News from Samarqand:
Islamic Papermaking

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> *…Indian paper is angry with Chinese paper and has informed Wasit about Byzantium and Zanzibar. Sometimes it manifests itself from the land of Cathay, and sometimes it brings news from Samarqand.*[1]

Introduction

In his amusing book about bookshelves, Henry Petrovski observes, "that for all the attention even the most observant of us pays to useful things, we all but ignore the infrastructure upon which they rest." It was the same with my research about Islamic books and papermaking. There are many books discussing the art of the book in Islamic countries, however only few of them notice the "infrastructure" – paper - upon which all arts of the book were built. In all the fascination with the colors and beauty of calligraphy, illumination, paintings and bookbindings most art historians overlook the paper itself.

All historians would agree that Islamic civilization completely relied on paper as its writing material. Nevertheless, very little is known about papermaking and papermakers in *Dar-al-Islam*. And much of what we do know today about Islamic papermaking was established in the second part of the 19th century. The curator of the Erzherzog Rainer Papyrus Collection, Joseph von Karabacek, published in 1887 a crucial article *Das Arabische Papier* [Karabacek vii] reviewing the known facts and clearing up many misconceptions about Islamic paper and papermaking. Yet despite developments in forensic science, research, and the globalization of knowledge, his article is still the main source of information quoted by almost all Western authors discussing the subject. Where von Karabacek speculated and guessed, we still have no more specific information, especially about the process of maceration of fibers, development of the papermaker's mold or the pressing process.

[1] 'Abdi Bik Shirazi (Navidi) 10th/16th ct. [Afshar 82-83].

Owning to the support of the government, the papermaking tradition of the Indian subcontinent is well researched and documented, and through that it is possible, by the process of historical analogy, to draw certain conclusions. Most of the papermakers in northern Pakistan, and especially in Kashmir are of Muslim descent bearing a distinct surname (*kagzi*) and attribute their origin to coming of the Mughal dynasty (1526-1761) [Soteriou 38ff]. Although valuable, this information relates to the late development in Islamic papermaking and does not fill the gaps in knowledge about the early development of papermaking in *Dar-al-Islam*.

One of the biggest unknowns is the social organization and position of the papermakers in Islamic society; how they worked, where they worked, how they sold their products, and how they collected their raw material. Most of the conclusions about that subject are circumstantial evidence and use the logic of Sherlock Holmes: "Why didn't the dog bark?" How could a whole civilization, to paraphrase Petrovski, fail to notice the "infrastructure upon which [it] rests"? How come all the artists, *ulama'* and *udaba'* who spent their lives writing and creating on paper, spared no thought for papermakers and the papermaking process? It is almost unbelievable that an industry of such importance left behind so few traces of its existence. Only one original source is known that briefly describe the preparation of the pulp and making of paper.[2] There are sentences here and there about the beauty of Samarqand paper, passing observations that there is an abundance of paper in Cairo, but no sources stopped to look at papermakers at work or deemed them important to write about.

After the introduction of European paper in the 13th century, and especially with the introduction of the papermaking machine at the beginning of the 19th century, all knowledge about the hand making of paper was slowly forgotten. Today there are but few regions where even the memory of the papermaking exists. If not for the casual observations, the poetry and the mountain of manuscripts, Islamic papermaking would be considered a myth.

[2] Ibn Badis. 'Umdat al-Kittab wa 'Uddat Dhawi al-Albab. 11th century Maghribi artisan.

Lovely and precious is this material,
Luxury but at a small price …[3]

Making paper is a very simple process. One need only to take some plant fibers, macerate them into a pulp, suspend them in the water, catch these suspended fibers onto a screen, and dry them. The result is a sheet of paper, material suitable for wrapping, writing, printing … However, making really good paper; a paper light and strong at the same time, smooth and even, to last centuries that requires the experience of generations.

The birthplace of paper is China during the Han dynasty (206 BC – 220 CE) [Needham 38]. The Chinese were in search for the appropriate writing surface for some time. They had a long tradition of writing that could be traced all the way to the Shang dynasty (1766-1122 BC) and their divination rituals. During the following centuries they experimented with different materials. For a while, they used split bamboo strips tying them together to make a book. Such material was cheap and easily accessible. Its narrow vertical surface influenced the custom of writing in vertical rather than horizontal lines across the page. However, long passages or books tended to become rather bulky affairs.

The development of silk production offered the possibility of light, smooth and workable surface, especially suitable for calligraphy and painting with brush and ink. The problem with silk, however, was that it was a luxury product under strict imperial control and with a complex production process. After unification of the Chinese empire under the short but pivotal Ch'in dynasty (221-206 BC), during which Chinese writing was standardized, the need for something light and cheap become urgent.

The first papers, according to available archeological findings, were made from various materials – hemp, refuse of silk industry or fishing nets. The first noticeable improvement in papermaking was accomplished by Cai Lun (d. 121 CE) in approximately 105 CE. He reported his invention to the emperor, detailing the material for making paper. The official history observed that "From this time [paper] has been in use everywhere and is universally called 'the paper of Marquis Cai'" [Needham 40].

Through the centuries, Chinese papermakers kept experimenting with fibers, as were locally available, developing different processes and quality of papers. With time

[3] From poem Chih Fu (On Paper) by Fu Hsien (239 – 293 CE) as translated in Tsuen-Hsuin p. 365.

bamboo [Needham 59] and paper mulberry (*Brussonetia papyrifera*)[4] become two most commonly used fibers. However, Chinese and later Korean, as well as Japanese papermakers never settled for a single fiber as raw material in papermaking.[5] In their search they also developed the wide range of the specialized papers – thin but strong paper for door covers in Japan, thick and durable paper for floor covering in Korea, soft and silky paper for woodblock printing. This variety of papers was used by all levels of society. The peasants wore oilpaper capes to protect them from rain, while scholars indulged in the pleasures of toilet paper. Not only master papermakers, but also whole villages were required to satisfy the needs of imperial workshops [Needham 48]. The wide range of paper application in Chinese culture, as well as in countries under Chinese cultural influence, created a diverse and vibrant paper market which encouraged the stratification of papermakers – from masters artisans producing papers for imperial purposes and foreign trade, down to village papermakers producing paper in their spare time for the local market.

Besides fibers, Chinese papermakers worked on developing a more efficient papermaking mold. With the original mold design – fabric stretched on a wooden frame – sheets were formed by pouring appropriate amounts into the mold which floated in water (hence "floating mold"); spreading the pulp and than carefully lifting the mold with pulp in it out of the water. This method makes any hole in the ground a papermakers vat, only needed small amount of water, and did not require real mastery to produce a number of sheets of equal thickness. The wet sheet would be left to dry in the mold, and fibers sticking to the edges (deckle) of the frame would hold the paper in place and prevent sheets from cockling. The treated fibers (usually boiled with soda ash or lime) were macerated in stone pestle or stamped. This mold design and technique of papermaking is still used by Tibetan, Nepalese and Uygur papermakers today.

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[4] Mulberry have three varieties: white mulberry (*Morus alba*) which leafs are food for the silkworm; red mulberry (*Morus rubra*) whose fruit are used for human food; and paper mulberry (*Brussonetia papyrifera*) whose inner bark is used for the papermaking.

[5] Chinese papermakers tried their hand on practically anything growing in their surroundings. Almost all plants with long and strong fibers were experimented with: hemp, jute, rattan, ramie, wheat and rice straw, blue sandalwood, hibiscus bark, seaweed. In Japan, besides paper mulberry, papermakers most often use bast fibers of mitsumata (*Edgeworthia papyrifera*) and gampi (*Diplomorpha sikokiana*) plants which grow as small bushes.

The main disadvantage of this design was the large number of molds that were required, which were to be reused only when a newly formed sheet was completely dry. Chinese papermakers designed a mold with a flexible screen that could be lifted of the frame. The wet sheet could be dispensed from it without damage. This screen was made of finely split bamboo strips or grass tied together by string or silk tread and it was pressed to the wooden frame with two (deckle) sticks. Sheets would be piled one on top of the other and one mold could be used again. This new method greatly increased productivity, and additional pressing of the paper to squeeze water from the sheets improved the strength of paper. After pressing, still wet sheets were strong enough to be pasted on the wooden boards or plastered walls to dry. The Japanese and Indian papermakers still use this method of drying their papers, sometimes using the same boards that were been used for generations.

China, Korea and Japan each developed paper and papermaking techniques that best suited their cultural needs, choosing one fiber over another, changing the mold design. The invention of woodblock printing sometime in the 8th century increased demand for paper even further. The Buddhist religious notion that one's life merit increased proportionally with repetition of devotional acts was one of driving forces in the development and spread of block printing. As acts of devotion, wealthy patrons, merchants and common people donated to the monasteries (*sangha* communities) and temples statues, paintings and copies of religious writings – in prodigious numbers. The most famous Dunhuang Buddhist community – known also as "caves of thousand Buddha" – was bestowed not only with thousands and thousands sculptures of Buddha, but tens of thousand books of religious writings.

In the 8th century papermaking, after slowly spreading westwards through the deserts and steppes of western China, finally entered central Asia and Islamic cultural territory.

The battle on the border

In the 7th century the Chinese and Islamic cultures met in deep valleys of the Altai and Pymir mountains. The high mountains make good neighbors, and the Chinese Empire and Islamic rulers preferred trade to violent warfare. However, occasionally their forces clashed and in one of this battles, initiated mostly by bad diplomacy and prodigiously chaotic local politics, victorious Muslim forces captured a number of the Chinese soldiers, some of them, accidentally, experienced papermakers [Karabacek 18]. The year of the battle was 751 CE and winner for the Muslims was Ziyad ibn Salih, governor of the Samarqand. He organized first papermaking production in his city and Chinese papermakers-prisoners taught local craftsman the new craft.

Or so the story goes. The story is still debated[6] [Karabacek 14-18, Bloom 42-43], but it is a historical fact that approximately from that time on, Samarqand became a city known for its papermaking industry, matching in quality the Chinese one [Afshar 80]. Paper as a writing surface was probably known and used in this area much earlier, but it is unclear if it was produced locally or imported from China. [Bloom 43].

In the next forty years, by the 793 CE paper mills opened in Baghdad under patronage of Harun-al-Rashid (ca. 766-809). With this royal support papermaking took off and completely replaced papyrus and parchment, until then the dominant writing surfaces. One of the advantages of paper, which state administration immediately took to liking, was that ink soaked into the paper and could not be easily scratched off as from parchment or papyrus. The newly forming Islamic culture that started to take its distinct shape during Abbasid period readily embraced the opportunity offered by paper.

[6] The archeological research in this area, after rampage of the Westerners at the first half of the 20th century, is seriously limited by political tug-a-war and political turf fighting. What is known from early archeological findings in Loulan and Dunhuang, the outpost on the outer edges of Chinese Empire, paper was used by Central Asian traders as early as in 3rd century CE [Needham 296]. In ruins of Loulan, then important military and trading outpost on the Silk Road, archeologists find fragments of letters written on paper in Soghdian and addressed to the merchant in Samarqand. It makes sense that paper would find its way down the Silk Road as many of the Chinese products before. However, besides the local needs of merchants and military commanders [Hopkirk 153], there was not big demand for paper among nomads on the western side of the mountains. For a while, the production of parchment, birch bark and imports of papyrus from Egypt could satisfy the demand for writing surfaces.

Culture of the book

The period from 8th until 11th century was the time of formation, consolidation and growth of Islamic civilization. Beside architecture, one of the most noticeable characteristics of new culture was the development of book production. The introduction of paper provided the means, and the cultures encompassed in *Dar-al-Islam* provided the human potential. Possibilities of peaceful travel through the vast geographical area that stretched from shores of the Atlantic Ocean to the high mountains of the Himalayas provided a necessary flow of the ideas and knowledge, trade and wealth. The religious requirement of the *Hajj* – pilgrimage to the Mecca – encouraged travel and the quest for religious learning. Knowledge of writing was encouraged, especially as a part of a religious learning, and the literacy rate among middle and upper classes was high. Islamic culture was definitely a culture that highly valued books and book arts.

The royal palaces, especially after the 11th century in Persia, often had specialized workshops producing manuscripts exclusively for royal patrons. The crafts of the calligraphy, illuminating, bookbinding and especially miniature painting were highly valued and collected. Famous painters and calligraphers signed their work and were well-respected members of the society. And although paper was produced throughout *Dar-al-Islam*, paper use was limited only to manuscript production. There were no oiled capes for the peasants, prayer flags for the religious ceremonies, no kites for the peasant children. While Chinese civilization could be defined as a paper culture, where paper find its uses in all social groups; in Islamic civilization paper never found such wide application and its consumption stayed limited to the literate class and state administration.

Barbarians at the Gate

Nevertheless, papermaking was a widespread activity throughout the *Dar-al-Islam* driven by the high demand for paper. In 11th century Cairo paper was so abundant that merchants readily provided paper wrapping to the customers, very much like plastic

bags today [Laufer 17]. There are no records complaining about shortages of paper. Wealthy merchants and scholars collected books for their reference or just the appearance of sophistication. This flourishing culture was interrupted in the 11th century by the invasions of the Turkic tribes from the central Asian steppes.

These nomadic tribes newly converted to Islam imposed strict Sunni orthodoxy on the fluid and intellectually tolerant Arab and Persian Islamic environment. Although the controversy between the Sunni and Shi'ia sects under the Seljuk and later Mamluk were rather political than theological, it had far reaching consequences. In Egypt the intellectually liberal Fatimid dynasty was replaced by the military elite of the Mamluks (1250-1517) which preferred the libraries under the auspices of religious schools and *waqfs* where books were selected by *ulama'* rather than scholars. Although Mamluks were the great patrons of religious art, it is the opinion of many that this was a period of scientific and intellectual stagnation.

Besides this, during the 13th century, the whole *Dar-al-Islam* was severely shaken by the devastations of the Mongol invasion. Baghdad was leveled in 1258, never to recover. The books from the libraries of caliph's court, private scholars and universities were thrown into the Tigris River to form "a bridge that would support a man on horseback" [Johnson 91]. Although the decorative arts of the book would soon recover under the Ilkhanide and Timurid dynasties, the cultural devastation was immense.

This political instability reflected also in the quality of paper, particularly in the western part of *Dar-al-Islam* [Loveday 26]. Paper used for the manuscripts from the 13th century on become thicker and softer (like blotting paper), uneven, pulp badly beaten and with numerous impurities. In addition, around the year 1276, paper mills of Fabriano and other Italian towns started independent paper production flooding the markets of the Eastern Mediterranean with a new type of paper. In 13th century Europe was still a cultural backwater and parchment production could satisfy local need for writing surface. Italian papermakers and merchants very quickly learned to produce paper tailored to the needs of the Islamic market: watermarks with Christian connotations were replaced with neutral symbols, snowy white cotton paper was tinted to creamy and peachy colors preferred by Islamic calligraphers. Although the technological superiority of Italian paper production is an open question, there are no doubts that Italian papermakers and

merchants managed to completely overtake the Mediterranean paper market and undercut local Islamic production.

In Central Asia and the Khorasan area, new rulers embraced the literary tradition of the Persian *shahnama* genre and revived literary production. The territory ruled by Mongol and Turkic dynasties was closely connected by cultural or political ties to the Chinese Mongol Yuan dynasty (1206-1368). This connection enriched the Islamic art of Central Asia with new energy. Influenced by the Chinese tradition, paper industry emerged once again in old glory and the city of Samarqand once again became the leading papermaking center, producing delicate paper, very much like Chinese one. Although in the time of the Safavid dynasty (1502-1736), the arts of the book and miniature paintings on paper reached high level of sophistication and beauty, and many cities of the Persian plateau formed their own distinct school of painting and book illustration, this production was carried in the *kitabhana* workshops of royal palaces. The time of scientific research, scholarly debate and international trade was over and paper consumption was increasingly limited to upper social classes. Block printing of books or paper money, that gave Chinese papermaking the new outlet of the production, never overcame the resistance of the scribes and *ulama'*.

Rags make paper … Beggars make rags.[7]

While adopting papermaking technology from China, Islamic papermakers made necessary local adaptations. Their fiber of choice was almost exclusively flax and hemp, used linen rags and cordage. Over the next 500 years they never commercially used any other fiber. The usage of macerated linen rags was distinctly an Islamic addition to paper technology [Karabacek 23-24] however; this raw material involved a problem with the logistics of supply. In Europe it required the cooperation of the whole society encouraged by the government orders to collect enough rags for paper production [Rudin 39, Clapperton 18].

How exactly Islamic papermakers collected an adequate supply of the rags is unclear. In Egypt, mummies were striped off their wrappings for that purpose [Karabacek

[7] Author unknown, circa 18th century. Opening epigraph in Dard Hunter's *Papermaking* …

30], and many sources mentioned papermaking associated with big population centers like Aleppo, Damascus or Samarqand. Often sources associate textile centers and papermaking without directly explaining how they were connected. The big towns were natural sources of used rags, and flax grown for textiles was used in papermaking as well. While the question of the fibers and paper molds are easily solved with help of the microscope, technology of the pulp preparation and fiber maceration is more difficult to detect.

Particularly at the point of maceration (pulping) of fibers, information about Islamic papermaking technology is contradictory and often subject to cultural bias. Economic historian David S. Landers echoes the belief of many in the statement that:

> Paper, which was manufactured by hand and foot for a thousand years or so following its invention by the Chinese and adoption by the Arabs, was manufactured mechanically as soon as it reached medieval Europe in the thirteenth century … Paper had traveled nearly halfway around the world, but no culture or civilization on its route had tried to mechanize its manufacture. [Landers 46]

Historians, especially those dealing with paper history, are not so sure about that. Dard Hunter [140], Jonathan Bloom [53, 76] and Pedersen [64] point to the original Islamic sources mentioning paper mills situated by the rivers in Baghdad, Cairo and Fez. Jean Gimpel in his book about industrial revolution of the Middle Ages state that “the first paper mills to be driven by waterpower were those of Xativa, near Valencia in Spain, mentioned in documents of 1238 and 1273” [Gimpel 14]. However, it is not clear whether the fibers were pulped by grinding it between grindstones or stamped by the trip-hammers.

Dard Hunter [139 ff] assumed that collected rags were processed much the same as in Europe. This was a rather unsightly process and presumably confined to the furthest outskirts of the town. In the book about the manufacturing of the papers used by the painter Turner, Peter Bower provides a following recipe for fermenting cotton rags:

> The (linen and cotton) rags being sorted, are put into a large stone vat, … water is poured on them to the top during ten days, and eight or ten times every day without stirring them. They are afterwards left to rest, the same number of days,

> and sometimes more or less, without pouring water on them. Then being turned over, the center is brought to the surface, to facilitate the fermentation; and after being turned again, they are still left fifteen or twenty days in fermentation, so that the rotting may last five or six weeks; the term is not fixed, but when the heat becomes so great, that the hand, thrust in, cannot endure it above some seconds, it is judged that it is time to stop it … When champignons grew on the heaps of rags, it is reckoned to be a sign of their being well rotted. [18]

That must have a significant social implication to the papermaking craft, and could explain why papermakers were not included in the royal book producing workshops. Besides being associated with rotting heaps of rags and similarly rotting heaps of raw flax, in Islamic society manual labor, associated with slave and female work had distinct social stigma attached to it. The crafts requiring intensive manual labor, refuse collecting and similar occupations were despised, and the groups involved in them were considered unclean [Lapidus 268]. That may explain the absence of sources about the papermaking industry regardless of its importance to the upper classes of the society.

The particular structure of paper consumption in Islamic society was probably the undoing of the paper industry in the long run. While in China paper involved the whole society, private and religious components of the culture, in Islamic countries consumption of paper was limited to the state and literate class. Besides merchants who used paper for wrapping and packaging their merchandise, paper was used exclusively for manuscript production and administrative purposes. That generally required medium quality paper, with heavy emphasis on quantity rather than quality.

Traditionally the writing tool used by Islamic scribes and calligraphers – the reed pen – required paper that was cured to allow smooth movement of the tip across the surface. For that purpose Islamic paper was polished and than sized with starch paste. Often polishing and sizing would cover many of the technological deficiencies [Loveday 47]. More often than not sizing was done by calligraphers themselves allowing them to control quality of the surface they would write or paint on. In that way designers of manuscripts could tint the paper to a desirable color, add golden sparkles or glue sheets together to achieve a desirable thickness of paper. The calligraphers or painters who

wanted the top quality paper, usually for the execution of the royal orders, there was always available imported Chinese paper [Bloom 70].

Besides the low social status of the Islamic papermakers, which excluded them from royal patronage and support in the way bookbinding had, there were no economical incentives to develop technology beyond a certain point. The paper market required medium quality paper and did not fuss much about details. Visual appearance was more important than technical quality of paper, and desirable color or surface was added later in the process mostly by the consumers themselves. There were no pressures that would spark development of the papermaking industry in the way Chinese or Japanese society forced their papermakers into diversification, specialized products, and development of technology.

Without state patronage as with other arts of the book, under strong competition on the top end of the market from Chinese production, and undercut by Italian papermakers by quality and fashion, Islamic papermaking industry become more and more diminished in quality and size. For a while, the craft survived in remote and isolated area away from big trading centers. The extinction of the craft was so complete that Hans E. Wulff in his encyclopedia of the traditional crafts of Persia explains to the readers that "papermaking as a craft has been omitted because no paper has been manufactured in Persia for more than one hundred years." [236]

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