

Electroplating as Alchemy

Labor and Technology among Muslim Metalsmiths

THE PUZZLES OF LATE NINETEENTH-CENTURY ELECTROPLATING MANUALS

Plating [metals] is the best of all crafts.
 The goldsmith is confounded by it, the alchemist astonished.
 Tin, copper, and iron, quicksilver, lead, and bronze,
 Zinc and silver . . . in a flash, it made them all like gold.
 Oh scholars! The transformative ion, which changes shapes and forms
 Is beyond philosophical intellect!¹

These verses concluded an 1872 Urdu-language manual on the technology of electroplating, published in the North Indian city of Meerut by the Hāshmi Press, a small regional press. The text, titled *Tuhfah-yi talmī‘ bah-kharbāyī* (The gift of plating through electricity), explained how to create a thin metal coating over another material—usually another metal—through electrolysis, or the use of an electric current generated using a water-based solution.

Authored by Hafiz Anwar ‘Ali, who described himself as a retired court inspector in the North-Western Provinces and a “master in the industrial arts,” the *Tuhfah-yi talmī‘* informed its readers that electroplating was “common knowledge” among metalworkers in Europe.² Through sixty pages of description, it explained how to prepare an aqua regia (nitrohydrochloric acid) solution to dissolve metals for gilding and plating, and how to clean and scrape the metal that one intended to plate. It described the properties of metals ranging from platinum to copper and from tin to gold. And although the text was not extensively illustrated, it featured a few small sketches of how to create and use a battery and how to transfer electric current to transfer the metal-plating.³

The *Tuhfah-yi talmī‘* is among the earliest works in a small surge in Urdu-language publishing about electroplating. This took place roughly between 1870

and 1910 but was most concentrated between 1870 and 1900, when at least seven Urdu publications wholly or partially on electroplating were released in the North-Western Provinces and Punjab alone.⁴ The existence of these late nineteenth-century Urdu electroplating manuals, many published from relatively provincial cities—Meerut city was home to about eighty thousand people as of 1872—presents a puzzle. Contrary to what might be suggested by the flurry of publishing on the topic, electroplating was not widely used as an industrial technology before the turn of the century. Colonial reports suggest that in Meerut there were no major electroplating firms before 1890, despite the fact that the city was known for its manufacture of scissors, the handles of which were often plated with gold, brass, and later nickel.⁵ Instead, a few metalsmiths—likely about five to ten in Meerut—used electroplating to meet European demand for electroplated cutlery and dinnerware, and may have occasionally been employed by scissor makers as well.⁶ And even in more industrialized cities such as Amritsar and Kanpur, colonial reports suggest that approximately fifteen to twenty workers per city regularly practiced electroplating before 1890.⁷

Why, then, did presses across the North-Western Provinces and Punjab print hundreds of copies of electroplating manuals and periodicals? Who were the audiences for these materials, and why, if there was not an especially large-scale electroplating industry, were they so interested in learning about electroplating? A second mystery presented by these electroplating publications may help us solve the first. One of the most notable aspects of the materials, regardless of where they were published, is that many speak to an explicitly Muslim audience. The framing of the texts, with occasional references to Quran or hadith and frequent references to the revelation of knowledge for Muslims by God, suggests that the authors expected their audiences to be Muslim and to understand the practice of electroplating through a lens of Islam. Several, like the *Tuḥfah-yi talmī*,⁸ also claimed that electroplaters had taken up or improved on the work of *kīmiyāgars*—alchemists in the Islamic tradition. In the context of nineteenth-century North India, where Urdu publications attracted readers from a wide array of religious backgrounds, why did the authors of most electroplating manuals assume a relationship between Muslims and electroplating?

The answers to these questions offer insight into the class and social dynamics of Muslim artisan workers and a consolidating class of Indian Muslim capitalists in colonial-era India. They suggest that these communities used references to Islam and the Muslim past to explain and make sense of technological change in their industries. But equally, and perhaps more importantly, they suggest that knowledge of new industrial and artisanal technologies became a mark of social status, a way of asserting one's positionality within the class and social hierarchies among North Indian Muslims. As these social hierarchies were reinscribed and reified through both colonial policy and the consolidation of a Muslim middle class, metalsmithing communities asserted engagement with technologies like electroplating for themselves to contest their social and economic marginalization.

In the case of the *Tuhfah-yi talmī*, a careful reading suggests that it was not, in fact, intended for use among artisan metalsmithing communities. Instead, it reflected the efforts of members of the Muslim middle class, such as Anwar ‘Ali himself, to assert their command over technology, science, and industry, and the ability of Urdu to communicate scientific knowledge representative of colonial modernity.⁸ But within fifteen years of the publication of the earliest Urdu electroplating manuals such as the *Tuhfah-yi talmī*, artisan metalworkers began to claim the technology for themselves through electroplating manuals aimed at laboring audiences.⁹ They engaged with some of the same language, imagining themselves as the *kimiyāgars* of industrial modernity. They played on the fact that *kimiyā*, in Urdu, references both classical alchemy and modern chemistry to assert their simultaneous command over colonial-era technologies and regional Muslim pasts. At the same time, they also subverted the middle-class norms of earlier manuals and instead asserted the Muslim piety inherent in the physical skill of artisan communities.

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Most of the chapters in *Pious Labor* trace how artisans asserted Islamic narratives about their trades from within their own communities. They frame middle-class engagement with artisan narratives as secondary to artisans’ own understandings of their Muslim pasts. In this chapter, however, I tell a more complicated story of the interpenetration of middle-class and artisan understandings of Islam and technology. Dhruv Raina and S. Irfan Habib have argued that in the nineteenth century, middle-class Indian practitioners of science “subvert[ed], contaminate[d] and reorganize[d] the ideology of science as introduced by Europe.”¹⁰ Through a study of electroplating manuals, I argue that processes of “ideological subversion” took place not only at the level of global scientific transfer but in a context of religious- and class-based claims on technologies.

In its earliest use in South Asia, electroplating was not limited to industrial applications. It was also pursued as a hobby by members of the emerging Indian middle class, who used it as evidence of their command over technological modernity. When a small number of Indian Muslim artisan metalsmiths were commissioned to electroplate beginning in the 1860s and 1870s, it is unlikely that they initially framed their work using the narratives of electroplating promulgated in publications such as the *Tuhfah-yi talmī*. Instead, they more likely engaged with Muslim oral traditions for metalsmithing and manual plating that circulated within their hereditary and trade communities.¹¹ However, between the 1880s and 1910s, the practice of electroplating in India slowly expanded, moving from niche art to an important if still limited part of the industrial economy in many North Indian cities. In this context, both the audience and contents of electroplating manuals changed. Increasingly these manuals addressed metalworkers. To do so, they connected electroplating to artisan religious and material worlds, rearticulating middle-class narratives as a form of artisan Islam.

The Muslim artisan metalsmiths who engaged with electroplating reimagined middle-class Muslim narratives about electroplating for themselves and positioned Muslim artisans and laborers as the natural inheritors of new material and technical practices. Texts aimed at artisan metalworking communities framed these workers as the alchemists of industrial modernity, in command of the alchemy of the past and the chemistry of the future. At the same time, they integrated electroplating with extant community histories, embodied skills, and Muslim traditions. This chapter thus focuses on the capaciousness of artisan Islam and its ability to reorient middle-class narratives about technological change.

As we explore throughout this book, middle-class Muslims sometimes viewed artisan Islam as a threat to their understanding of a normative or orthodox religious practice. But Muslim artisans demonstrated a flexibility and an ability to reimagine middle-class narratives for emerging industrial technologies in conversation with their own, extant traditions for their trades. Whereas the earliest electroplating publications, including the *Tuhfah-yi talmī*, appear to have addressed primarily members of an emerging industrial-capitalist class, beginning in the 1880s electroplating manuals explicitly addressed artisan metalworkers. One of the most significant shifts in this period was the use of verse to communicate knowledge about electroplating and the rise of texts that were written to be read aloud, circulating through overlapping practices of literacy and orality within workshops and factories. These shifts suggest new intended audiences and an adaptation of electroplating publications to speak to the social and class interests of Muslim artisan communities.

Following an analysis of electroplating manuals, their contents, and their intended audiences, the chapter turns to the experiences of one specific community of urban artisans and laborers who engaged with electroplating. It focuses on manufacturers of surgical tools in Sialkot, a city in Punjab near the border with the princely state of Jammu and Kashmir. Like Meerut, Sialkot was a midsized city with regional renown in specific forms of metalsmithing. But in Sialkot, the electroplating industry grew far more rapidly than elsewhere in Punjab or the North-Western Provinces. While exploring why this was the case, I ask how local Muslim traditions surrounding metalwork intersected with new claims on electroplating in Sialkot. I demonstrate that electroplating manuals became part of the movement of workers and ideas between industrialized and home-based workshops. Through this culture of mobility and flexibility, Muslim metalsmiths circulated intersecting religious narratives, community identities, and forms of technological expertise.

HISTORIES OF (ELECTRO)PLATING IN SOUTH ASIA

To understand the history of electroplating in South Asia, including its circulation and use among Muslim artisans and laborers, we must weave together two stories. The first is that of the technological experimentation that enabled the use of an electric current for metal-plating and the emergence of electroplating as a commercial trade globally. The second is a far longer history of metal-plating

and gilding in South Asia. Electroplating texts aimed at members of the Indian middle class—rather than artisans and laborers—often portrayed electroplating as an abrupt break with earlier practices of plating. They connected electroplating not to an extant artisan tradition but to the experiments of either Europeans or precolonial scientists and alchemists with connections to Muslim courts. Conversely, those manuals that spoke to artisan metalworkers explained electroplating and electrometallurgy as part of a continuum of plating practices, suggesting that workshops and workers might choose from a variety of methods that included—but were not limited to—electroplating.

The earliest attempts to plate metals using an electric current took place in Italy using the recently invented voltaic pile battery around the turn of the nineteenth century. Experiments throughout the 1820s and 1830s focused on improving the consistency of the voltaic battery's currents and the solutions in which plating took place, to make electroplating commercially viable.¹² The first patents on the technology of electroplating were granted in Birmingham in 1840 to artisan-inventors who plated and gilded toys and trinkets. Iwan Rhys Morus has shown that in the wake of these patents, electricity became “an agent of mass production” in Britain.¹³ The technology was embraced by producers and consumers globally beginning in the 1850s and 1860s, with articles in *Scientific American* highlighting its widespread adoption in North America.¹⁴ Reflecting middle-class aspiration, electroplating became popular because it allowed increased access to household consumer goods such as cutlery that appeared similar to those used by the wealthy. The ability to rapidly create thin coatings of gold and silver meant that popular, relatively inexpensive goods were now more difficult to distinguish from their costly counterparts made entirely of precious metals.¹⁵

The earliest reference to electroplating that I have found in the British Indian colonial archive is a mention of a European-run electroplating workshop in Calcutta in 1856.¹⁶ Indian-made electroplated items were displayed at regional arts and industrial exhibitions from at least 1864.¹⁷ As was the case in Bengal, the earliest commercial electroplating enterprises in the North-Western Provinces and Punjab were managed by Europeans, though reliant on Indian workers. Among the most notable was a workshop in Sialkot, run by a European medical officer identified as Mr. W. Spence who recruited local workers skilled in inlay and manual gilding to electroplate surgical instruments. These surgical instruments were displayed at the Punjab Exhibition of Arts and Industries, held in Lahore in 1864, where they won several awards and were praised as reflective of the potential of Indian workmen to embrace electroplating.¹⁸

As suggested by the fact that Spence recruited workers from local gilding and inlay workshops to his new electroplating enterprise, it is of course possible to plate and gild metals without battery power or an electric current. Indeed, several South Asian metalsmithing communities were, by the mid-nineteenth century, well known for their skill in manual plating and gilding. These included Kashmiri metalworkers, many of whom migrated to Punjabi cities such as Sialkot, Lahore,

Amritsar, and Gujranwala in the nineteenth century, establishing Kashmiri neighborhoods across the region.¹⁹ Other metalworkers who were praised in colonial writing for their abilities in plating included *koftgars*, artisans who damascened or inlaid steel with gold. While metal-plating and *koftgarī* are different processes, artisans skilled in *koftgarī* were often also commissioned to plate metal wares, as many of the skills overlapped. *Koftgars* sometimes turned to plating in periods of decreased demand for *koftgarī* or practiced the two skills alongside each other. The processes that these manual platers and gilders used varied based on the metals used. But the common methods included scratching a surface of copper or iron with checked lines, washing it with an acidic solution made from dried, unripe apricots, heating it or applying mercury, and then applying a layer of gold, silver, or other metal “leaf” as plating.²⁰

A third, and perhaps the most numerous, community of artisans who engaged in manual plating were *qal'igars*, or tanners. Unlike *koftgars* and Kashmiri gilders and platers, *qal'igars* were not characterized as especially skilled or worthy of artisanal prestige in colonial reports. On the contrary, they were depicted as particularly tradition bound and resistant to technological and material change. Nonetheless, they played an important role in the Indian economy because copper and brass cups, plates, and pots are often not safe for use unless plated with tin, a process that was usually carried out monthly by a *qal'igar*.²¹ In cities and towns, *qal'igars* often maintained mobile workshops. Their process of tin plating involved cleaning utensils with hydrochloric acid, heating and coating them with ammonium chloride, and finally melting tin over the surface and polishing it.²²

MUSLIM TRADITIONS FOR METALWORK

Across India, metalwork—including plating—was rarely associated exclusively with a single religious community. Muslims, Hindus, Sikhs, and Christians all worked in some of the largest metalworking trades, including blacksmithing, copper work, and brass work. While most *koftgars*, *qal'igars*, and others known for plating in Punjab and the North-Western Provinces identified as Muslim, they participated in a wider economy of metalsmithing that accommodated many religious practices and beliefs.²³

Colonial records also portrayed metalworking trades as especially flexible in terms of caste identity. They argued that although *lohār* served as a caste term for Hindu, Sikh, and Muslim blacksmiths, people from other artisan and agricultural caste backgrounds often took up metalwork, especially as they migrated into urban areas. Likewise, they noted that *lohār* as a term was often used as a caste category by smiths who worked with a wide range of metals in addition to iron. As in the case of tailors discussed in chapter 3, the flexible engagement with this marker of caste and social identity, especially among Muslims but also among some

Hindu-identified artisans, sparked occasional colonial consternation. It upset what Joel Lee has referred to as the “state regime of recognition,” projects meant to enumerate stable religious, caste, and social categories.²⁴

The variety of religious identities within metalworking trades, combined with the relative flexibility of the caste category of *lohār*, also informed colonial ethnographic depictions of metalworkers as religiously unorthodox and marginal members of their traditions. In the case of Muslim metalworkers, one report from Sialkot—where nearly all metalworkers identified as Muslim—characterized metalsmiths and other urban artisans as “followers of the Prophet only in name. They circumcise their children and repeat the creed [*kalima*], but they continue to pay respect to local deities, and employ a Brahmin priest in their social ceremonies.”²⁵

But the Muslim metalworkers of urban North India did not portray themselves as marginal, unorthodox, or corrupted Muslims. Their traditions for their trade reflected an explicit self-identification with Islam. Among these, the only one regularly recognized in colonial ethnographic writing was an association between blacksmithing and the Prophet Dawud, referenced in the introduction to this book. Most ethnographic writing attributed this to the thirty-fourth surah of the Quran (*Saba*), which asserts that God “soften[ed] iron” for Dawud and compelled him to take up the art of making “coats of chain mail.”²⁶

Despite the primacy given to this narrative in the colonial archive, it was not the only way in which Muslim metalsmiths—including manual platers—asserted Muslim religious and social identities and a connection between their trade and Islam. In many cases, their traditions for their trade were tied to local Sufi shrines or saints and were asserted for specific practices within metalwork. As Hussain Ahmad Khan has shown in the case of Punjab, from at least the twelfth century, “Sufis became part of artisan communities, and used a particular vocabulary related to their professional practices to attract colleagues and followers, who popularized Sufis’ ideas in their respective communities.”²⁷ For instance, in Lahore, a mid-sixteenth-century tomb honors Sheikh Musa “Ahangar,” (“blacksmith” in Persian) a blacksmith-saint who died early in the reign of the Mughal emperor Akbar.²⁸ Many Sufi lineages in Punjab and the North-Western Provinces underwent financial transformations between the sixteenth and eighteenth centuries by cultivating patronage and support from large landlords or expanding their own landholdings. This meant that by the nineteenth century few lineages remained engaged in the practice of artisanship, though, as Khan has shown, they retained ties to artisan communities through systems of patronage and as the hosts of fairs.²⁹ In turn, artisan communities often asserted localized traditions about the connections between specific shrines or saints and their trades.

These localized traditions often circulated orally, and they are not well attested in either the colonial or Urdu-language archives. However, many persist—perhaps in an adapted form—through the present day. In a 1999 study, anthropologist Alain

Lefebvre noted oral histories among blacksmiths and carpenters in modern Pakistani Punjab, in the region that includes Sialkot and Gujranwala, two cities that became important centers of electroplating by the turn of the twentieth century.³⁰ These oral histories center on a Sufi *pīr* called Shura Sharif and attribute the spread and settlement of Muslim blacksmiths throughout the province to his influence. They assert, via the community's connection with the *pīr*, an association with the Mughal state and its patronage. Moreover, they position metalworkers and carpenters as responsible for the conversion of other Punjabi communities to Islam through their association with the *pīr*.³¹ These oral traditions reflect a practice of artisan community self-assertion and self-definition through the claiming of Muslim pasts. Their persistence in regional oral histories illustrates that claims on the past circulated orally within artisan communities, both before and after the rise of print.

ELECTROPLATING AND THE MUSLIM MIDDLE CLASS

As noted in the introduction to this chapter, the *Tuḥfah-yi talmī* ' , among the earliest electroplating manuals in North India, was not intended primarily for audiences of artisans. To that end, it made no reference to the religious traditions and Muslim pasts asserted by metalsmiths. Likewise, it made limited reference to the skills or practices of manual platers, portraying electroplating as innovative and as a break with past practices of plating. To the degree that it did consider pasts for electroplating, it focused on the European inventors of the technology, not regional artisan practices.³² In contrast, later electroplating manuals explicitly rooted electroplating within a longer tradition and practice of plating, seeking to build on and reference workers' extant metal-plating skills to explain the process of plating through electrolysis.

A treatise published two years before the *Tuḥfah-yi talmī* ' , titled *Risālah-yi fan-i talmī* ' (Treatise on the art of plating), printed in Gujranwala in central Punjab in 1870, similarly highlighted the interest of middle-class hobbyists and aspiring capitalists in electroplating. Published by the Gyan Press, a local press, the ten-page publication was framed as a special issue of a local Urdu periodical on the arts and sciences. In an introduction, its authors described themselves as two local "captains of capital" named Ramzan 'Ali and Qamaruddin Khan.³³ They spoke to the interests of an emerging class of Punjabi Muslim capitalists who aimed to use their knowledge of new technologies to employ artisan laborers, not necessarily to engage in artisan work themselves.

The periodical introduced the technology of electroplating before shifting to a question-answer format that allowed the authors to highlight their technical expertise. Questions such as "How does one prepare sulfuric acid and what are its uses?" focused on the types of materials a workshop would need to provide to employ workers in electroplating.³⁴ The questions chosen suggest

that the authors saw knowledge of electroplating as a marker of engagement with models of industrial capitalism but that they did not necessarily expect most of their readers to individually practice the trade beyond the level of a hobbyist's experimentation.

Around the mid-nineteenth century a "new middle class" of Indian Muslims asserted their social distinction from both the working class and courtly elites.³⁵ In portraying themselves as "captains of capital," Ramzan 'Ali and Qamaruddin Khan situated themselves as representatives of this emerging Muslim middle class of what Margrit Pernau termed "upwardly mobile traders and merchants," who expressed pride in their professions and their claims on "self-improvement."³⁶ And the authors positioned electroplating as one of many new scientific, technological, or industrial breakthroughs in which an educated Muslim capitalist should be proficient by publishing their work as a special issue of a magazine that targeted Urdu readers with a general interest in "the sciences and the arts."³⁷

In this context, references to Islam and Muslim piety in the *Risālah-yi fan-i talmī* read not only as a framing device but also as an assertion of social positionality. The authors explained, in their introductory comments, that they had "turned to God the granter of success, placing trust in him alone," in their attempt to "understand the great and small work of electroplating." In doing so, they connected their piety as Muslims to their dedication to industrial and technological knowledge. They framed their work as bettering the Muslim community, not only materially but also spiritually, explaining that they had "taken up the pen of truth" to enlighten "anyone who searched for knowledge."³⁸

Similarly, in the Meeruti *Tuhfah-yi talmī*, the author, Hafiz Anwar 'Ali, described himself as a retired court inspector for the North-Western Provinces who had developed an interest in the industrial development of his city and region. He wrote for the consolidating middle class who increasingly asserted ownership and authority over urban artisan workshops and factories. The work may also have been aimed at his own class of Indian government workers who sought, not necessarily to own a workshop, but rather to demonstrate an interest in what the state termed "industrial arts" as a marker of their own technological modernity. The *Tuhfah-yi talmī*—like its contemporary the *Risālah-yi fan-i talmī*—is thus suggestive of Projit Mukharji's argument that "members of the colonial middle class were engaged in class-identity formation by consuming small technologies."³⁹ They reflect the fact that not only consumption of technologies but also consumption of knowledge about technology became central to class identity for many middle-class Indians.

These texts aimed to adapt what their authors consciously framed as "European" knowledge not only into the Urdu language but also into the religious and social idiom of the Muslim middle class. They sought to demonstrate that members of this class were simultaneously the inheritors of Muslim tradition

and promoters of an Indian Muslim future. Reflecting his claims to an Indian adaptation or reimagination of a European modernity, Anwar ‘Ali explained in his introduction that his goal was to bring “knowledge that is common in Europe” to India.⁴⁰ Written in a high register of Urdu, Anwar ‘Ali’s text aimed to explain the scientific properties of electroplating to hobbyists, aspiring industrialists, and other interested members of his own class. A careful reader may have been able to use his text to practice electroplating, but like the *Risālah-yi fan-i talmī*’, it featured only a small number of visual aids and was aimed primarily at communicating principles, not practices.⁴¹

NEW CONTENT AND FORM IN ELECTROPLATING MANUALS

Not all electroplating manuals and treatises spoke to this same middle-class audience. Within about a decade—by the early 1880s—the authors of electroplating manuals increasingly addressed the artisan metalworkers who would be responsible for plating metals in a workshop. These new manuals focused on the physical practice of the work, with particular attention to explaining how to set up and use a homemade battery to create an electric current and comparing solutions used to plate different metals. In addition, many of these manuals referenced practices of plating and gilding that were common in India and did not rely on an electric current, portraying electroplating as part of a continuum of regional metalworking practices. Rather than asserting the trade as a technological breakthrough—engagement with which demonstrated the social and class distinction of middle-class Muslim capitalists—the manuals increasingly claimed a technological prowess for metalworkers by highlighting fluidity between different practices of plating and gilding. In doing so, they suggested that it would be possible for artisan workers to integrate electroplating into their extant religious traditions and material practices.

Shifts in the content of electroplating manuals were accompanied by shifts in the form of the books. Manuals increasingly incorporated detailed drawings illustrating the work of an electroplater, as well as versified descriptions of the practice. Versification in electroplating manuals likely contributed to the circulation of the texts beyond the realm of the written word, allowing platers in regional workshops and factories to communicate knowledge about the trade to each other despite limited literacy. Versified content was not limited to praise of the trade or to efforts to root it in a cultural context, as was the case in the concluding verses of the *Tuhfah-yi talmī*’ that spoke of the “confounded goldsmith” and the “astonished alchemist.”⁴² Instead, versification was used to explain technical and material practices. The *Jāma ‘yi tarākīb-i talmī*’ (Collection of types of plating), an 1880 manual on electroplating published in Lucknow, was written entirely in

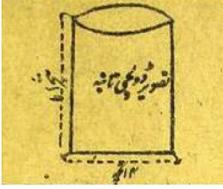


FIGURE 3. A small sketch showing the height and width of a small copper container for electroplating, from Jawaharlal Shaida's *Jāma 'yi tarākīb-i talmī'* (Lucknow: Naval Kishore Press, 1880). (Rekhta)

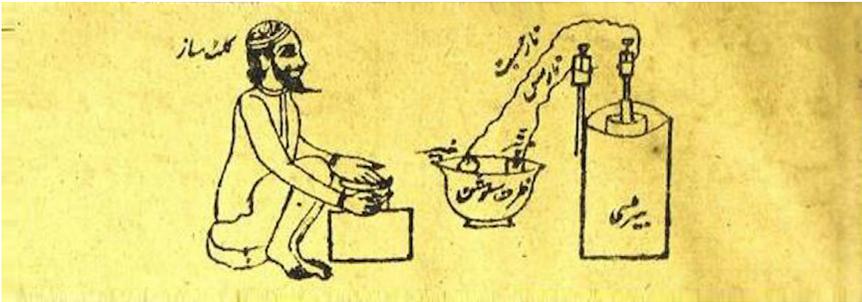


FIGURE 4. A sketch of an electroplater from Jawaharlal Shaida's *Jāma 'yi tarākīb-i talmī'* (Lucknow: Naval Kishore Press, 1880), with labels on the battery and tools for the plating process. (Rekhta)

verse and featured detailed sketches and diagrams. In an early section titled “On How to Make Batteries,” it described how to prepare the copper rods needed to make a copper-zinc battery, framing the verses around a small sketch of the copper vessel (figure 3):

Make this small container from copper
 Form it just like the shape below:
 The diameter should be at least four inches
 And its height should be nine inches, oh dignified one,
 Then make a single flower stem of copper
 But such that each part of this stem is flattened
 And as for its length, oh trustworthy one,
 It must be four inches . . .⁴³

The verses proceed in this manner, offering electroplaters exact dimensions for their batteries, as well as descriptions of how to connect the wires to both the battery and the material to be plated (figure 4).⁴⁴ When the manual was published, a large-scale electroplating industry in Lucknow had yet to be established. According to colonial reports, a small number of workmen regularly used electroplating in the region, primarily to plate cutlery for European demand.⁴⁵ But the publication suggests that despite this lack of a large-scale regional electroplating industry, electroplating manuals increasingly addressed artisans who engaged more directly in metalwork and plating.

SOCIALLY AND RELIGIOUSLY PLURAL AUDIENCES
FOR ELECTROPLATING MANUALS

In addition to its versification, the *Jāma ‘-yi tarākīb-i talmī‘* is notable as the only Urdu electroplating manual of the late nineteenth century—that I have identified so far—that was authored by a non-Muslim. The text was attributed to an author named Jawaharlal, who used the *takhalluṣ* (pen name) Shaida, meaning “lover,” for his poetry and identified himself as a member of the “community of Bhatnagar Kayasthas.”⁴⁶ Like Anwar ‘Ali, Shaida was a government employee, though instead of serving the British Raj he worked for the princely state of Udaipur. And whereas Anwar ‘Ali was a court inspector who had developed an interest in industry and technology as a hobby and marker of social status, Shaida was an employee of the Engineering Department of Udaipur. He notes in his introduction that he “saw a need” for expanded knowledge of electroplating because of his supervision of government technical projects in Udaipur.⁴⁷ Published by the Naval Kishore Press, a prominent Lucknavi press discussed in chapter 1, Shaida’s text was likely intended for a religiously, socially, and economically mixed audience.

Reflecting the social and economic plurality of its intended audience, the text spoke to and for both members of the emerging middle class and metalworkers themselves. The versification of the text suggests that Shaida may have sought to demonstrate a courtly ideal of the poet/state employee, a model of which has been explored extensively in the Mughal context in Rajiv Kinra’s scholarship.⁴⁸ To this end, Shaida sought to demonstrate his command of both industrial knowledge and poetic forms to his own class of state employees and industrial or technical overseers. At the same time, versification reflects the potential for oral circulation of the text among laboring communities. The text’s rhyming verses suggest an effort to make the information easy to memorize and to repeat. Indeed, in his introduction, Shaida claimed that his text provided more details, in a more beautiful and accessible form, than other electroplating texts.⁴⁹

Shaida’s engagement with references to God likewise suggests a broad intended audience, made up not only of people from differing social and class backgrounds but also of readers—or listeners—of different religious identities. The manual opened with “Bismillah hir raḥman nir raḥim,” but this was common practice in texts printed at the Naval Kishore Press in the late nineteenth century that addressed a mixed religious audience. To the extent that its contents referenced God at all, Shaida limited those references to *khudāvand* (the Lord), recognizable terminology across multiple religious communities in South Asia.⁵⁰ This language may have allowed readers of multiple religious communities to read or listen to the text through their own religious imagination. While electroplating was a popular technology through which middle-class Muslim men demonstrated their claims on industrial modernity, efforts to claim modernity and social status through electroplating were not limited to Muslims.

Indeed, although they do not appear to have been as widespread as manuals in Urdu, electroplating manuals in other languages also addressed religiously mixed communities. For instance, a Gujarati manual published in Surat in 1899 titled *Giliṭ nī Copḍī* (Gilding book) made no reference to an intended religious readership, nor did it reference God to explain the revelation or circulation of artisanal skill. Instead, it noted that the text was intended to prevent “injuries.” The author, Nagindas Dayaldas, noted that, as the practice of electroplating had expanded, so too had incorrect practices—particularly in the preparation of the battery—that could physically harm the electroplater.⁵¹ Like Shaida’s text, *Giliṭ nī Copḍī* seems to address a socially and religiously plural audience, but religious language was largely absent from the text. It provided extensive detail on how to manufacture and use batteries for electroplating and on how to “gild and plate” using not only silver and gold but also more common materials such as copper. These detailed descriptions may have been of interest to middle-class hobbyists or aspiring industrialists, but they assumed a high level of physical practice and skill. As such, it is likely that they were written with the intention that they would be read or circulated among artisan metalsmiths in workshops.⁵²

METALWORKING SKILL AND THE EXPANDING AUDIENCES OF ELECTROPLATING MANUALS

Whether we consider Shaida’s *Jāma ‘-yi tarākīb-i talmī‘*, the Gujarati *Giliṭ nī Copḍī*, or post-1880 Urdu electroplating manuals that addressed specifically Muslim audiences, it is apparent that as the audiences of manuals expanded, so too did the skills and practices referenced in the texts. Where texts aimed at an exclusively or primarily middle-class audience in the 1870s celebrated electroplating as a technological breakthrough, manuals from the 1880s portrayed it as a logical extension of work already done by manual platers in India. Increasingly, these texts assumed that platers would build on embodied skill in manual plating when they took up electroplating.

The *Iksīr-i malm ‘ah* (The elixir of plating), printed in Delhi in 1893, was written by Mirza Ibrahim, a practicing artisan electroplater, and primarily addressed metalworkers rather than middle-class hobbyists or aspiring industrialists. It is also notable that it assumed that electroplaters would build on extant skills as manual platers. Many other texts opened with descriptions of how to manufacture a battery for electroplating, but the *Iksīr-i malm ‘ah* began with descriptions of “water plating” and “warm plating, meaning leaf plating.”⁵³ The aim of these brief descriptions was not to teach platers how to carry out these practices—given that were likely already quite familiar to most artisan platers—but to present them as part of a continuum of plating practices.

Following these references to manual plating, the *Iksīr-i malm ‘ah* described electroplating and the manufacture of a battery. Its author praised the skill and

knowledge of the “masters of plating” and noted that “we now know that a battery can also become a master of plating. If [the battery] is made correctly, then the work will be done well.”⁵⁴ And, while earlier texts aimed at members of the middle class focused primarily on plating in precious metals, especially gold and silver, the *Iksir-i malm‘ah* addressed audiences who worked in a wider range of materials. The *Iksir-i malm‘ah* described copper and iron electroplating, emphasizing their importance for artisans who manufactured boxes and trunks, a prominent industry in the cities and towns of North India.⁵⁵ Likewise, it emphasized not only the production of plating but also its repair, a topic that was rarely included in electroplating manuals aimed at middle-class hobbyists but was of central importance for laborers employed in the trade.⁵⁶ For instance, in a section titled “The Deterioration of Plating,” the text advised electroplaters on how to identify mistakes in silver plating that required repair:

Sometimes [the silver plating] will become yellowish, in other cases oily and grease-covered, and sometimes it will become blackish. This is all the result of too much potash, though the blackish color may also be from the battery charge. And if the silver has been plated but its dust comes off the item, this is also a fault. Repair it by placing it in a flame or in acid. You must pay attention to each defect that could cause the work to deteriorate.⁵⁷

The *Iksir-i malm‘ah* assumed that its primary audience—metalworkers with experience in other forms of plating—were sufficiently knowledgeable to evaluate whether to use acid or flame to repair “defects” in their electroplating. In the assumptions that it made about artisans’ technical knowledge as well as its efforts to claim electroplating skill for laboring communities, it is representative of the types of texts that spoke directly to artisan metalworkers, rather than middle-class hobbyists or industrialists. Though written primarily in prose, it used accessible language and extensive diagrams, suggesting it may have been intended to be read aloud, with its images circulated within a workshop.⁵⁸ Its diagrams highlighted multiple potential processes of plating, suggesting that the author expected readers to be familiar with some of the technologies but not all, and to incorporate new knowledge of electroplating into their existing embodied knowledge.

The cover page of the text noted that the author, Mirza Ibrahim, compiled it on the basis of “his own experience” with the trade, emphasizing physical practice rather than command over capital.⁵⁹ Indeed, Mirza Ibrahim decried the fact that most authors of electroplating manuals were not, themselves, working practitioners of metal-plating. He accused these authors of other manuals of simply “writing down what they read in other books,” without practicing the trade. Conversely, he asserted that he had “been working in a shop in the bazaar for ten years and had done all kinds of work by hand.”⁶⁰ And, he explained, “no other author” of an electroplating manual had this type of physical experience, making their texts

potentially even “dangerous” for users, because they did not contain sufficient practical content.⁶¹

On the basis of this explanation of his experience, Mirza Ibrahim identified as a metalworker, though likely a particularly successful, upwardly mobile, and economically prosperous one, a “master artisan” who possessed some capital and may have employed others. He was among a small number of metalsmiths who negotiated the increased industrialization of the urban colonial economy in cities like Delhi, successfully maintaining ownership of a workshop in the bazaar in a context where many metalsmiths had shifted to wage labor. From this position, he spoke explicitly to the “craftsmen of the bazaar,” as well as “the merchants of the age,” asserting authority through—not despite—his status as successful *kārīgar*.⁶²

Despite Mirza Ibrahim’s authorship, the *Iksīr-i malm‘ah* did reflect continued middle-class intervention into the production of manuals, even when they were aimed at artisans. Mirza Ibrahim noted that his publication had received support—presumably funding—from an industrialist and printer named Bulaqi Das. Bulaqi Das owned the Mayūr Press, where the text was printed; he also published a local newspaper.⁶³ Like many of the publishers profiled in chapter 1, Bulaqi Das was invested in educating potential artisan workers for his own lithographic publishing house and may have also owned other industrial workshops in the city. But despite Bulaqi Das’s involvement, the contents of the text make it clear that Mirza Ibrahim intended his text to be read and used by members of regional metalworking communities, not members of the industrial middle class. Indeed, his intended audience was reflected not only through the technical skills that he referenced but also in his cultural and religious framing of the trade, and especially the claiming of “alchemical” pasts for electroplating.

ELECTROPLATING AS ALCHEMY

As I noted in the introduction to this chapter, references to alchemists or *kīmiyāgars* proliferated in electroplating manuals, including the earliest manuals, such as the *Tuḥfah-yi talmī‘*, aimed at middle-class hobbyists and aspiring industrialists. The verses that conclude the *Tuḥfah-yi talmī‘*—referencing the “astonished” alchemists—were printed in 1872 and are the earliest mention of a relationship between *kīmiyā* and electroplating that I have identified. They reflect a trend that expanded in the 1880s and 1890s and was increasingly aimed at artisan metalsmiths, rather than members of the middle class.⁶⁴

The comparison between electroplating and *kīmiyā* is, in several ways, a logical one. Both *kīmiyā* and electroplating suggest the potential transformation of one metal into another and the possibility of turning a base metal into something precious, like gold. However, the use of a language of alchemy for and about

artisan metalsmiths is, in the context of Muslim South Asia, unusual. In the western European context, Bruce Moran has shown that from at least the sixteenth century, some writers and scholars attributed alchemy to artisans and craftsmen, characterizing the work of glassmakers and metalsmiths as alchemy.⁶⁵ Although he notes that the “definition of alchemy was greatly disputed” in late Renaissance Europe, Moran argues that many writers saw “workshop creations” as alchemical projects.⁶⁶

In the South Asian, Indo-Islamic context, scholars and court authors occasionally recognized the relationships between craft and *kīmiyā*. For instance, seventeenth- and eighteenth-century Persian-language descriptions of crafts that circulated in the courts of regional dynasties sometimes characterized glass and metal crafts as *kīmiyā*. One such collection, the *Majmū‘ al-Ṣanā‘i* (Compendium of trades) was first written around 1620 but was copied repeatedly at the Mughal and regional courts throughout the eighteenth century. It included long segments on the transformative practices of metalwork, such as how to “transform iron into copper,” as well as sections on the use of acids to dissolve and plate silver.⁶⁷ It integrated discussions of the “alchemical” properties of metal with a focus on a wide range of crafts such as blade-smithing, enameling, masonry, and even paper-making. An edition of the *Majmū‘at al-ṣanā‘i* was published in 1847 by an early Persian typographic press supported by the colonial state-run Calcutta Madrasa, founded in 1770. The cover page of this published edition framed it as a treatise on the “branches of alchemy and magic” (*kīmiyā-o-hīmiyā*) highlighting the ways that categories of craft were subsumed within an understanding of alchemy.⁶⁸ This was especially true in the nineteenth century, when there was a resurgence of South Asian Muslim scholarly interest in the history of Islamic alchemy and its influence on European sciences.

Moreover, sections of craft compendia and collections that focused on trades and practices most closely associated with alchemy—including the transformation of metals—were sometimes extracted into shorter manuscripts, which were circulated among wider potential audiences, including merchants, as small manuals. For instance, a short ten-page Persian-language treatise on quicksilver (mercury), copied in Mysore in the mid-eighteenth century, explained the process of tinning and the use of mercury to tin other metals effectively.⁶⁹ However, while crafts may have sometimes been understood as alchemical, craftworkers usually were not recognized as alchemists. Text such as the *Majmū‘at al-sanai* are notable in part because there is a distinct absence of craftworkers from the discussions of craft. They functioned as guides to the work done within royal workshops but largely omitted discussions of the workers themselves.

Texts such as the *Iksīr-i malm‘ah* thus marked a departure from earlier writing on both metalwork and alchemy, and not just because they targeted a new, laboring audience. They were also distinctive in content, connecting *kīmiyā* to the physical skill and labor of metalworkers rather than to a generalized courtly or intellectual knowledge of craft. This was not true of the earliest references to

alchemy in electroplating manuals, such as the verses that concluded the *Tuḥfah-yi talmī* in 1872. These references instead reflected a middle-class rediscovery or reassertion of Muslim traditions of alchemy in colonial India. The middle-class rediscovery of alchemy was informed by the interest of prominent Muslim scholars in what they saw as a Muslim scientific golden age and Muslim influence on European scientific ingenuity.⁷⁰ This Muslim middle-class project also connected the two popular meanings of *kīmiyā*—classical alchemy and modern chemistry—by highlighting the degree to which modern European chemistry traditions were indebted to the Islamic alchemical past.⁷¹ But by the time the *Iksīr-i malm 'ah* was published in Delhi in 1893, *kīmiyā* had become an important part of how manuals asserted social status for metalworkers themselves rather than for middle-class hobbyists or industrialists.

The *Iksīr-i malm 'ah* integrated references to the electroplater-as-chemist not only through its evocative titular reference to an “elixir” for plating but throughout its contents. It repeatedly referred to batteries as the “modern elixir” that allowed the electroplater to carry out his work. In its extensive chapter on how to make homemade batteries, the text suggested that what set electroplaters apart from those who were “admirers of the work” was their ability to make and repair batteries to carry out their labor. The modern elixir was thus dependent on the electroplater’s physical skill and labor.⁷²

Moreover, throughout the text, Mirza Ibrahim valorized the physical work of platers and metalsmiths. Writing of the process to plate a small iron box, he claimed that “in the first instance, you may fail and have to repair the work, but you will learn as if at the foot of an *ustād*.”⁷³ By writing of metalsmiths’ engagement with electroplating as complementary to their education in a workshop or apprenticeship, he framed the alchemy of electroplating as the distinct purview of craftsmen or *kārīgars*. Likewise, by highlighting physical skill and repeated practice as the source of the electroplaters’ skill in a kind of alchemy, Mirza Ibrahim suggested that metalsmiths were worthy of social status by virtue of their labor itself. The metalsmith, he argued, should be respected not only for the traits that he might share with the middle class but for his practice of physical labor, the very thing that distinguished him from the middle class.

MOBILITY AND TECHNICAL FLEXIBILITY IN THE WORLD OF THE MUSLIM ELECTROPLATER

The *Iksīr-i malm 'ah*’s language of alchemy suggests the role that the manuals may have played in the social worlds of Muslim metalworkers by the end of the nineteenth century. Engagement with electroplating through manuals like the *Iksīr-i malm 'ah* allowed metalsmiths to assert technological and material skill as well as social positionality as Muslims. Simultaneously, they reflected the movement of ideas, people, and practices between industrialized factories and small artisan-led

“cottage” workshops, spaces of labor that were usually portrayed as fully distinct and divorced from each other in colonial ethnographies.⁷⁴

These ethnographies also sometimes attempted to distinguish between Hindu and Muslim metalworkers, even if they doubted the piety and orthodoxy of both groups. Muslim metalsmiths were depicted as more likely to be urban than their Hindu (or occasionally Sikh) counterparts. As such, colonial industrial reports and ethnographies suggest that Muslims were more likely to work within emerging centers of industrial labor, including both private and state-run factories and the railways. Colonial writing also posed a strict social and technological divide between Muslim metalworkers who labored for wages in industrialized factories and the “traditional, independent artisan” engaged in “cottage labor” in a city or town. G. Worsley, who wrote a monograph on iron and steelwork for government of Punjab in 1908, argued that there were no similarities between a smith “working in his own house, surrounded by his family . . . working [on] made to order” items, and a smith employed in the “modern factory system.”⁷⁵ As Abigail McGowan notes, whether colonial administrators assigned positive or negative attributes to each system differed, with some asserting the “essential opposition between the aesthetic and social glories of Indian craftsmanship and the horrors of Western industry.”⁷⁶ But whether they saw Indian *kārīgars* as inflexible and inert or a source of “aesthetic glory,” they broadly agreed that cottage labor was fully distinct from industrialized manufacturing.

Contrary to this presumed sharp divide, texts such as the *Iksīr-i malm‘ah* reflected the movement of new ideas and practices between the wage laborer of the modern factory or workshop, and the independent or traditional urban metalworker. Unlike Mirza Ibrahim’s self-run, bazaar-based workshop, many of the electroplating workshops in nineteenth-century Delhi were sites of wage labor that until the twentieth century were usually under European oversight. The movement of ideas between these spaces reflected, the persistence of “decentralized” forms of artisanal labor in a period associated globally with proletarianization, and exchange between multiple forms of production.⁷⁷ Indeed, in the introduction of the *Iksīr-i malm‘ah*, Mirza Ibrahim expressed a hope that electroplating would “spread through the shops of the city,” moving beyond the European-run spaces of wage labor to the realm of the independent metalsmith.⁷⁸

Likewise, the *Iksīr-i malm‘ah* contested the common colonial portrayal of the independent artisan as obsessed with guarding irrelevant trade secrets. By portraying the electroplater as “possessing secrets beyond the *kīmiyāgar*,” Mirza Ibrahim suggested that while trade-specific practices—secrets—marked a skilled metalworker, such practices were neither inflexible nor uncirculated.⁷⁹ On the contrary, knowledge of new ideas—“secrets” that circulated textually—seems to have allowed for improved social standing among some Indian Muslim metalsmiths, whether they worked as wage laborers or independent artisans.

ELECTROPLATING AND THE MUSLIM METALSMITHS OF SIALKOT

To understand how the social and religious narratives embedded in electroplating manuals circulated between independent workshops and spaces of wage labor, I analyze the experiences of one specific Muslim metalworking community. Sialkot, in Punjab and a major center for the growth of the electroplating trade in the late nineteenth century, provides an opportunity to read electroplating manuals in context and to consider how workers might have materially engaged with the texts. Sialkot was home to one of the most successful early electroplating factories in the region, a workshop founded in the early 1860s and run by W. Spence. It made surgical tools and other electroplated items. Sialkot remains a prominent center of surgical tools production—and a prominent center of the accompanying electroplating work—producing over 25 percent of the global surgical tool supply.⁸⁰

However, Sialkot is not representative of the growth of electroplating in other cities across India. On the contrary, the practice likely grew more quickly and to a greater level there than in any other city of its size. Home to an urban population of 45,762 in 1881, Sialkot was a midsized provincial city, and as in the case of Meerut, it is somewhat surprising to find a high level of interest in electroplating from the mid-nineteenth century there, rather than in the larger cities of Punjab such as Lahore and Amritsar.⁸¹ At the same time, Sialkot is an especially instructive example because it was home to several well-established and regionally renowned Muslim metalsmithing communities, including groups of *koflgars*, Kashmiri guilders and platers, and *qal'igars*. It is therefore an ideal site to analyze how artisans took up the work of electroplating in the context of both wage labor and family or community-based workshops.

Sialkot's distinct history of metalwork, especially but not limited to weapon-smithing and *koflgari*, allows us to analyze a story of artisan flexibility and mobility. I argue that the reason for the success of early electroplating firms in Sialkot, such as Spence's, was the existence of highly skilled manual platers in the city and its surroundings. More specifically, early electroplating firms in the city relied on the fact that communities of manual platers and other skilled metalworkers had seen their traditional, family trades threatened, entering a period of economic decline or deindustrialization over the past few decades.

THE HISTORIES OF MANUAL PLATING AND DECORATIVE METALWORK IN SIALKOT

Before the rise of the surgical tools industry, the most renowned metalworkers of Sialkot were *koflgars*, those who practiced decorative inlay work or damascening. The *koflgari* industry grew in conjunction with a regional weaponsmithing industry, with *koflgars* often commissioned to damascene swords, daggers, knives,

shields, and other weaponry. Starting from at least the late eighteenth century, Sialkot and the surrounding towns were also known for the manufacture of arms, some of which were commissioned for the military forces of Ranjit Singh, and eventually also for the British East India Company.

Koftgari workers in Sialkot district were often associated with two neighboring villages located about ten kilometers outside of Sialkot city, known as Kotli Loharan East and Kotli Loharan West. According to regional histories, the villages were settled around the time of the region's conquest by Mughal emperor Babur in 1525, and some local metalworkers asserted that their ancestors were weapon-smiths for the Mughal military forces. The origins of the names are unclear, but with the inclusion of the term *lohār*, the villages were clearly evocative of metalwork. An 1877 Urdu-language history and geographical guide to Punjab explained that "in Kotli Loharan there are numerous shops of *lohārān* [blacksmiths], in which the craftsmanship is greatly respected and quite famous . . . [and] they forge the most wondrous items from *lohā* [iron]."⁸²

The decline of Sialkot's weaponsmithing and *koftgari* industries and the rise of its surgical tools industry were broadly inverse processes and were intricately connected. In 1849, with the end of the second Anglo-Sikh war and the British annexation of Punjab, British officials pursued a policy of disarmament, restricting the sale and carrying of weapons.⁸³ This policy was further strengthened in 1878, when the Government of India imposed the Indian Arms Act. The act created a licensing system for both the ownership and the manufacture of weapons, although there were several exemptions in Punjab, including one that allowed Sikhs to buy *kirpāns*, daggers worn as an article of faith.⁸⁴ Combined with competition from European-made weapons, the act marked a moment of crisis for many independent North Indian weaponsmiths, including those in Sialkot and Kotli Loharan.

Koftgars, of course, were able to damascene items other than blades, swords, guns, and shields, and they did so, inlaying plates and cups, pandans, inkwells, locks, hookahs, and jugs, among a wide variety of other objects, some of which were sold abroad. But throughout the second half of the nineteenth century, they faced uneven and unstable demand and struggled to make inroads into rapidly evolving local and foreign consumer markets. Nita Kumar describes the uneven consumer market in colonial India as one that upended economic security for artisans, even among those whose industries did not experience an overall decline in output or demand.⁸⁵ Instead, artisans struggled to predict the radically shifting patterns of both local and foreign demand on a month-to-month or year-to-year basis. In the case of Sialkot, the decline of the local arms market drove down demand for the more intricate and expensive forms of *koftgarī*, and *koftgars* found that they could not consistently make a living from unpredictable foreign demand for *koftgarī* trinkets. This drove debt and pushed some *koftgars* out of the trade.

THE TRANSITION TO SURGICAL TOOLS
MANUFACTURE AND ELECTROPLATING

Spence and the other early founders of surgical tools workshops in Sialkot depended on the labor of artisans who were already skilled in other forms of metalwork, including manual metal-plating, and could easily transition to surgical tools manufacture and electroplating. Sialkoti surgical tools were known for their high quality of work from the industry's inception. Sialkoti-manufactured surgical tools won all three of the prizes offered for surgical instruments during the 1864 Punjab Exhibition of Arts and Industries. The instruments from Sialkot included "bleeding lancets," "lithotomy instruments," "midwifery instruments," and "instruments for extracting teeth," all of which were praised by the exhibition judges.⁸⁶ Surgical tools manufacture meant a rise in demand for laborers skilled in silver, copper, tin, and eventually nickel plating—which prevented rust on iron instruments.

Koftgars who had been displaced from their familial trade—or who found it impossible to sustain livelihoods solely through *koftgari*—were in high demand at surgical tools workshops. So too were Kashmiri gilders, platers, and other metalsmiths. This was especially true after 1878–79, when an India-wide famine hit the Kashmiri capital of Srinagar particularly hard, increasing Kashmiri artisan migration to the cities of Punjab.⁸⁷ Sialkot was the closest sizable Punjabi city to the border with the princely state of Jammu and Kashmir, and had a well-established Kashmiri Mohalla, which attracted migrant Kashmiris throughout the late nineteenth century. While the largest artisan group of migrant Kashmiris in Sialkot were carpet weavers and textile workers, metalsmithing and papermaking were also prominent professions among the migrants. As noted in the discussion of manual platers in the "Histories of (Electro)-Plating" section, Kashmiri metalsmiths in Punjab cultivated a reputation for high-quality silver plating and gilding, as well as jewelry making.⁸⁸ The owners and managers of surgical instruments factories were eager to recruit skilled Kashmiri platers and gilders throughout the last decades of the nineteenth century. Surgical tools factories competed with the railway workshops of the city, as well as some of the city's sporting goods factories, both of which also sought to recruit skilled Kashmiri metalworkers as blacksmiths, boilermakers, and mechanics.⁸⁹

While the earliest surgical instruments workshops that employed artisan metalsmiths as wage laborers were European run, Punjabi capitalists—whether Hindu, Muslim, or Sikh—entered the trade from the 1880s. By the 1910s two of the most prominent surgical tools factories in the city were those owned by S. S. Uberoi and A. F. Ahmad, two local capitalists who also employed workmen to make scissors and cutlery.⁹⁰ The company of the latter remains a manufacturer in Sialkot, while the family of the former, who also owned sporting goods factories, migrated to India after Partition and re-formed their company in Jalandhar.⁹¹ Though

both were founded before the First World War, these firms expanded exponentially during the conflict, in part because of restrictions placed on imports from Germany that had previously supplied many of the surgical tools used in India.⁹²

KĀRĪGAR MOBILITIES

Colonial industrial monographs repeatedly asserted that there was no relationship between modern industrialized factories, like those that manufactured surgical instruments, and “traditional” workshops, such as those of Kotli Loharan’s *koftgars* or the metal-platers of the Kashmiri Mohalla. The two spaces of production were, in this understanding, completely distinct sectors of the economy, and the skills used by *kārīgars* within them likewise differed markedly. But reading electroplating manuals alongside records of metalworking and metal-plating production in Sialkot shows that this difference was overstated. It hid the mobility of artisans between small family-owned workshops and capitalist-run forms of wage labor. Equally, it obscured the degree to which artisan understandings of the Muslim past—as represented in texts such as the electroplating manuals—circulated across both spaces of work.

The *koftgars* of Kotli Loharan and the metal-platers and gilders of Sialkot’s Kashmiri Mohalla saw their familial trades threatened by European imports and regulations on production, including limitations on weapons manufacture. But despite British prognostications of imminent decline and displacement in the late nineteenth century, some members of these trades maintained and even expanded their workshops. For instance, Kotli Loharan developed a reputation for artisanal wealth in the wake of the First World War, as many of the *koftgars* and other metalsmiths had been recruited to work as “armorers and shoeing-smiths during the War” and returned home with the funds necessary to expand their workshops.⁹³ Even before the First World War, smiths in Kotli Loharan sometimes took on temporary, seasonal wage labor and piecework for surgical tools and other factories to buttress their earnings and support the maintenance or expansion of their workshops. Likewise, members of a single family may have had members who chose to maintain a home-based workshop while others left to work on the factories and larger workshops of the city. Reports of child labor in the surgical instruments industry—an issue that plagues the trade today and has led to international condemnation—appeared as early as 1919, suggesting that some smiths may have sent their sons to work for wages, rather than apprenticing them.⁹⁴

Accepting colonial administrators’ insistence that “modern” factories that relied on wage labor and “traditional” urban workshops were technologically and materially worlds apart would mean accepting that artisans never incorporated practices from one workspace into another. It would mean accepting that members of the same family, skilled in ostensibly the same trade, never discussed or compared their work among themselves and that they did not learn from or

model their skills for each other. This seems unlikely. Moreover, the administrators' writing contradicted the way that the circulation of knowledge among metalworkers was portrayed in vernacular texts such as the *Iksir-i malm 'ah*.

ELECTROPLATING MANUALS AND ARTISAN FLEXIBILITY IN SIALKOT

Electroplating manuals such as the *Iksir-i malm 'ah* spoke to audiences of metalworkers who were familiar with, and may have moved between, different sites of production. Mirza Ibrahim, with his emphasis on physical practice and the growth of electroplating within the "shops of the bazaar," clearly assumed that electroplating was just as relevant for a small, artisan-run workshop as for a larger factory or capitalist-owned firm. Texts such as the *Iksir-i malm 'ah* were written with the assumption that they would be relevant for artisans whether they led their own small workshop, worked for wages in a larger factory, or labored in some combination of those two. They assumed—and promoted—the circulation of narratives about artisans' religious identities and claims on social status across multiple different sites and forms of production.

While the *Iksir-i malm 'ah* itself may or may not have circulated within Sialkot in the late nineteenth century, other manuals on electroplating almost certainly did. How might these manuals have been used to support artisans' claims on social status and Muslim pasts for their trades? As scholars including Khalid Nadvi have noted, one way that metalworkers in Sialkot and the surrounding region sought social mobility was by asserting a *sharif*, "Mughal" lineage. This referred to descent from the Central Asians who had accompanied the early Mughal emperors into India in the sixteenth and seventeenth centuries or had migrated later to seek service with the Mughal court.⁹⁵ This was an important and popular strategy in the context of Kotli Loharan, because regional histories held that the town was founded under the Mughal emperor Babur and that its residents had been weaponsmiths for the court.⁹⁶ Asserting a connection to alchemy, with its courtly histories and connotations, may have buttressed this claim, supporting metal-smiths' access to social privileges usually associated with elite or genteel classes of Muslims, the *ashraf*.

The potential use of electroplating manuals to support social identities rooted in the Muslim past extended beyond efforts to claim a *sharif* familial lineage and modes of behavior associated with the Muslim elite. Beyond circulating knowledge about new technologies between different sites of labor and production, electroplating manuals contributed to a shared sense of community identification with specific technical skills. The manuals provided artisan metalworkers with access to shared narratives that centered their physical skill and material flexibility, while also asserting their social status and prestige as Muslims through claims on an Islamic tradition of alchemy.

Electroplating manuals and their narratives of technological flexibility and alchemical artisanship did not displace other forms of artisan engagement with Islam within communities such as the metalsmiths of Sialkot and Kotli Loharan. Unlike the earliest electroplating manuals aimed at members of the middle class, which positioned electroplating as a radical break from earlier practices of metalwork, manuals like the *Iksir-i malm 'ah* positioned it as part of a continuum that included traditions of manual plating. The assertion of electroplating as part of a longer tradition of artisan physical practices may have allowed metalworkers to position it within their own, often localized, religious traditions, practices, and community engagement with Islam.

The dramatic increase in the publication of electroplating manuals declined after the first decade of the twentieth century. As the practice became more widespread, demand for manuals that explained it decreased. In both small-scale, artisan-led workshops and in centers of industrial wage labor, artisans likely incorporated electroplating into their embodied skills and their modes of oral education.⁹⁷ This incorporation of electroplating into a wider body of skills may have drawn on knowledge that had previously circulated in both oral and written form through electroplating manuals. As electroplating became part of day-to-day practice in several centers of metalwork, artisan engagement with printed texts that positioned electroplating as a mark of social distinction declined. In Sialkot and Kotli Loharan knowledge of electroplating and its relationship with an alchemical past were likely subsumed within other narratives that circulated among artisan metalworkers.

. . .

The puzzle of the popular publication of electroplating manuals in colonial North India suggests that to understand how technologies of industrial production circulated and were interpreted, we must consider the class and social hierarchies within which they were embedded. Urdu texts on electroplating were important not just because they explained a new technology in a context of industrial change. They were also used to assert social status. For members of the Muslim middle class, electroplating manuals demonstrated their values of industriousness and command over capital. But as the manuals became more accessible and addressed—and were written by—artisan metalsmiths, they challenged the artisans' social marginalization. Manuals increasingly emphasized artisans' adaptability and relationship with new technologies and valorized their physical skills.

Even if large numbers of Indian metalsmiths did not practice electroplating until at least the early twentieth century, this imaginary extended beyond the realm of a single technical practice. Electroplating manuals became popular because they offered workers a model of social standing within the hierarchies of North Indian Muslim society. They allowed artisans to assert community identities that commanded prestige within colonial North India but that also reached beyond the adoption of middle-class norms and narratives. These manuals

positioned electroplating as an extension of regional traditions related to both metal-plating and the Muslim identities of metal-platers. In valorizing the physical skill and practice of metalwork, they argued that what made artisans distinct from the middle classes—their physical labor—also made them deserving of prestige within Muslim communities.

Ultimately, the story of the electroplating manuals of the late nineteenth and early twentieth centuries is a story of the “subversion, contamination, and reorganization” of a technological practice.⁹⁸ But unlike other stories of reinterpretation and meaning making for science and technology in the colonized world, it is not just one in which members of a local elite subverted colonial claims on scientific knowledge. Instead, it is a story of how Muslim artisans subverted elite and middle-class Muslim claims on a new technology. Through electroplating manuals, Muslim artisans asserted new claims on the Muslim past that challenged their economic or social marginalization while simultaneously integrating a new technology into long-standing traditions about their work. In chapters 3 and 4, I retain this focus on how Muslim artisans claimed their trades and technologies as pious and Islamic. I turn to the circulation of these narratives, first through the printing of community histories, and second through artisan migration to growing regional metropolises.