

Introduction: Ceramics Research in Northwest China and Beyond

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Prehistoric painted pottery has long attracted considerable interest in Chinese archaeology (e.g., Gansusheng 1979; Han 2012; Nanjing 1978; Qinghaisheng 1980; Yan 1978). In fact, some of the earliest targeted surveys and excavation projects conducted in Northwest China were aimed at tracing the origins of painted pottery and the potential exchange of this kind of objects and/or transmission of this vessel type across Eurasia. This research commenced in the early 1920s when the Swedish geologist turned archaeologist Johan Gunnar Andersson travelled to Gansu to investigate whether the painted pottery of Neolithic northern China had its origins in the West, as some of his colleagues suggested, or if it was a local development (Andersson 1943; Chen 1997; Fiskesjö 2014; Fiskesjö and Chen 2004). Eventually, Andersson discovered that there was a painted pottery tradition in Northwest China that – rather than having come from the West – had developed locally based on shapes and decoration motives adopted from further east, more specifically the Yangshao ceramic tradition. It is this Northwestern late Neolithic tradition of high-quality fine-ware painted pottery – now referred to as Majiayao based on the eponymous site in Gansu – that much of Hung Ling-yu’s research focused on.

In her work, Hung Ling-yu combined archaeological methods such as ceramic typology, social interpretation in mortuary archaeology, ethnoarchaeology, and archaeomaterial approaches. Her interest in ethnoarchaeology went back to her time as a BA student in anthropology at National Taiwan University and is reflected in her early publication on “Research on Neolithic Period Hearths: An Ethnoarchaeological Perspective” (Zhongguo xinshiqi shidai de lu wenhua yanjiu 中國新時期時代的灶文化研究：一個民族考古的觀點) (Hung 1998). In her Master’s thesis, written at Peking University at the School of Archaeology and Museology, she took a traditional typological approach to ceramics, conducting *A Study of the Decorative Designs of the Yangshao Culture Painted Pottery of the Wei River Valley* (Weihe liuyu Yangshao wenhua caitao huawen yanjiu 渭河流域仰韶文化彩陶花纹研究) (Hung 2000). During her doctoral studies at the Department of Art History and Archaeology at Washington University in St Louis, she acquired knowledge and expertise in a wide range of additional approaches and methods including settlement pattern analysis, issues of culture contact, social inequality as reflected in mortuary data, the connection between social structures and object production, ceramic technology, and techniques of physiochemical analysis. These she combined with her previous training in ceramic typology in her dissertation, entitled *Pottery Production, Mortuary Practice, and Social Complexity in the Majiayao Culture, NW China (ca. 5300-4000 BP)* (Hung 2011).

In this thesis, published posthumously in the present volume (with minor edits), she collected a vast amount of data from collections of excavated finds held at various and not easily accessible research institutions and museums in Northwest China, data that can be of great use for future research. Providing a broad overview of settlement patterns and burial customs, this study engages with and contributes to research on ceramic typology based on vessel shapes and decoration motifs, providing new insights into the relationship between painted pottery production/consumption and social inequality. Furthermore, in the work presented in this monograph, Hung provides a detailed analysis of changes in mortuary practices and their intersection with changes in subsistence practices and patterns of ceramic production and consumption. This work builds on and goes beyond studies by Allard (2001) and others linking ceramic consumption in Majiayao grave contexts (together with burial postures and grave structures) and social hierarchies.

Most research on painted pottery preceding Hung Ling-yu's work focused on typochronological questions (e.g. An 1982; Lu 1983; Shui 2001; Xie 2002; Yan 1978). Such research has continued in recent years, with scholars mainly discussing fine chronological issues as a basis for suggestions on culture contact and exchange throughout northern China and beyond (e.g. Chen Wei 2012; Chen Xiaosan 2012; Han 2013; Ren 2016). One of the few studies combining typological and technological discussions is Li Shuicheng's 1998 monograph *Research on the Painted Pottery of Banshan and Machang* (Banshan yu Machang caitao yanjiu 半山与马厂彩陶研究), Banshan and Machang being periods and ceramic subtypes of the Majiayao culture. In that monograph, Li treated ceramic forms and decorations separately, arguing that, in the case of Banshan and Machang, the designs changed more slowly while the forms changed faster as the latter were responding to changes in technology and subsistence practices. In his more recent publications – partially in response to Hung Ling-yu's work – Li (2015) emphasized the importance of raw material choices for ceramic production and technological developments over time.

Indeed, Li Shuicheng – having been a professor at Peking University during Hung's studies there and having established the Tao River Valley Archaeological Project (TRAP) with her, Rowan Flad, and Chen Po-chen, Li was a mentor, and their work continued to influence each other once Hung moved to the US for dissertation study. The TRAP project, which commenced in 2012, investigates technological changes in Northwest China around 4,000 BP, including the introduction of metallurgy, new domesticates, changes in subsistence systems, and of course also changes in ceramic technology (e.g. Hung, et al. 2019; Womack, et al. 2017, 2019a, 2021; Jaffe, et al. n.d.). On this project, Hung Ling-yu contributed to research on ceramic technology, conducting scientific analysis on material obtained during survey and excavation work, and starting an ethnoarchaeological project that sadly remains unfinished.

Hung has made a considerable contribution to research in scientific analysis of archaeological ceramics, commencing with her PhD work and publications in Chinese (Hung et al. 2011 and 2012). Research on Chinese ceramics using archaeometric methods commenced already in the 1960s, using various methods such as X-radiography, Scanning-Electron Microscopy (SEM-EDX), XRF (either handheld or bench-top), and to a lesser extent petrographic analysis, however, such studies have mostly focused on high-fired wares while similar research on low-fired wares has been far and few between, gaining popularity only in recent years (for a summary consult Hein et al. forthcoming). Most of this research has furthermore focused on local developments in ceramic technology and/or raw material selection and processing (Ma et al. 2001), while Hung Ling-yu's work has concentrated on possible evidence for ceramic exchange and culture contact.

In her dissertation work, Hung analysed 687 archaeological samples (275 from the Majiayao period, 53 from the Banshan period, and 359 from the Machang period) from 33 sites in Gansu, Qinghai, and Sichuan, and 10 samples from two modern ceramic workshops producing imitations of Neolithic ceramics for tourists (Appendix A in this volume). Working with Cui Jianfeng from Peking University, she conducted LA-ICP-AES (laser-ablation inductively coupled plasma-atomic emission spectrometry) to obtain the geochemical composition of the samples. This approach identifies major and minor elements with great accuracy and precision. Indeed, it was Cui Jianfeng who drew her attention to the painted pottery of Maoxian in northwest Sichuan, pointing out the chemically distinct composition to her and thus initiating over ten years of collaborative research between the two scholars that was sadly cut short by her untimely passing. While in Hung's dissertation the samples from Sichuan and the Tibetan Plateau (mostly Zongri) played a somewhat minor role, it was her joint publications with Cui Jianfeng and others on these materials that gained much attention in the field (Hung et al. 2011, 2012, and 2014). While comparative chemical analysis of ceramics from various sites with the

aim of establishing provenance and identifying patterns of ceramic exchange are quite common in Europe and the Americas, in China such research had previously only rarely been applied to low-fired wares such as the painted pottery of Neolithic Northwest China (e.g., Ma et al. 2001). Based on comparative analysis of samples from Sichuan, Gansu, and Qinghai, Hung et al. (2011) suggested that painted pottery vessels of Majiayao type found in Sichuan were probably imported from the Gansu-Qinghai region, likely from two separate areas, with wares found at Yingpanshan having been traded in from a different location than those found at Haxiu. Similar comparative analysis with samples from Zongri suggest that the high-quality Majiayao-style painted pottery found there was likely imported from Gansu as well. But there were also lower-quality local imitations that differed in ceramic colour, chemical composition, and overall appearance from the imported wares, with both differing from local-style wares (Hung et al. 2012 and 2014).

Their data have since been re-analysed by Ren et al. (2013) and Huan (forthcoming). While Ren et al. agreed with the broad conclusions on evidence for culture contact and exchange of ceramics between Gansu and Sichuan, they pointed out that chemical analyses alone were not sufficient to infer culture contact but that further analyses on paint and style had to accompany scientific results. The stylistic analysis is already provided in Hung's work published in the present volume, and she had also planned and commenced a study on paints, however this work remains sadly unfinished. Huan (forthcoming) has pointed out potential issues with relying on major and minor elements alone and not taking into account trace elements. The latter can point to specific locations rather than broad geological regions. Indeed, high calcium loess and red clay are available in northwest Sichuan and across much of northern China, not only in the Northwest, as Ma et al. (2020) have shown in a comparative study across the Loess plateau. Similarly, Hein and Stilborg (2019) have shown the limitations of XRF data (especially the less precise and less accurate p-XRF variety) in distinguishing between painted wares from different sites in Gansu while at the same time showcasing the power of petrographic analysis in identifying principles of raw material selection and processing. All of these scholars thus call for further studies of both archaeological and geological samples using a variety of analytical techniques.

In recent years and up to the present, such in-depth research but on smaller geographical areas has been undertaken by a number of scholars, many of them associated with the TRAP project. For instance, Andrew Womack (2017; see also Womack et al. 2019b) has conducted petrographic analysis on hundreds of samples from Majiayao- and Qijia-period sites and geological samples from the Tao River Valley, Gansu, and has begun extensive geological survey work in the region together with Su Xin, Anke Hein, and Evgenia Dammer, work that is still ongoing. Dammer (forthcoming) is likewise conducting petrographic analysis on archaeological and geological samples, combining them with use-wear and experimental analysis, focusing on raw-material choice and processing among Majiayao-period potters in Gansu and Qinghai. Hein and Stilborg are also conducting further petrographic work on ceramics from various prehistoric periods from Northwest China.

At the same time, various scholars continue chemical analysis on painted pottery from the region to investigate culture contact and exchange. For instance, Cui Yifu et al. (2015) conducted XRF analysis from a range of Yangshao, Majiayao, and Qijia period sites, concluding that it was only in the later period that ceramic wares were exchanged over longer distances. Picking up on Hung Ling-yu's work on Zongri, Hou et al. (2016) confirmed that the Majiayao-style pottery found at Zongri was indeed imported, though they pointed out that it was problematic to reach such conclusions based on major and minor elements alone. Xiang Jihui (2018) recently collated results of chemical analyses obtained by various methods by other scholars to reconsider the issue of Majiayao-style ceramic imports from Northwest China

to Sichuan. Xiang agrees with Hung that the wares from Haxiu and Yingpanshan were somewhat different in composition and that the ones from Haxiu had been produced in Gansu, but disagrees with her on the place of production of the ceramics found at Yingpanshan, which she considers to be local products. As has been pointed out by Hein et al. (forthcoming), directly comparing chemical analyses conducted at different labs using different methods in this way is somewhat problematic. However, combining the results of chemical analyses with comparative typological and statistical analysis of ceramic shapes and decoration, as Hung did in the present volume, and/or with petrographic analysis, as done by Stilborg and Hein (2019), can provide more reliable results, especially when also taking into account geological samples as done by Ma et al. (2020).

All in all, Hung Ling-yu's work has had considerable ripple effects, especially her Chinese-language publications, leading to a flurry of studies conducting chemical analysis on Neolithic painted fine ware from North and Northwest China, and discussions on the appropriateness of such studies and the potential of their integration with geological surveys. What has been discussed much less is the incorporation of ethnoarchaeological work that Hung suggested, partially because her ethnographic observations were opportunistic rather than systematic and buried in her dissertation rather than published separately. These observations included the fact that the modern potters added fine loess silt – a material judged by Zhou et al. (1964) to be unsuitable for use in pottery production due to their limited plasticity, while Chastain (2019) has shown that moulds for bronze casting were primarily based on loess silt – to the much more suitable Tertiary red clay otherwise used in ceramic production. Other observations concern the use of jade or horn in polishing vessel surfaces after painting them, confirming Ma's (2000) work suggesting that the mineral pigments are better embedded in the vessel surface through this process.

Another ethnographic observation by Hung pertaining to paint was that only one modern potter knew how to mix natural mineral pigments and kept his recipe a secret, leading to differences in the colours between the products by various modern potters, something that may also have happened in prehistory, as she suggests. Indeed, the issue of paint recipes, pigment sources, as well as paint application and differences between different sites, workshops, and even individual potters fascinated Hung so much that she started a systematic research project on the topic combining chemical analysis of archaeological and modern samples with ethnographic observations and sampling. This work was started together with Cui Jianfeng who is hoping to continue and thus preserve and honour her legacy. Additionally, they had started to conduct a raw-material survey and investigation of the production process of painted pottery beyond Majiayao including Banshan-Machang, Siba, and Qijia. This, too, is to be continued by Cui Jianfeng, probably involving also other scholars in the field to spread the workload (personal communication by Cui Jianfeng). In connection with her dissertation work, she had also done an extensive standardization analysis of painted pottery from the site of Liuwan, though she never published her findings. The data is with her sister and there are plans to publish it in the future.

Another legacy Hung leaves are her students and an exhibition at the Harvard Art Museum. After completing her PhD at Washington University, St. Louis in 2011, Dr. Hung joined the faculty in the Department of Anthropology at Indiana University starting in 2012, where she taught courses on technology, ceramic analysis, geoarchaeology and ancient China. Her first and sadly only PhD student, Eric Carlucci, worked at Peking University with Cui Jianfeng for a while, though now he slightly changed his focus to small-scale craft production on the Chinese Mainland and Taiwan. In 2015-16, Ling-yu spent one year at the Harvard University Fairbank Center on an An Wang Fellowship. This visiting fellowship developed based on a talk she gave to the Harvard Asian Archaeology Seminar in 2013 when she was introduced to

the painted pottery collection housed at the Harvard Art Museums. Her An Wang fellowship focus involved assessing these materials and putting together an exhibit in advance of the 7th International Conference of the Society for East Asian Archaeology, which took place at Harvard University and Boston University in June 2016. She intended to build off of this exhibit to write one or more research articles regarding this collection in collaboration with the Harvard Art Museums conservation department. This, unfortunately, was another research direction that was cut short by her untimely passing.

All in all, Hung Ling-yu's influence on the field has been considerable, starting a broad discussion on potential long-distance exchange of painted pottery and transmission of ceramic technologies over time and space. She had even greater plans for the future, research projects that nobody will be able to conduct quite the way she would have done, yet, her ideas and projects live on and the authors and other scholars in the field are doing their best to carry on her legacy by publishing her work and continuing her projects. In this endeavour, her sister Hung Hsiao-chun, a great archaeologist and influential scholar in her own right, is our greatest ally, generously agreeing to undertake the painful task of going through her sister's files and notes to share them with the world. We are all in her debt.

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