcelain sherds, mainly blue-and-white with some white-glazed porcelain, and small quantities of brick and tile fragments, coal slag, saggars, and spacer discs; dating to the mid-Ming period; features T17H3 and T17H4 situated under this layer

layer 3c distributed throughout T17; 0.1-0.25m in thickness; containing large quantities of red burnt soil fragments, kiln slag, and numerous blue-and-white porcelain sherds, as well as small quantities of brick and tile fragments, coal slag, and kiln furniture; dating to the early Ming period

layer 3d distributed throughout T17; 0.2m in thickness; containing small quantities of white-glazed porcelain sherds; dating to the early Ming period; feature T17H5 situated under this layer

layer 4a, 4b deposit of kiln waste dating to the Yuan period; no further excavation conducted below this layer to preserve house ruins F12

Y1

located in the central part of T25 and the northern part of T24, situated under layer 2c, at a depth of 1.6-1.8m from the ground surface; severely damaged; preserved length (north-south) 5.6m, with a remaining height of 0.95m; consisting of front area, kiln door, firebox, kiln chamber, kiln wall, and protective wall

kiln door only bottom part preserved; constructed with bricks laid horizontally in staggered pattern; 0.4m in width

fire box flattened semi-circular in plan, connected to ventilation channel on north side; bottom paved with one layer of bricks; 3.64m in width, 0.45m in depth; saggars arranged in stacks forming grates

kiln chamber gourd-shaped in plan, rear section damaged; preserved length 3.08m, width 3.85m; sloping from front (lower) to rear (higher) at 3° angle; kiln bed constructed in four layers, solidly built; top layer paved with 0.1m thick grey-brown quartz sand with coarse grains

protective wall 0.55-1.1m in thickness; constructed with brick blocks, stones, saggar fragments, and clay soil

the kiln chamber yielding blue-and-white porcelain sherds and white glazed porcelain sherds; dating to the mid-Ming period

F14

located in the eastern part of T3, situated under layer 4b, broken through by pit H1; only portions of the eastern and southern walls preserved, remaining section forming an L-shape in plan; preserved length (north-south) 6.2m, width (east-west) 0.7-0.8m, with a preserved height of 0.5m; wall thickness approximately 0.8m; wall built with broken saggars, porcelain bowls fused during stack-up firing, bricks, kiln slags, and stones, surface coated with a layer of mud, core filled with fragmented kiln furniture and soil; dating to the Zhengtong and Tianshun periods

C11

located in the northwestern part of T21 and northeastern part of T22, opening below layer 3a; east-west orientation; near-rectangular in plan, measuring 2.18m east-west and 1.6m north-south; four walls vertical and regular, built with layers of stone bricks (approximately 20cm long and 12cm wide) laid horizontally; bottom built with vertically placed bricks; western wall built with columns of saggars; filled with greyish-brown clay, yielding sherds of blue-and-

white porcelain, white glazed porcelain, green-glazed porcelain, coarse-bodied jar fragments, kiln furniture; inferred as a clay storage pond dating to the Jiajing and Wanli periods

T17H5

located in the northern part of T17, situated on layer 3d, broken through by T17H1, T17H2, T17H3, and T17H4; rectangular in plan with a relatively flat bottom; preserved length of 4.4m, width of 2.1m, with a depth of 0.4m; filled with bluish-gray soil, relatively loose in texture; consisting of large quantities of white glazed porcelain sherds and saggars fragments; small quantities of qingbai porcelain, white-glazed porcelain, and blue-and-white porcelain also found; inferred as a kiln waste deposit pit dating to the Hongwu and Xuande periods

T27H1

located in the southwestern corner of T27, situated on layer 3a, broken through looting pits D2, D3, and D4; rectangular in plan, trapezoidal in section, wider at the top and narrower at the bottom, with a flat base; opening measuring 2.8m long and 2.1m wide; bottom measuring 2.5m long, 1.2m wide, and 0.6m deep; built with columns of bowls and plates fused during firing, stones, bricks, and clay, filled with light gray sandy soil, relatively loose, containing broken tile fragments, saggars, and porcelain sherds (mostly blue-and-white, with small quantities of white glazed porcelain and overglaze red enameled porcelain); notable finds include a small number of kraak porcelain plate sherds; grayish-white clay suitable for porcelain making remaining at the bottom and walls; inferred as a kiln waste deposit pit after a clay storage pond was abandoned, dating to the Wanli periods or afterward

No.2

Year: 2023–2024

Fieldwork type: systematic archaeological excavation

Location: within the Hongguang Porcelain Factory 紅光瓷廠, west of South Zhonghua Road 中華南路

Research institutions: Jingdezhen Ceramic Archaeological Research Institute 景德鎮市陶瓷考古研究所, School of Archaeology and Museology at Peking University 北京大學考古文博學院, Jiangxi Provincial Institute of Cultural Relics and Archaeology 江西省文物考古研究院, Department of History at Sun Yat-sen University 中山大學歷史系

Data source: JCARI *et al.*, 2024

State of publication: preliminary excavation report

Findings: a total of 27 excavation units laid out (for their relative locations, see Figure 3-6), uncovering features of 5 firing kilns (with Y5 described in detail), 21 house ruins, 15 ponds, 11 pottery wheel installations, 4 glaze jars, 10 drainage ditches, 5 road surfaces, 14 walls, 1 cooking stove, and 71 pits; yielding porcelain sherds dating to the Yuan, Ming, and Qing periods

Y5

located in the northern part of T0108 and the southern part of T0109, situated under layer 3 of T0109 and layer 4 of T0108; severely damaged, with only the kiln's front area, kiln door, firebox, and front part of the kiln chamber preserved

kiln door 0.52m in width, preserved height 0.9m

firebox built with flat semi-circular floor plan, with a remaining width of approximately 3.55m and a depth of about 0.72m; within the firebox, funnel-shaped saggar columns placed on the east and west sides

kiln chamber 3.03m in east-west width, 0.11-0.15m in thickness; foundation layer containing small amount of blue-and-white porcelain fragments, small amounts of broken bricks, and saggar fragments

dating to the early Ming period

Catalogue D: Summary of Archaeological Features at Hutian

This catalogue records archaeological features excavated at the Hutian Site (湖田遺址) during the fieldwork project of 1988–1999, focusing on those dating to the Ming period. The site is located in Hutian Village (湖田村) along the South River (南河). Multiple surveys and planned excavations conducted between 1988 and 1999 uncovered ceramic production remains spanning the Five Dynasties through the Song, Yuan, and Ming dynasties, documented in a full excavation report published in 2007 (Figure 3-7).

To contextualise these features, the catalogue first provides brief information on the fieldwork project, including fieldwork type, location, responsible institution(s), data source, state of publication, and principal findings. Feature identifiers retain the original excavation numbers assigned in published reports and appear as entry numbers. Complete feature references in the thesis follow the format of site abbreviation (HT) and catalogue entry number—for example, waste pit F20 is referenced to as HT-20.

Fieldwork types: survey (survey locations see nos.14-28, Figure 3-7) and planned excavation (excavation locations see nos.1-13, Figure 3-7)

Research institutions: Jiangxi Provincial Institute of Cultural Relics and Archaeology 江西省文物考古研究所 and Jingdezhen Ancient Folk Kiln Museum 景德鎮民窯博物館

Data source: JPICRA *et al.*, 2007

State of publication: full excavation report

Findings: a total of 28 areas within the site surveyed or excavated; uncovering Ming-period features including pillar bases, road surfaces (with F51 described in detail), waste pits (with F20 and H6 described in detail), sand pits (with F68 and F69 described in detail), walls (with F108 described in detail), work stands (with F103 described in detail), water wells (with J2 described in detail), and kilns (with YW and YZ described in detail); yielding porcelain sherds dating to the Ming period

F20

waste pit; located in excavation area 96B (no.6), situated in the southwest area of excavation unit T1, below layer 2A; circular in shape, 0.88 m in diameter, with a depth of 0.34 m; containing white-glazed, bluish-green glazed, and blue-and-white porcelain sherds; dating to the Chenghua and Hongzhi periods

F51

road surface; located in the excavation area 95A (no.5), situated in the southeast area of excavation unit T6 and T7, below layer 2A; 10.4m in length, 2.4m in width, with a thickness of 0.18 m; main body consisting of a road surface constructed with cobblestones; one side of the road edge formed by saggar walls, the other side formed by grey bricks; dating to the fourteenth century

F68, F69

sand pits; located in the excavation area 95A (no.5), situated in the eastern area of excavation unit T1 and the central-western area of excavation unit T2, below layer 3A; rectangular in shape, 17.5 m in length, 6.5 m in width; foundation constructed with bricks, stones, and saggars; walls constructed with stones and bricks; refractory sand used for firing found inside the pits; dating to the Chenghua and Hongzhi periods

F103

work stand; located in excavation area 96B (no.6), situated in the central-western area of excavation unit T4, below layer 2A; square in shape, 1.2 m in length, 1.3 m in width; working

surface constructed by stacking bricks, stones, and saggars; dating to the Chenghua and Hongzhi periods

F108

wall; located in excavation area 96B (no.6), situated in the southwest area of excavation unit T5, below layer 2A; elongated in shape, 2.5 m in length, 0.4 m in width, with a thickness of 0.3 m; constructed by stacking saggars; dating to the Chenghua and Hongzhi periods

H6

waste pit; located in excavation area 99H (no.12), situated on the south side of excavation unit T17, below layer 1; irregular in shape; containing light yellow clay soil with relatively loose texture; yielding tubular roof tiles, stem cups, bowls, dishes, and large quantities of blue-and-white porcelain sherds; dating to the Chenghua and Hongzhi periods

J2

water well; located in excavation area 99H (no.12), situated in the northeast corner of excavation unit T18, below layer 1; circular in shape, 1m in diameter, with a depth of 1.80 m; well shaft constructed using saggar covers, with 37 preserved layers; yielding white-glazed and blue-and-white porcelain sherds; dating to the fourteenth and sixteenth centuries

Wuyuling Kiln (YW)

situated on Wuyuling Hill (烏魚嶺) (excavation no.16), no excavation number assigned; relatively well-preserved; horseshoe-shaped; constructed entirely with bricks; total length 4.3m, width 3.6-3.2m; slope of 7°; east and rear walls preserved height 2.3m, kiln wall thickness 0.34m

kiln door facing north; 0.7m in width; ash pit outside door flaring outward, bottom 0.66m lower than kiln chamber, maximum width 1.5m

firebox semi-circular in shape; maximum width 2.72m, depth 0.66m

kiln chamber 1.94m in width, 2.72-2.5m in length; when excavated, yielding saggar column placement marks and some broken saggars

flues locating at kiln chamber rear wall, 6 vents consisting of a *smoke box*; middle 4 vents rectangular (height 0.25m, width 0.16-0.18m), two side vents semi-elliptical (height 0.2m, width 0.18-0.2m); connecting with two *chimneys* (length 0.4m, width 0.3m)

foundation layer of kiln chamber yielding white-glazed stem cup sherds and blue-and-white porcelain sherds; dating to Chenghua and Hongzhi periods

Zhanbei Highway Kiln (YZ)

situated on the north side of Zhanbei Highway (戰備公路) (excavation no.24), no excavation number assigned; gourd-shaped; constructed with bricks; preserved length 8.4m, rear part damaged; slope of 4-10°

kiln door 0.52m in width

firebox originally trapezoid-shaped, with 3.7m in maximum width; later modified with brick walls built on both sides, forming current rectangular shape; 2.0m in width, 0.5-0.6m in depth; north wall showing obvious cracks and repair traces

front chamber 2.2m in length, 1.9-3.7m in width; rear chamber 4.86m in length, 1.9-3m in width; north wall showing obvious cracks and repair traces

kiln waste yielding blue-and-white porcelain sherds; dating to the early and mid-Ming periods

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