CHAPTER 2
Thus, paper was used for government documents and diplomas. Afterwards, people used paper in sheets for government and scholarly writings, and the manufacture [of paper] reached a considerable degree of excellence. —Ibn Khaldun, The Muqaddimah

The unification of West Asia under Islam in the eighth century meant that once Muslims encountered paper in Central Asia, its use spread rapidly across Iran, Iraq, Syria, Egypt, and North Africa to Spain. For papermaking to travel from its place of origin—China—to Samarkand, in Central Asia, had taken about five centuries, but a mere two centuries after Muslims encountered paper in Central Asia they were using it in Spain, on the Atlantic fringe of Eurasia. Just as the swift spread of Islam in the seventh century was unprecedented in human history, so the introduction of paper and papermaking across the Islamic lands in the ninth and tenth centuries was a remarkable historical and technological achievement that transformed society in its wake.

Before Islam, paper was entirely unknown to the empires of Sasanian Iran and Byzantium, which stood at the western termini of the Silk Road. Iranians are said to have copied the Avesta, the sacred book of Zoroastrianism (the main religion of pre-Islamic Iran), on twelve thousand skins. Paper was also unknown in early seventh-century Arabia, to judge from the evidence of the Koran and the biographies of the prophet Muhammad; no word for it appears in either source. When the Arabs eventually encountered paper in eighth-century Central Asia, they called it kaghad (sometimes kaghid or kaghadh), borrowing the Persian word kaghaz, itself derived from the Soghdian kyqygh. All these words, as well as the Uighur word for paper, kagda or kagda, are phonetically derived from the Chinese word guzhi, meaning “paper made from paper mulberry [bark],” although the paper mulberry (Broussonetia papyrifera) grows nowhere in the region.

The Arabs also called paper qiratā, a word they had originally used for papyrus, papyrus rolls, and even parchment (also known as riqq). The word qiratā appears in the Koran in this sense, referring to writings on separate sheets. Perhaps the most common Arabic word for paper, however, was waraq, meaning “leaf,” probably from the expression waraq qiratā, “a leaf or sheet of paper.” From this usage in turn derive the words warraq—the common term for stationer, papermaker, paper merchant, and by extension copyist—and wirqa, “papermaking,” as well as many modern compound expressions referring to paper money, lottery tickets, commercial papers, banknotes, and the like.

IRAQ

Although paper was used earlier in Central Asia and Iran, let us look first at Iraq, the heartland of the empire, because the decision by the Abbasid bureau—
cracy to use paper was instrumental in its acceptance everywhere else. Bureaucratic necessity led Muslims to adopt paper. The second Umayyad caliph, Umar I (r. 634–44), who ruled from Arabia, had established the first government office to organize payments, register the army, and regulate the treasury, and he needed account books for this purpose. Such documents—known in Arabic as daftar (from the Greek word diphtera, meaning “skin; hide”)—were, strangely enough, initially kept on papyrus, which became the normal writing material used in caliphal offices following the conquest of Egypt in 641.

Early Islamic papyrus documents survive from Egypt as quires (booklets), rolls, and loose sheets, but the sheet format seems to have been most common. In contrast, Byzantine bureaucrats in Egypt and Syria had used papyrus rolls, and Sasanian bureaucrats in pre-Islamic Iran had kept their records on codices of prepared animal skins. According to later secretarial tradition, during the reign of the first Abbasid caliph al-Saffah (r. 751–54), who was responsible for moving the capital of the empire from Syria to Iraq, his vizier Khalid ibn Bar- mak ordered the loose sheets replaced with codices. These were possibly made of parchment, following Persian precedent, although papyrus continued to be used during the reign of al-Saffah’s son al-Mansur, the founder of Baghdad. Assuming that the format of the account book was more important than the material on which the records were kept, the new codex format would have exposed two of papyrus’ greatest weaknesses, just as it had in early Christian times: its edges were easily frayed and it was damaged by repeated folding. In both ways, paper was noticeably superior.

According to the thirteenth-century encyclopedist Yaqut, the first paper-mill in Baghdad was established in 794–95 during the reign of the Abbasid caliph Harun al-Rashid, and enough paper was made available for bureaucrats to replace their papyrus and parchment records with paper ones. Bureaucracy begat more bureaucracy, and in addition to recording such traditional information as landholdings, the assessment and levying of taxes, and army service, a host of new offices were established. The War Office (Diwan al-jaysh) now had two branches for recruitment and payment. The Office of Expenditure (Diwan al-nafaqat) dealt with requirements of the expanding court, covering salaries, provisions, supplies, contingency planning, and copying. The State Treasury (Diwan bayt al-mal) provided monthly (and later weekly) accounts to the vizier. The Board of Comparison (Diwan al-musadaran) made duplicate orders for payment. The Office of Correspondence (Diwan al-rasa’il or Diwan al-insha’) wrote the caliph’s letters and drew up documents and letters of appointment. The Post Office (Diwan al-barid) supervised the post roads and personnel, as well as a network of informants about conditions in the empire. The Cabinet (Diwan al-tawqi) received petitions, the Office of the
Signet (Diwan al-khatam) applied the caliph’s seal to his orders, and the Office of Letter Opening (Diwan al-fadd) received the caliph’s official correspondence. The Caliphal Bank (Diwan al-ghibta) changed coins and received fines, and the Office of Charity (Diwan al-birr wa’l-sadaqa) collected taxes!

Virtually none of the documents these offices produced has survived, but vast quantities of writing materials were undoubtedly used. It is no surprise that scarce Egyptian papyrus and expensive parchment were quickly replaced by paper, which could be produced in virtually unlimited quantities anywhere. Contemporary observers, however, ignored the triumph of paper. Like all medieval Islamic historians, they were interested in recording the responsible acts of particular individuals and not cultural and technological developments.

Only in retrospect did some perspicacious historians realize that something momentous had happened in the eighth century. One of the earliest was the tenth-century Iraqi historian al-Jahshiyari, who was in a position to know, for he had served as chamberlain to an Abbasid vizier and written a book on the history of viziers and state secretaries in the Abbasid period. Al-Jahshiyari noted that paper had been introduced during the reign of the caliph al-Mansur (754–75), founder of Baghdad. The great Iraqi theologian Abu’l-Hasan al-Mawardi (974–1058), quoted by the fifteenth-century Egyptian historian al-Maqrizi, ascribed the change to the famous caliph Harun al-Rashid. Ibn Khaldun, the North African historian and philosopher (and one of al-Maqrizi’s teachers), was even more specific, indicating that the manufacture of paper had been introduced by the Barmakid vizier al-Fadl ibn Yahya, who served the caliph Harun, when insufficient parchment was available. “Thus,” Ibn Khaldun wrote in his Muqaddima (Introduction [to the Study of History]), “paper was used for government documents and diplomas. Afterwards, people used paper in sheets for government and scholarly writings, and the manufacture [of paper] reached a considerable degree of excellence.” Ibn Khaldun neglected to mention an important reason why bureaucrats would have been attracted to paper over parchment or papyrus: Because paper absorbs ink, writing on it could not be erased easily. Paper documents were therefore far more secure from forgery than those written on papyrus and parchment; from them the writing could be erased by scraping or washing the surface.

Ibn Khaldun’s association of paper with the Barmakid family of viziers is intriguing, if unprovable. The charismatic Barmakids were descended from the chief priest (pārmak) of a large Buddhist temple at Balkh, capital of ancient Bactria and now a city in northern Afghanistan. After the Arab conquest of Central Asia, the family threw in their lot with the Arab conquerors, and Khalid ibn Barmak (d. 781–82), apparently the first member of the family to convert to Islam, served the first Abbasid caliph in the powerful role of admin-
Three basic types of waterwheel were known in the medieval Muslim world: the undershot wheel, the overshot wheel, and the horizontal or Norse wheel. The undershot wheel is a paddle wheel mounted vertically on a horizontal axle; its power derives almost entirely from the velocity of the water flowing past it, and the power it produces is affected by both the water level and the rate of flow. Like the undershot wheel, the overshot wheel is also mounted vertically on a horizontal axle, but it has bucketlike compartments along the rim into which water is discharged from a reservoir above. Because the overshot wheel is unaffected by water level or rate of flow, it can be three times as efficient as the undershot wheel, but it is consid-

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istrator of army and land-tax records. In spite of court intrigues, he remained in the administration, and his grandson, al-Fadl ibn Yahya, was foster brother to the future caliph Harun. The family revived interest in the literary master-
pieces of Iran and India, as well as in various eastern philosophical and reli-
gious doctrines. Al-Fadl was appointed governor of the western provinces of Iran, then governor of the province of Khurasan, and eventually he was sent to pacify the region of Kabul. His successes and his family’s notwithstanding, in early 803 the Barmakids fell into disfavor and disgrace. Several family mem-
bers were executed, and their half-century of ascendancy was over. Their Cen-
tral Asian and Buddhist antecedents, their experience in Khurasan, and their special interest in administration may well have familiarized them with paper and could have made them appreciative of its potential role for the burgeoning Abbasid bureaucracy.

Whatever the Barmakids' actual responsibility, Baghdad soon became a center of papermaking, and some considered paper made in Baghdad to be the best. Byzantine sources sometimes refer to paper as bagdatizon, which clearly refers to the city of Baghdad, but medieval Islamic sources mention many types and sizes, which can only rarely be identified or localized. The encyclopedist al-Nadim, for example, mentions Sulaymani paper (named after Sulayman, Harun’s financial officer in Khurasan), Talhi (after Talha ibn Tahir, governor of Khurasan), Nuhi (after Nuh ibn Nasr, Samanid ruler of Transoxiana), Jafari (after Jafar ibn Yahya, one of the Barmakids), Tahir (after Tahir ibn Abdallah, another governor of Khurasan), and Firawni (pharaoh-type, perhaps comparable to papyrus).

When papermaking flourished in Baghdad, stationery was big business. The Stationers’ Market (Suq al-warraqin), in southwest Baghdad, was lined with more than one hundred shops selling paper and books. The population of the capital city would have provided a ready supply of rags, and its rivers and canals sufficient water, for papermaking. In the tenth century, ship–mills—

floating mills powered by the flow of the current—were moored on the Tigris above the city, although the sources do not specify what product the mills processed, for example, grain or pulp.

Perhaps the earliest specimen of paper that can be associated with Baghdad is a ninth-century letter from the members of the Babylonian Jewish academy to their colleagues at Fustat, Egypt, now in the Cambridge University Library. The thick but unusually even paper suggests the proficiency of Baghdadi papermakers from an early date, as well as the availability of the material beyond the caliphal bureaucracy. Another specimen that can be associated with Baghdad is the small, 7- by 5-inch (17.5 by 13.5 centimeter) copy of the Koran that was prepared more than a century later by the noted calligrapher Ibn al-
Bawwab in 1000–1001. The paper, which has browned and stained with age, is thinner and more consistent than the letter paper, indicating not only that different qualities of paper were available but also that the finest available was used for transcribing the word of God (fig. 21).

The great Islamic theologian Ibn Hanbal (d. 855) is reported to have said that he preferred to write with “a reed pen, shining ink, and parchment,” but by the middle of the ninth century—barely a century since Muslims had first encountered paper—many, if not most, lettered Muslims, as well as Christians and Jews, were using it for writing letters, keeping records, and copying liter-

![Image](image.png)

*Fig. 21. Page from a copy of the Koran on paper transcribed by Ibn al-Bawwab in Baghdad, 1000–1001. Reproduced by kind permission of the Trustees of the Chester Beatty Library, Dublin [Is. 1431, fol. 260r]*

erably more expensive to install. When either type of vertical wheel is used to grind grain, a pair of gears is needed to transmit the energy to the millstones, which turn at right angles to the waterwheel.

Vertical wheels were known to the Roman architect, engineer, and writer Vitruvius in the first century B.C.E. They were most common in the Mediterranean region. Mills powered by undershot wheels were often mounted on the banks of swiftly moving streams and rivers and even in tidal pools. Some of the most famous are the huge norias in Hama, in Syria, which raise water from the Orontes River into aqueducts to irrigate the nearby fields.

Floating mills, a variant of the undershot wheel, were mounted in boats moored in rivers to take advantage of rapid currents. The Byzantine historian Procopius wrote that General Belisarius invented the floating mill when the Goths besieged Rome in 537 and cut the aqueducts. By the tenth century large ship-mills were moored along the banks of the Tigris and Euphrates Rivers between Mosul or Raqqa and Baghdad, but we do not know what they produced.

The horizontal wheel, in contrast, has propellers or scooped vanes radiating from a vertical axle that are driven by a jet of water directed from a reservoir. Some
say the horizontal wheel was a Greek invention, although the geographer Strabo wrote in the first century B.C.E. that the Parthian (Iranian) king Mithridates was the first to build such a mill, for the palace he erected in Asia Minor in the year 65. Archaeologists have discovered horizontal mills in the eastern Mediterranean region that date back to the fourth century C.E.

That the rotary energy of the horizontal wheel was in the same plane as the turning millstone meant that no gearing was needed, as for vertical mills. Horizontal mills enjoyed a further advantage, particularly in the eastern Islamic lands where they were most popular: they could run on the potential energy of slowly moving water gathered into tanks or reservoirs. Thus, they were perfectly suited to water coming from qanats, the underground aqueducts of Iran primarily used for irrigation, and many horizontal mills were built underground to operate in conjunction with qanat systems.

ary and theological works. Byzantium itself was slow to adopt paper, but other Christian communities within and on the fringes of the Islamic empire were not. Syrian Christians used paper by the early ninth century, and Assyrian Christians in Egypt soon followed (although Egyptian Copts continued to use papyrus). Armenians used it by the tenth century—an extant manuscript is dated 961—and Georgians perhaps even earlier, although the oldest surviving Georgian manuscripts on paper date from the eleventh century.

All of these Christian communities appear to have been reluctant to use this material for copying Scripture. In this regard, Christians may only have been emulating Muslims and Jews, who continued to copy their scriptures on parchment. By the middle of the tenth century, although Jews held fast to copying their scriptures only on parchment, Muslims began to copy their Korans on paper, first in Iran and Iraq, much later in the western Islamic lands. By about the year 1000 paper appears to have been acceptable for all types of manuscripts, including the Koran, in Iraq, Iran, and Syria.

A book by the eleventh-century secretary Hilal al-Sabi, Rukum dar al-khilafa (The Rules and Regulations of the Caliphal Court), contains a chapter entitled “The Sheets of Paper [wirs] Used in Writing to or from the Caliphs, the Envelopes Used to Hold Letters to or from Them, and the Seals Used in Them.” In it Hilal describes the elaborate protocol surrounding the use of special paper for particular purposes. He specifies that Egyptian paper, for example, was used until the Fatimids took control of Egypt in the mid-twelfth century. When this kind of paper was no longer imported into Iraq and became scarce, it was replaced by the wide Sulaymani paper. Such paper was used for letters of investiture and entitlement, as well as for correspondence between provincial governors and the caliph. But for letters from the caliph or petitions submitted to the vizier, half-size (nisfi) paper was preferred.

Over the following centuries, paper became finer and whiter, and the books made from it steadily larger, as we can see in manuscripts produced in Iraq. In contrast to the Koran penned by Ibn al-Bawwab, the celebrated copy of al-Hariri’s Maqamat, probably made in Baghdad in 1237, is written and illustrated on whiter and larger (15 by 11 inch; 37 by 28 centimeter) pages, and a contemporary copy of the same text, now in St. Petersburg, which measures only half that size (10 by 7½ inches; 25 by 19 centimeters), is still larger than al-Bawwab’s Koran. The pages of the dispersed twenty-volume manuscript of the Kitab al-aghani (Book of Songs) made at Mosul, Iraq, in the early thirteenth century are only slightly smaller, measuring 12 by 9 inches (30 by 22 centimeters). This trend toward larger paper in the last century of Abbasid rule continued in the late thirteenth and fourteenth centuries, when the Mongol dynasty of the Ilkhanids was ruling both Iraq and Iran.
A variety of sizes of paper were produced in Baghdad. The Egyptian historian al-Qalqashandi (d. 1418) enumerated nine sizes of paper, of which the two largest were the standard, full-sized Baghdadi sheet, measuring one (Egyptian linen) cubit (approximately 29 inches, or 73 centimeters) high by one and a half cubits (approximately 43 inches, or 110 centimeters) wide, and the reduced Baghdadi sheet (26 by 39 inches; 65 by 98 centimeters). The pages of an early fourteenth-century manuscript penned by Ahmad al-Suhrawardi measure approximately 20 by 28 inches (50 by 35 centimeters). This implies that they were folded from a sheet twice as large, or approximately 20 by 56 inches (50 by 70 centimeters)—in other words, about half the full-Baghdadi size. An even more magnificent manuscript made for the Ilkhanid sultan Uljaytu in 1306–7 was copied in thirty volumes, each averaging sixty-eight pages, with the pages having a trimmed size of 26 by 19 inches (66 by 48 centimeters). The two thousand pages would have measured 28 by 20 inches (70 by 50 centimeters) before trimming; they were folded from approximately one thousand full sheets measuring 28 by 39 inches (70 by 100 centimeters). This sheet size must be the “full Baghdadi” sheet mentioned in the sources.

The fine quality of Baghdad paper was celebrated despite the Mongols’ reported destruction of the city in 1258. Nevertheless, as the city’s fortunes ebbed in the following century, production of paper there declined. Al-Qalqashandi said that Baghdad paper (maraq al-baghdadi) had become rare by his time and was used exclusively for copying such important documents as treaties, acts of investiture, and writings from princes. At one time all princely correspondence had been written on this type of paper, and to keep it available, al-Qalqashandi said, a factory was established at Damascus that made an equally good product.

Al-Qalqashandi’s judgment about the high quality of Baghdad paper is confirmed by a magnificent large manuscript of the Koran copied in Baghdad in 1307 for an anonymous patron by the noted calligrapher Ahmad al-Suhrawardi. The paper looks snowy white, smooth, and even, with a surface that allowed the calligrapher’s pen to glide across it. Viewed under a microscope, the paper shows extremely well beaten long white fibers under a flawless size and glaze (fig. 22).

The art of papermaking died out centuries ago throughout most of the Islamic lands, and there is virtually no reliable evidence—apart from surviving sheets of paper themselves—about how paper was actually made. Nevertheless, papermakers must have found it extremely difficult to make excellent paper of a considerable size, particularly in large batches of even quality. Surviving manuscripts from earlier periods show that pages of such size were not made before the fourteenth century. Quite apart from the difficulties of preparing
The Spread of Papermaking

beating flax, fulling woolen cloth, hammering iron and copper, and making tanbark.

The history of the trip-hammer mill in the Islamic lands is largely a matter of speculation. Its prototype is the Chinese water-driven mill for husking rice. used from the first century C.E. and undoubtedly powered by a vertical waterwheel. The cultivation of rice had slowly spread from China and India to Iran and the Mediterranean region in pre-Islamic and Islamic times; by the tenth century there are numerous references to the cultivation of rice in Spain. In most of the Islamic lands, however, rice never enjoyed the popularity of other cereals, like wheat, sorghum, and barley.

appropriate molds and mold covers of fine grass or flax, plus horsehair—not to mention assembling sufficient quantities of pulp to assure reasonable consistency of quality—it would have taxed the physical ability of the strongest papermaker to repeatedly bend over to dip and lift a pulp-filled mold nearly a yard square without assistance and without spoiling the just-formed sheet. A mold that measured 28 by 39 by 1 inches (70 by 100 by 2 centimeters) would contain nearly 1,100 cubic inches (14,000 cubic centimeters) of water and pulp when full. This quantity would weigh nearly 31 pounds (14 kilograms), although the mold would quickly lighten as the water drained out. To get around the problem of weight, Chinese papermakers developed ways of making large sheets by attaching the mold to a system of counterweights, thereby making it easier for the papermaker to lift the mold repeatedly.

The speed with which the production of large sheets of paper resumed—indeed, increased—after the Mongols conquered Baghdad in 1258 suggests that the damage said to have been suffered by the city may have been overstated. Strong Mongol connections with China, however, may have encouraged Baghdadi papermakers to adopt Chinese techniques, such as the use of counterweights. We know, for example, that in the early fourteenth century the Ilkhanid vizier Rashid al-Din had Chinese papermakers working for him at Tabriz, in northwestern Iran. Whatever the technique used for producing such large sheets, however, the difficulty must have made them unusually expensive, even in prosperous times, and ample pages inscribed with only five lines of text would have connoted luxury as surely as did the majestic gold script and gold and lapis lazuli decoration.

The expense of even smaller sheets can be judged from a copy of the Koran transcribed by the famous calligrapher Yaqt al-Mustasimi in 1286. On one leaf of the 201-page manuscript, which measures 10 by 14 inches (24.5 by 34.5 centimeters), the calligrapher left out a single word in the twelfth verse, about
halfway down the page. Although neither the marginal rulings nor the illumination had yet been added, the calligrapher decided to insert the equivalent of an asterisk and write the missing word vertically in the left margin rather than recopy the text (fig. 23). Yaqt’s great predecessor, Ibn al-Bawwab, had done much the same thing nearly three centuries earlier, when paper was theoretically much more expensive.

With the collapse of the Ilkhanid state in the 1330s, the market for such luxuries seems to have collapsed, and the papermakers of Baghdad were no perhaps because in many places conditions were unsuitable for growing it. In the well-watered regions of southern Iraq and southwestern Iran, however, rice bread—made from ground rice—was the staple of the poor, and in many Islamic lands rice flour was used as a thickening agent for savory and sweet dishes in medieval cooking. Several medieval Arabic cookbooks describe rice dishes that resemble a pilaf; to make them grains of husked rice were boiled and steamed. The Chinese type of trip-hammer mill must have spread across Eurasia along with the cultivation of rice; otherwise, it would not have been practical to prepare dishes of husked rice. This type of mill is not attested in Iran before the seventeenth century, however.

The Iranian polymath al-Biruni, in discussing the extraction of gold from its ore, establishes unequivocally that water-driven trip-hammer mills existed in Samarqand in the late tenth and early eleventh centuries. He wrote that “gold can be united with the stone as if it is cast with it, so that it needs pounding. Rotary mills can pulverize it, but pounding it with trip-hammers is more correct and is a much more refined treatment. It is even said that this pounding makes it redder, which, if true, is rather strange and surprising. The trip-hammers are stones fitted to axles which are installed on
longer called on to produce such large sheets. That several behemoth copies of
the Koran were penned in either Damascus or Cairo in the third quarter of
the fourteenth century suggests that some of these papermakers might have
moved to Damascus, as al-Qalqashandi suggests, or even Cairo itself. The
decline of Baghdad papermaking in the mid-fourteenth century may also
explain why some Muslims were receptive to imported European paper. The
earliest known manuscript of the Koran copied on European paper was pro-
duced just after the fall of the Ilkhanids, probably in Baghdad in the 1340s. It
bears an Italian watermark of a double-key design surmounted by a cross (fig.
24). By the middle of the fourteenth century many Arabic, Persian, and
Armenian books were being copied on Italian paper. Although it may not have
been better than the local product, it was cheaper, particularly since Italian
merchants seem to have been willing to sell it at an artificially low cost.
Furthermore, the sack of Baghdad by Timur (r. 1370–1405), better known to the
West as Tamerlane, in 1401 and the massacre of its population was a devastat-
ing blow to its culture, and, despite brief revivals under the Jalayirids and
Turkmens in the fifteenth century, the city never regained its prestige. Iraqi
papermaking had come to an end.

SYRIA

The Abbasid caliph Harun al-Rashid, who disliked Baghdad, established an
alternative residence in the twin cities of Raqqa and Rafqa, in northern Syria,
on the middle Euphrates, in the late eighth century. The largest metropolis in
all of Syria and northern Mesopotamia, and nearly as large as Baghdad, Raqqa
remained Harun’s base until his death in 809, when his successors retreated to
the older capital in Iraq. While resident in Raqqa, Harun built enormous
palaces and a huge city, which became not only the stage for world-changing
political events but also the temporary military and administrative center of
the vast Abbasid empire. It was from Raqqa, for example, that the Barmakids
managed the empire’s affairs, and to Raqqa that knowledge of paper and
papermaking must have been brought from Mesopotamia at this time.

Syria’s importance in the history of papermaking is confirmed indirectly
by Byzantine sources, which called Arab paper bambuxinon, bombuxinon, bambaxeron,
and sometimes, in late texts, Bambaxeros kartis. Nineteenth-century scholars
thought the term bambuxinon referred to bombar, which means “cotton” or “silk”
in Greek, and supposed that the Byzantines had been the first to invent a sub-
stitute for papyrus by making “bombycin” paper from raw cotton fiber.
Although some cotton was grown in Syria during the Middle Ages, it was a rela-
tively rare fiber in West Asia until modern times, and Julius Wiesner’s analyses
of early Islamic papers showed that cotton played an insignificant role in Islamic
papermaking. The few cotton fibers he found, like the occasional wool fibers, had been accidentally introduced in the ragbag from which the pulp was made.

The Greek word *bambuxinon* and its variants actually referred to the Syrian city of Manbij, which was known to the Byzantines as Bambyke, and the Greek expression referred to the paper’s place of origin rather than the material of which it was made. Manbij, located in a fertile region on the Sajur River northwest of Raqqah, had an abundant supply of water, and paper seems to have been manufactured there at least from the tenth century. The Palestinian geographer al-Muqaddasi, who lived then, writes of paper being exported from Tiberias and Damascus as well; fine papers were associated with Syria for centuries. In the Latin West, paper was sometimes known as *charta damascena*.

From the ninth century geographers note the existence of papermills outside the walls of Damascus on a branch of the Barada River. Other papermills existed in the cities of Hama and Tripoli, but there were none in the major city of Aleppo, because no stream was strong enough to power the mills. Quantities of mass-produced Syrian paper were sent from Damascus to Egypt, particularly during the eleventh century. An Egyptian merchant is known to have put down a deposit of 250 dinars, a princely sum, for twenty-eight camelloads of paper bearing the trademark of a certain Ibn al-Imam of Damascus. The same trader is also known to have sent thirty bales of Damascus paper by sea via the port of Tyre. Because this was long before the invention of water-
marks, the trademark must have been an extra leaf pasted to the bundles or rolls, much like the protocollon, the thicker sheet pasted to the beginning of papyrus rolls in antiquity and early Islamic times.

The oldest surviving manuscript written on Syrian paper is a Greek text, in the Vatican, of miscellaneous teachings of the church fathers, *Doctrina patrum* (fig. 25). On the basis of its script, the manuscript has been ascribed to Damascus in the early ninth century. The yellowish brown paper is remarkably smooth and even, despite the occasional clumps of fiber. The sheets, though flexible and soft, vary in thickness from one to another, suggesting that quality control was still a problem. The distinctive page size (10 by 6 inches; 26 by 15 centimeters) and narrow format of the manuscript show not that papermakers used molds of that size but that the paper sheets were trimmed, probably to imitate the standard format of books written on papyrus.

A damaged bifolio (sheet folded once), roughly the same size, of brownish paper made from linen was discovered in Egypt and is now in the Oriental Institute, Chicago (fig. 26). It bears the beginning of the text of the *Thousand Nights*—the well-known collection of stories was originally known by that title—as well as several other phrases, texts, and a drawing. The arrangement of the writing indicates that the original sheet once formed the first pages of the earliest known manuscript of the *Thousand Nights*. The original manuscript fell apart, and the first four pages were used as scratch paper in October 879, when a certain Ahmad ibn Mahfuz practiced copying legal phrases in the margins. Nabia Abbott, who first published the fragment, ascribed it on historical grounds to Syria in the first quarter of the ninth century, making it contemporary with the Greek text in the Vatican (of which she was apparently unaware) and making it as well the earliest surviving fragment of an Arabic book written on paper.

The oldest dated complete book in Arabic copied on paper that we know is a manuscript dating to 848, recently discovered by accident in the regional library of Alexandria, Egypt; it awaits complete publication. The second oldest surviving Arabic book on paper is generally believed to be a fragmentary copy of Abu Ubayd’s work on unusual terms in the traditions of the Prophet, dated Dhu’l-Qada 252, or November–December 867 and preserved in Leiden University Library (fig. 27). It bears no indication of where it was copied. The opaque stiff paper has turned dark brown and has a tendency to split along the edges. This feature has led some observers to suggest that the pages of early manuscripts were pasted together, back to back, from two separate sheets made in floating molds, which leave one side rougher than the other and unsuitable for writing. This tendency for the pages to split is actually a result of delamination, a condition seen in many early papers, such as the Vatican manuscript. When the pulp was not sufficiently beaten, the outer layers of the cellulose
FIG. 25. The Greek text of the Doctrina patrum, the earliest surviving manuscript on Arab paper. Damascus, early 9th century. 10 1/2 x 6 in. (26.4 x 15 cm). Vatican Library [Gr. 2200]

FIG. 26. Paper fragment from the 9th century, discovered in Egypt, that contains the opening text of the Thousand Nights on the left. Folded dimensions 9 1/2 x 5 in. (24 x 13 cm). Courtesy of the Oriental Institute of the University of Chicago [no. 17618]
fibers did not detach and form physical and chemical bonds with adjacent microfibrils, and the resulting paper has weak internal cohesion. This condition was exacerbated when the paper was given a hard surface with the application of size. The weaker interior splits easily in two, revealing a rough, woolly, and feltlike inner surface.

By the twelfth century, papermaking had become a major industry in Syria, and paper was made in a range of sizes and weights. Perhaps the most delicate was waraq al-tayr (bird paper), a thin, light sheet, which al-Qalqashandi said was only three "fingers" wide (approximately 2½ inches; 6–7 centimeters) and which was perhaps 3½ inches (9 centimeters) long. The ruler Nur al-Din ibn Zangi used carrier pigeons for airmail service during the period of the Crusades, and this practice continued under the Mamluk sultans in the thirteenth and fourteenth centuries, when Syria and Egypt were governed as one. Pigeon stations were established in Syria a distance of three ordinary post stations apart. A message was written on small sheets of this lightweight paper and attached to one of the bird's rigid feathers in order not to disturb its flight. When the bird arrived at a station, the dispatch was removed and tied to the wing of another bird, and it was sent off to the next station. When the last pigeon arrived at the sultan's palace, within the citadel of Cairo, an official would take the bird to the head of the messenger service, who would remove the dispatch and read it. In this way the sultan received daily reports from the provinces.

Papermakers were still active at Damascus in the thirteenth and fourteenth
centuries, for the authors of several texts insist that papermakers be careful to keep their paper pure by not recycling papers on which sacred texts or names were written. This attitude is strikingly similar to Jewish concerns, as well the Chinese concern about toilet paper, and led to the preservation of many medieval documents in Cairo. What remained of the Syrian papermaking industry after the ravages of the plague in the middle of the fourteenth century and after economic mismanagement by the Mamluk governors and amirs seems to have collapsed after Timur sacked Damascus in 1401 and took its best artisans to Samarqand. At the same time Europeans began to export their own products to the Middle East in earnest, and Syrian papermakers could not stand up to the competition. The industry never revived.

Iran and Central Asia

Although paper was introduced to the Islamic lands through Central Asia and Iran, little direct evidence survives for its use there in the first three or four centuries of Islam. The unparalleled prestige of Arabic, the language of Islam and of Iran’s new Muslim rulers, put an end to Middle Persian, used under the Sasanian dynasty, as a written language, and New Persian, which was written in Arabic script, did not emerge as a literary language until about 1000. In the early twentieth century, Sir Marc Aurel Stein discovered a fragment of paper at Dandan Uiluq, in Chinese Turkestan, which had been inscribed in Judeo-Persian (Persian written in Hebrew characters) in the year 718. Otherwise, the oldest paper manuscript in the Persian language to survive is believed to be a copy made in 1055 of a treatise composed a century earlier by Muvaffaq ibn Ali of Herat.

Iranian scribes, however, used paper in the tenth century—and undoubtedly earlier—to copy manuscripts in Arabic. The oldest dated Koran manuscript on paper to survive was copied by Ali ibn Shadan al-Razi (whose name indicates that he came from Rayy, near modern Tehran) in 971–72, and the same calligrapher also copied an Arabic text some fifteen years later. Although there is no indication where this calligrapher worked, an anonymous calligrapher is known to have transcribed another copy of the Koran at Isfahan, in central Iran, in October–November 993 (fig. 28).

Medieval Persian authors mention papers of different qualities and types, as well as the professions and locations associated with papermaking. In the tenth century the Iraqi scholar al-Nadim had noted that the province of Khurasan was a center of papermaking, and the anonymous Persian author of the geographical work Hudud al-alam (The Regions of the World), written in 981–82, states that a monastery of Manichaeeans in Samarqand made paper that was exported throughout the (Muslim) world. One eleventh-century
Iranian source mentions that sheets of old manuscripts were used as linings for hats or as pasteboard for bookbindings, indicating that old paper remained a valuable commodity. By the eleventh century papermaking must have been common for the Persian poet Manuchihr to expect readers to understand a metaphor likening the snow-covered desert to ground covered with damp sheets of paper to dry: "The land from Balkh to Khavaran has become like the workshop of Samarqand/The doors, roof and walls of that workshop are like those of painters or paper-makers."

In the early fourteenth century Rashid al-Din, vizier to the Ilkhanid (Mongol) rulers of Iran and Iraq and one of the most powerful men of his time, is known to have established a kaghaz-khana (papermill) along a stream flowing through the grounds of the Shahristan-i Rashidi, the charitable foundation he established in a suburb of Tabriz. The paper, intended to supply the scriptorium that Rashid al-Din established there, was of the Baghdaï type and size, which is not surprising, because Baghdad was one of the Ilkhanids' winter capitals. In the endowment deed for the foundation, Rashid al-Din stipulated that the Korans copied in the scriptorium should be done on Baghdad paper and that collections of hadith, or Prophetic traditions, should be copied "in the suitable format."

Rashid al-Din was also open to other aspects of papermaking. From information given in his treatise on agriculture, he is known to have brought Chinese artisans to work at his papermill. This is not as far-fetched as it sounds, for the Mongol domination of Iran had opened up easy communication across Central Asia. From the Chinese, Rashid al-Din learned about making paper from
mulberry bark, writing on only one side of a sheet of paper, and wrapping many goods in paper. Mafarrukhi’s late eleventh-century Arabic text about the wonders of the city of Isfahan, which was reworked in Persian in the fourteenth century, mentions that paper of the Rashidi type, presumably similar to that made for Rashid al-Din, was made in Isfahan, too. Mafarrukhi (or probably his anonymous translator) praises this paper, which was used for copying literary works and reviving the books of past scholars: “From the point of view of clarity of sheet, size and format, softness and cleanliness, firmness, evenness and sizing, paper of such quality does not, and did not, exist in any kingdom beyond Isfahan.” It goes without saying that Mafarrukhi and his translator were natives of that city: chauvinism is a timeless trait.

Fig. 29. "Noah’s Ark," from Rashid al-Din’s Compendium of Chronicles, fol. 589a. Tabriz, 1314. The Nasser D. Khalili Collection of Islamic Art, London [Ms. 727]
The profligate use of big sheets of paper was a prerogative of power. Both the sultan Uljaytu and his vizier Rashid al-Din consistently preferred that their scribes use high-quality paper in ostentatiously large sizes and quantities. In addition to ordering copies of the Koran and the hadith, the vizier ordered that every year the resident scribes should use large sheets of good Baghdadi paper to prepare copies of his own literary work, the *Jami al-tawarih* (Compendium of Chronicles), in Arabic and Persian.

Several of Rashid al-Din’s manuscripts survive. The single surviving volume, dated April 1315, from a thirty-volume Koran manuscript that he ordered made measures 21 by 14 inches (52 by 37 centimeters), approximately the same size as the one copied a decade earlier in Baghdad by Ahmad al-Suhrawardi and equivalent in size to the "half Baghdadi" sheet. The pages of the Arabic copy of the *Compendium of Chronicles* now measure 17 by 12 inches (43 by 30 centimeters), but the margins have been trimmed, perhaps by more than 1½ inches (3 centimeters) from each side (fig. 29). The original pages would then have measured at least 20 by 14 inches (50 by 36 centimeters), corresponding to sheets of the same half-Baghdadi size. The Persian version of the same text preserved in Istanbul was copied on pages measuring 22 by 15 inches (54–56 by 38–39 centimeters). The slightly larger dimensions suggest that the manuscript was rebound fewer times and consequently trimmed less. A copy of Rashid al-Din’s theological works, *Majmua al-Rashidiyya*, originally measured 20 by 14 inches (50 by 37 centimeters), and an anthology of poetry associated with the Rashidiyya scriptorium was written on the same large sheets.

The preference for ostentatiously large sheets continued after Rashid al-Din was put to death in 1318. The pages of the Great Mongol *Shahnama* (Book of Kings) were similarly large; that book has been associated with the patronage of his son Ghiyath al-Din about two decades later at the revived Rashidiyya scriptorium (fig. 30). The manuscript has been extensively refurbished, and the margins have been replaced, probably in the nineteenth century; but because the text panels themselves measure 15 by 11 inches (40 by 29 centimeters), and original margins of 4 inches (10 centimeters) on at least three sides are not improbable, the original pages must have been at least of the half-Baghdadi size, if not somewhat larger.

The collapse of the Ilkhanids in mid-fourteenth-century Iran meant that, as in Iraq, there were few, if any, patrons still able or willing to commission manuscripts of such generous proportions; and some papermakers, along with calligraphers and other artists, probably migrated to such intellectual centers as Cairo and Damascus. Nevertheless, Iranian papermakers continued to produce fine, if smaller, sheets, or so we can judge from the paper used for illustrated manuscripts made in such provincial cities as Shiraz. Indeed,
the quality of the paper appears to have gradually improved over the second half of the century.

Papermaking, as well as all the other arts of the book, was transformed after Timur began to re-create Genghis Khan’s Mongol empire in the second half of the fourteenth century. Timur rapidly conquered Central Asia, Iran, Iraq, Syria, Anatolia, the Caucasus, and southern Russia, returning to his capital at Samarqand with not only immense wealth but also thousands of captured artisans. They were set the task of beautifying his capital. Among the greatest of Timur’s projects just before his death was the construction of a colossal mosque in Samarqand, now known as the Mosque of Bibi Khanum. The mosque was larger than any in Central Asia, able to hold ten thousand worshipers, and it seems likely that it was Timur who commissioned for it the largest Koran manuscript ever produced in medieval Iran and Central Asia—and probably in the entire medieval Muslim world (fig. 31). Eventually it was displayed in the mosque on an enormous stone lectern, measuring more than 2 yards square and nearly as high, commissioned by Timur’s grandson Ulughbeg.

On the basis of the surviving pages and fragments of this gargantuan man-
uscript, each page originally measured just over 7 by 5 feet (2.2 by 1.55 meters), or eight times larger than a full-Baghdadi sheet of paper. The gigantic size of the sheets required that the paper be heavier and stronger than usual, so that it would not tear when the leaves of the book were turned. Since the surviving pages have seven lines of text each, the complete Koranic text would have required approximately sixteen hundred sides, or 29,000 square feet (about 2,700 square meters) of paper—two-thirds of an acre.

Oddly, none of the surviving pages has any text on the back, which is unusually rough and unsuitable for calligraphy. The absence of text on the reverse, combined with the unusual thickness of the sheets, indicates not only that the papermakers had to make at least twice as much paper than if they had used the backs but also that they used a different technique. Had they used the normal technique of dipping two-piece molds of the appropriate size in a pulp-filled vat and removing the just-formed sheet from the mold, the mold would have had to be deeper to make the thicker sheet. If the mold was at least 2 inches (5 centimeters) deep to collect sufficient pulp, a reasonable assumption, the filled mold would have weighed nearly a staggering 390 pounds (172 kilograms). The papermakers must have resorted instead to the older process of ladling pulp into floating molds, which rested in a basin of water. Making the paper in this fashion would have required more molds, for each sheet of paper had to dry before it could be removed from the mold and a new sheet formed, but it obviated the need to dip and lift a pulp-filled mold of back-breaking weight. This process must have been the only one available in Samarkand that allowed papermakers to make the sheets of the colossal size the patron required. Although the paper of Samarkand had long been renowned, it is tempting to imagine that the papermakers responsible for this feat were Damascenes captured by Timur and brought back to his capital.

Chinese papermakers had developed a different technique for making extra-large sheets of paper by the tenth century, but these techniques do not seem to have been known in Ilkhanid Iran. And because Timur had not yet conquered China—he was just setting off on campaign when he suddenly died in early 1405—these techniques were not known in Samarkand. Su Yijian, the tenth-century author of the Wen fang si pu, the earliest Chinese treatise on paper and papermaking, described papermakers in Huizhou making a sheet of paper some 50 feet (17 meters) long. The hold of a ship was used as a vat, and fifty or so workers lifted the enormous mold in time to the beating of a drum. This paper was dried horizontally over a big brazier, instead of on the usual wall, to make the sheet even. The rough reverse sides of the leaves in the great Timurid Koran manuscript indicate that Timurid papermakers did not use this technique. Even had they known of it, it might not have suited their purposes, for

MOLDS

The first sheets of paper were probably formed using a floating mold—a woven cloth stretched on a wooden frame. To make paper this way, the mold is floated in a shallow vat of water, and the prepared pulp is poured into the mold. When the mold is lifted from the vat, the water drains slowly through the interstices of the cloth, leaving behind the fibers in a thin, moist mat. The entire mold, with its deposit of fibers, is placed in the sun to dry. When it is dry, the mat of fiber can be separated from the woven screen, whose faint regular impression is visible on one surface of the paper, and the mold can be used again.


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the Chinese mold was undoubtedly long and very narrow—ideal for making a long strip of paper to use in a roll but quite inappropriate for making a book in codex format.

Timur’s mammoth Koran manuscript was still famous nearly two centuries after it was made, for the Safavid chronicler Qadi Ahmad was familiar with the manuscript and attributed it to the calligrapher Umar-i Aqta (Umar the Amputee), who had lost his right hand and wrote with his left: “He wrote a copy of the Koran in ghubar [minuscule] script: it was so small in size that it could be fitted under the socket of a signet ring. He presented it to the Lord of the Time, but as Umar had written the divine word in such tiny characters, Timur did not approve of it or accept it and did not deign to favor the calligrapher. Umar then wrote another copy, this time extremely large, each of its lines being a cubit or more in length. Having finished, decorated, and bound the manuscript, he tied it on a barrow and took it to the palace of the Lord of the Time. Hearing that, the sultan came out to meet him, accompanied by all the clergy, dignitaries, amirs, and pillars of the state, and rewarded the calligrapher with great honors, marks of respect, and endless favors.”

Qadi Ahmad’s amusing story notwithstanding, it is inconceivable that any Timurid calligrapher would—or could—have ordered thousands of such large sheets of paper on his own. Rather, the sheer magnitude of the project indicates that it was a royal commission from the start, requiring a substantial portion of the resources available even to the experienced papermakers of Samarkand. This great manuscript, however, apparently remained unique, for other patrons in the fifteenth century, though bibliophiles, chose not to emulate their ruler’s example. Rather, they encouraged papermakers to produce sheets of more modest dimensions but of extremely high quality.

By the fifteenth century Iranian papermakers had perfected their art. They could make paper of virtually any size, strength, or texture, and calligraphers and painters appreciated the qualities of the different papers they used in producing some of the most elegant and splendid manuscripts yet made anywhere in the Islamic lands. The years when Timur’s successors ruled in Central Asia and Iran were the classical moment for the Persian arts of the book, as exquisite illustration was integrated into a harmonious ensemble of paper, calligraphy, illumination, and binding. Technical examination shows that papermakers were able to beat the pulp so thoroughly that the resulting paper had few visible fibers. The improved processing gradually allowed them to make thinner and finer sheets without any loss in strength. Although consistency between individual sheets was valued, calligraphers were still prepared to use papers of somewhat varying thickness in a single volume.

That the finest paper for calligraphy and painting should be thin, strong,
and sized with rice starch was mentioned in Jamal-ı Yazdi’s encyclopedia Far-rukhnama-ı Jamali, written centuries earlier, in 1184–85. In the thirteenth and fourteenth centuries, thanks to improvement in the quality of materials, calligraphers brought their art to new heights, developing scripts of breathtaking beauty. To create a smooth surface on which their reed pens could leave a flawless trail of ink, calligraphers preferred to glaze their paper by burnishing the already-sized surface with a hard, smooth stone. The eminent calligrapher Sultan-Ali Mashhadi (d. 1520) devoted several couplets of his treatise on calligraphy to sizing and glazing paper by hand:

**ON SIZE PASTE**

Prepare the size (ahar) from starch
Learn these words from an old man (repeating) ancient words
First make a paste, then pour in water,
Then boil this for a moment on a hot fire;
Then add to this starch some glue.
Strain [so that it is] neither too thin nor too thick,
Spread it on paper and see
That the paper should not move from its place;
When you are applying size to your paper
Moisten the paper slightly with water, carefully.

**ON POLISHING PAPER**

The paper must be polished so
That no creases appear in it.
The board for polishing should be wiped clean
With a strong hand, but neither hard, nor softly.

In addition to glazing, paper for calligraphy was often tinted. A taste for colored paper had long existed in the eastern Islamic lands. Simi Nishapuri, a librarian in the city of Meshed, in Iran, and an expert in the arts of the book in the fifteenth century, wrote, "It is better to give paper a slight tint because white is hard on the eyes and the master calligraphic specimens that have been observed have all been on tinted paper." Simi offered various recipes for dyes. For him, the most popular colors were reddish yellow, reddish orange (henna), lime green, pistachio, and buff. In the era before the discovery of chemical bleach, although papermakers were proud of being able to make very white paper, calligraphers seem to have preferred tinted paper, and the distinct tan or beige tone of many medieval Persian manuscripts may reflect that sieve or strainer while still moist, and other sheets could be formed while the first sheet was dried. In some parts of the world, the moist sheet was placed vertically on a smooth wall to dry; in Europe, the wet sheets were normally or couched (pronounced "coached")—interleaved with woolen felt—placed in a press, and squeezed of the remaining water. The damp sheets were then hung on lines to dry.

The dipping mold is a rectangular wooden frame. When the mold was large, supplementary ribs connecting the longer sides were sometimes added to give the mold dimensional stability and to keep it from warping. The edges of the mold (and ribs) supported the sieve, which might be made of grass or strips of rounded bamboo laid side by side. Whatever the material, the strips were fastened together at regular intervals with strings of silk, flax, or animal hair. In some of the Islamic lands where bamboo was not available, the screen may have been made of flax fibers stiffened and strengthened by being boiled in oil, but fiber screens tended to sag with use and eventually resulted in an uneven sheet. Once Europeans had sufficiently developed the technology of drawing fine wire, the screen was normally woven from bronze wire, which would not rust from continued exposure to water.

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The modern paper mold consists of a fine screen laid on a frame and surmounted by a second, removable frame. The second frame, called a deckle, helps to regulate the amount of fiber collected on the screen. The two-part mold is introduced vertically into the vat containing the pulp and brought up horizontally, allowing it to fill with a measured amount of fiber and water. The water drains through the screen, leaving a mat of fiber. Because the screen is both smooth and firm, once the deckle is removed, the moist fiber mat can be released, the sheet of paper laid to dry, and the entire mold reused immediately.

Many Persian calligraphers considered the finest paper to be Chinese (khītā). Already in the tenth century, Ibn al-Nadim had met a bibliophile who collected Chinese paper. The fourteenth-century litterateur and chancellery scribe Hindushah Nakhchivani mentions sixty sheets of “Chinese” paper among a list of gifts included in the collection of private and official letters that he compiled for the Jalayirid ruler Uvays. The calligrapher Sultan-Ali Mashhadi thought Chinese paper the best for quality and color, and this sentiment was repeated by several contemporary and later poets.

Just as Baghādi became a generic term for fine and large sheets in the fourteenth century, the term Chinese may have taken on a generic meaning as well. Still, Chinese paper was expensive; some idea of its value is given in a document bearing the name of Sultan Husayn Mirza, ruler of Herat in the late fifteenth century. The document contains estimates of the expense of copying a manuscript of the Shahnama: 42,450 dinars, of which 12,000 dinars (28 percent) went for “Chinese” paper at 20 dinars a page. Some 15,570 dinars (37 percent) was paid to the calligrapher, who got 250 dinars for copying every thousand couplets. The rest of the money went to illuminators, marginators (people who drew the margins), and painters. The exact figures cannot be trusted because the document is probably a forgery intended to increase the value of the manuscript when it was resold in the sixteenth century, but the relative percentages must have been reasonable enough to fool the contemporary eye. That paper accounted for 28 percent of the total cost indicates that the material was still far more expensive than it is today, when the cost of paper is usually a small fraction of the total cost of producing a book.

Chinese paper was made from fibers entirely different from those used in Iran, and it was given a much softer finish because it was prepared for writing with soft brushes, not reed pens. Not only was it valued for its fine quality, but it was also prized for the various decorative treatments that Chinese papermakers had developed over the centuries, including dying, marbling, and sprinkling and painting it with gold. Some of these techniques appear in the oldest surviving examples of identifiably Chinese paper used in a Persian manuscript: two volumes of the poetry of Farid al-Din Attar, prepared in Herat in 1438 for the library of the Timurid ruler Shahrukh. The manuscripts were copied on sheets of thin Chinese paper tinted various colors, sprinkled with gold flecks, and painted with gold designs. Another manuscript, a small copy of Mir-Haydar Khwarazmi’s Makhzan al-asrar (Treasury of Secrets), was copied
in Tabriz in 1478 by the calligrapher Sultan-Ali Qaini on sheets cut from two Chinese rolls. Careful examination of the manuscript has allowed scholars to reconstruct the rolls from which the sheets were cut. Both rolls measured 17 inches (44 centimeters) wide, but one was twice as long as the other (110 versus 57 inches; 280 versus 144 centimeters). The paper, dyed light blue, had been sprinkled with gold flecks and painted in gold with flowers and birds, as well as landscapes (fig. 32). Presumably the Persian calligrapher had to size the Chinese papers with starch before writing the Persian verses on them with reed pens, unless starch had already been used to make the gold adhere.

Such decorated Chinese papers had probably been brought to Iran as gifts from the numerous embassies exchanged between Timur and his successors and the Ming emperors of China. One caravan of merchants from the Timurid lands arrived in Nanjing in 1413 bearing presents for the Yongle emperor. The emperor sent a return mission to Samarqand, which arrived in 1414, bearing gifts of plain and patterned silk. Persian sources mention another Chinese embassy arriving in 1417 bearing gifts of falcons, brocades, porcelains, and paper.
Iranian artisans soon developed their own techniques for speckling and painting paper with gold (zarafshan), and this technique became very common when collectors developed a taste for binding together specimens of calligraphy—and eventually paintings—in albums. The specimens of various sizes were mounted on standard-size sheets of fancy paper before being bound together in books. Several medieval writers give directions for decorating paper with speckles in sizes ranging from "dust" to "coarse." The paper was first starched and then sprinkled with gold particles—made by grinding pure gold leaf—using either a horsehair brush or sieves of this or that degree of fineness, depending on the effect desired. Next, the paper was burnished with a hard stone to make the gold adhere and develop its metallic luster. Simi also gives recipes for making suspensions of gold, silver, bronze, and copper to paint on decorative papers.

Marbling was another Chinese technique adopted and developed by Persian artisans, and marbled papers were used in the same ways as gold-sprinkled ones. As early as the tenth century Chinese artisans had developed various ways for decorating paper with motted or marbled designs, to which they gave such colorful names as "fish-eggs notepaper" and "drifting sand notepaper." Although no early examples of these papers are known to survive in Iran, they were probably brought to the Timurids as gifts, for it is at that time that Iranian artisans first developed their own techniques for achieving similar effects. They called this paper kaghaz-i abri ("clouded" or "variegated" paper).

The Persian marbling technique was based on suspending ground colors in a medium lighter than water, normally oil. A vat large enough to hold the sheets of paper was filled with water that had been thickened with a mucilaginous substance. The colors were gently poured or dropped at random or in a desired pattern onto the surface of the thickened water, and a sheet of prepared paper was laid carefully down. The designs could be infinitely modified with the help of rods or combs to manipulate the colors. At first the effects were simple, but the colors and patterns became increasingly complicated. From Iran the technique of marbling spread to India, the Ottoman Empire (where it is known as ebru), and eventually Europe, where it enjoyed enormous vogue, particularly in the nineteenth century.

Iranian papermaking improved remarkably in quality, size, and decoration between the thirteenth century and the sixteenth. Before then, books written on paper had been relatively small, having likely been made from small sheets. (Before the advent of printing, there would have been no economic advantage to making large sheets of paper and then cutting them up into small pages.) In addition, the older papers are thicker, softer, and more floccular (a technical term meaning "fluffy") and have relatively poor internal cohesion.
They are usually brownish or tan, not from intentional tinting but from the difficulty of bleaching the fibers. Over the course of the twelfth and thirteenth centuries, papers from the eastern Islamic lands became distinctly whiter and finer, and they were, or could be, manufactured in larger sizes. The best-quality paper of the fourteenth and fifteenth centuries is thinner and stronger and, for the finest calligraphy and painting, was normally glazed. By the fifteenth century, the papers used in Iranian books were better than ever before; they were thin, strong, very smooth, and highly polished, allowing artists to use them for exquisitely delicate calligraphy, illumination, and painting characteristic of the period.

Although some of these technical improvements resulted from Persian papermakers perfecting their own techniques, the markedly improved quality of paper in the eastern Islamic lands during this period must have been due to direct and repeated contacts with China following the integration of Iran into the Mongol sphere of influence. Chinese paper and papermakers had played little or no part in the introduction of papermaking in the Islamic lands in the eighth century, but they apparently played a far greater role from the thirteenth century on as papermakers and artists became familiar not only with specimens of Chinese paper but also with Chinese papermakers and their techniques. Chinese papermaking itself had improved dramatically between the eighth and thirteenth centuries, because printing, which the Chinese had invented in the eighth century, eventually led to an increased demand for paper. In response, Chinese papermakers developed more sophisticated methods of producing greater quantities. Iranian papermakers’ contacts with China provided the impetus for them to improve their own products in terms of size, thinness, strength, and decoration.

The high standard of Iranian papermaking continued into the sixteenth century, as Safavid patrons continued their predecessors’ interest in the arts of the book. By the eighteenth century, however, the industry had fallen on hard times, for the Indian paper industry provided stiff competition. A Safavid work on administration from 1725 or thereabouts specifies that the chancellery secretary received thirty reams of paper from Dawlatabad, in the western Deccan, which had become an important papermaking center. By the nineteenth century Russian papermills were also supplying Iran, and many old manuscripts were refurbished using machine-made Russian paper.

All told, the tradition of papermaking in greater Iran between the ninth and the seventeenth centuries was the longest of any in the Islamic lands, and papermaking there reached the most advanced levels. The papers made there, particularly from the late thirteenth century to the late sixteenth, were of extraordinarily high quality and—when necessary—of a large size, and the best
papers of the fifteenth and sixteenth centuries, which were exceedingly smooth and strong and sometimes remarkably thin, played an essential role in the florescence of the decorated luxury book as the major art form there. The paper-based arts of calligraphy, ruling margins and columns, gold sprinkling, illumination, illustration, doublures (endpapers), and binding were symphonically combined: in the final works the exquisite whole was far greater than the sum of the beautifully made individual parts.

EGYPT

Paper had been introduced to Egypt from Syria in the ninth century, and it was manufactured there by the tenth. Although papyrus, which had been made in Egypt for more than four thousand years, was still being made in the early tenth century, the geographer Ibn Hawqal, who visited Egypt in 969, makes no mention of it as a writing material, and the geographer al-Muqaddasi, writing in 985–86, mentions paper as one of Egypt's products. The shift to paper is confirmed by archaeological evidence: during the archaeological season at Fustat (Old Cairo) in 1980, for example, 441 documents dating from 950–1050 were found; of them, 399 (90 percent) were on paper, 35 (8 percent) on parchment, and only 7 (2 percent) on papyrus. In 1216 a traveler to Egypt explicitly declared that the manufacture of papyrus was by then quite forgotten.

In contrast to other regions of the Islamic lands, where physical evidence for the early history of paper is lacking, Egypt's unusually dry climate, like western China's, has preserved an abundance—indeed, a plethora—of paper from medieval Islamic times. Twenty thousand paper fragments dating from the ninth to the fourteenth centuries were among the more than 100,000 papyrus and parchment documents found in excavations in the Fayyum in 1877–78. These documents were acquired by Archduke Rainer of Austria in 1884 for his papyrus collection and examined by Josef von Karabacek and Julius Wiesner at the end of the nineteenth century. The sheets, made almost entirely from linen rags, had all been made in molds and sized with starch to render them suitable for writing. According to Karabacek, the earliest dated paper was a letter of 874, although he claimed that two letters on paper could date from a century earlier—which is conceivable, if not very probable. It has been impossible to determine where the papers were manufactured or the letters composed; it seems likely that some of the early ones, like the *Thousand Nights* fragment in Chicago, were brought from Syria.

Nearly 300,000 more paper documents, including trousseau lists, commercial documents, and personal letters relating to the Jewish community and dating mainly from the mid-tenth century to the mid-thirteenth, were among the Geniza documents found in the Palestinian Synagogue in Fustat (fig. 33).
Largely written in Judeo-Arabic—the vernacular Arabic (Middle Arabic) spoken by all medieval Cairenes, which Jews wrote in Hebrew characters—the documents had been placed in the synagogue storeroom to await proper disposal by burial, because it is an article of Judaic belief that inscribed papers should not be desecrated if it is at all possible that they bear God’s name. The storeroom and the papers it contained were forgotten until the nineteenth century, when their importance for medieval social and economic history began to be appreciated. A very few Geniza documents predate the year 1000, but there are hundreds, if not thousands, of dated or datable documents from almost every year between 1002 and 1266, after which use of the storeroom seems to have declined. Together the Geniza and Vienna documents are particularly important because—oddly enough—very few books survive from this period in Egypt, even though the libraries of the Fatimid caliphs, who ruled the country at this time, are known to have contained hundreds of thousands of books.

In contrast to the Vienna papers, in which paper and content alike have been scrutinized, the Geniza documents have been analyzed only for their literary and historical content. Nevertheless, their often precise dates and specific localization should allow scholars to understand better the development of the medieval paper industry and the varied uses of paper. A cursory
examination of some Geniza documents suggests some preliminary generalizations. We see various shades of beige and light brown, which indicates incomplete bleaching of the fibers used for inexpensive papers, as well as natural discoloration over time. The rather spongy and floppy papers are somewhat cloudy (floccular) when held up against the light, a result of the fibers from an incompletely beaten pulp clumping on the screen. One document, dated 1084, contains a tiny fragment of woven cloth, which proves that the pulp was made from rags.

Ibn Said, the Andalusian poet, historian, and geographer who visited Egypt in the 1240s, remarked that papermills were confined to Fustat and not found in Cairo itself; ample supply of running water for the papermills would have been available along the banks of the Nile in Fustat, but not in Cairo itself, which was built on higher—and drier—ground. Papermills also needed copious quantities of fiber. Flax (Linum usitatissimum) had been one of the major agricultural products of Egypt since prehistoric times; it was valued not only for its fiber but also for its seed, which was pressed for oil. Grain, however, had been the major crop in Pharaonic, Roman, and Byzantine times, for the empires depended on the surplus grain provided by Egyptian farmers. In Islamic times, the caliphs and their governors replaced wheat with flax as the main cash crop of Egypt. The major industry of medieval Egypt thus became the manufacture of linen textiles, and flax supplanted grain as the primary Egyptian export, supplying the looms of North Africa, West Asia, and Europe. This shortsighted policy led to food shortages and epidemics, which contemporary authors blamed on the Nile’s failure to flood the fields rather than on their rulers’ mercenary policies.

Although paper can be made directly from the fibers of the flax plant, making it out of waste fibers is easier—particularly rags and old paper, which have already been processed and bleached in the sun. Some of the bundles of paper and textile fragments excavated at Fustat in modern times may therefore have been left by ragmen who had collected them for papermakers to recycle. The 1980 excavations at Fustat, for example, yielded approximately three thousand textile fragments, most found in refuse heaps near the top of the mound and attributed to the eleventh century. Roughly 70 percent of the textiles found were relatively coarse undyed linens woven in a balanced plain weave, representing the most common type of textile. About 12 percent were linens dyed medium blue with indigo, and another 5 percent were striped, checked, or plaid linens of blue and white. About 8 percent were heavy fabrics of hemp or reed woven with undyed linen. The remaining 5 percent included textiles of wool, silk, cotton, hemp, and reed. Virtually all but the wool and silk would have been appropriate raw material for Fustat’s paper mills. Micro-
scopic examination of medieval Islamic papers shows the occasional presence of colored fibers, often blue, probably from indigo-dyed rags or patterns that slipped into the paper miller’s vats.

In addition to recycling rags from the living, Egyptian papermakers were said to make a coarse wrapping paper for grocers by recycling shrouds collected by graverobbers. The Iraqi scholar Abd al-Latif al-Baghdadi visited Cairo in the late twelfth century and reported that graverobbers there looted tombs for bodies wrapped in hempen winding-sheets, but the story sounds like something told by a tour guide to a gullible traveler. According to Abd al-Latif, the shrouds sometimes measured over one thousand ells long, which is clearly an exaggeration. The graverobbers, he said, removed the shrouds and sold the ones in good condition to the poor, who made garments from them; otherwise, they sold them to papermakers. Perhaps this ghoulish report inspired I. Augustus Stanwood, a nineteenth-century Maine papermaker, to make a coarse brown paper from the wrappings taken off mummies he imported for this purpose from Egypt.

As elsewhere, Egyptian paper was traded and used in different sizes. The court records from the Geniza documents are remarkably uniform in size, suggesting that Jews, like their Muslim counterparts, sometimes used specific sizes for specific purposes. Mostly, however, scribes cut paper to size, according to their needs, and very little of a sheet was left blank. S. D. Goitein, a scholar who devoted his entire life to the study of the Geniza documents, believed that this practice was partly aesthetic: he felt that medieval writers regarded blank space as an offense to the eye, so they filled the margins on the front of a sheet with writing before they turned it over. It seems equally likely that thriftiness played a role and that medieval writers regarded blank space as an offense to the pocket. Small pieces of paper were used (and reused) for important purposes: the typical Geniza order of payment measures half the size of a modern check (less than 3 by 3 1/2 inches; 7.5 by 9 centimeters).

Large sheets of paper were available when necessary. One document, dated 1027, measures an unusual 28 3/4 inches (73 centimeters) long, apparently the full width of the original sheet. Others, such as a responsa (a nonbinding Jewish legal opinion equivalent to a Muslim fatwa) dated around 1000 and a document dated 1018, were written on long (up to a yard) but narrow (7 1/2 by 28 inches; 19–35 centimeters) sheets pasted up from smaller pieces of paper. To prevent fraudulent additions or omissions, Geniza documents were normally written on only one sheet of paper. When multiple sheets had to be pasted together, the copyist arranged his writing so that a line straddled the join between two sheets, and sometimes a word like emeth, “truth,” was written across the join. Muslim scribes did likewise, running the text or impressing a seal across the join to prevent forgery.
The varying sizes and generally coarse quality of the Geniza documents suggests that, as is true today, different qualities of paper were used for different purposes. Letters and comparable documents were not normally written on fine polished paper, which was undoubtedly more expensive because of the increased processing involved. People were sensitive to the variations in quality: one writer apologized for using inferior paper by saying he was unable to find better. Most Egyptian writing paper was neither heavily sized nor burnished, and this lack of processing can be seen by the way the paper soaked up ink. Some paper documents were inscribed twice, first with brown ink of a type normally used on parchment, then with a black (carbon) ink; the gall-based ink tended to eat through paper eventually, whereas the carbon ink did not.

Letters and bills found in the Geniza collection indicate that Egyptians exported their paper to North Africa, Yemen, and India. Syrian paper was imported into Egypt, and Egyptian paper was exported to Iraq. According to the Geniza documents, one Tunisian merchant ordered five thousand sheets of fine paper and one thousand of the talhi type, which was apparently made in Egypt. The Geniza correspondence of Ben Yiju, an eleventh-century Jewish trader from Tunisia resident in India, shows that the most important of his imports was paper; along the Malabar coast, as elsewhere in India, the most common writing material remained palm leaf, paper being rare and difficult to obtain. Once Ben Yiju moved to India, his Egyptian friends kept him well supplied with paper, including packages of it in virtually every shipment they sent to him from Aden. His friends normally sent him somewhere between twelve and thirty-six sheets at a time.

Like the Abbasid rulers of Baghdad, the Fatimid caliphs in Egypt used paper lavishly for their decrees and documents, but in Egypt, unlike Iraq, several decrees of the Fatimid period have survived intact. The documents, preserved in St. Catherine’s Monastery in Sinai, are rolls measuring as much as 33 feet (10 meters) long; they vary between 8 and 18 inches (21 and 45 centimeters) wide. Each roll is composed of several sheets pasted end to end. In contrast to the densely written Geniza documents, these official decrees show a profligate use of space between the lines of writing (fig. 34). Wide spacing was characteristic of documents produced in the Fatimid and Abbasid chancelleries: the ability to waste so much expensive paper was a prerogative of power. Logically enough, letters and petitions submitted to the caliph were spaced "normally," without such expanses of blank paper between the lines.

Later letters and decrees from the Ayyubid and Mamluk chancelleries are also long, narrow, and widely spaced. A letter to the king of Aragon dated 29 January 1292, for example, is a long narrow strip (5 by 79 inches; 13 by 201.6 centimeters) pasted up from sheets of unsized, yellow hempen paper, each
measuring 5 by 13 inches (13 by 32 centimeters). Six other letters from Egypt in the Aragonese archives dating from 1292 to 1300 are also in the form of long (maximum 79 inches; 200 centimeters), narrow (11 inches; 28 centimeters) scrolls, pasted up from similar sheets of paper 18–19 inches (46.5–48.5 centimeters) long. This format continued to be used under the Safavids and Ottomans, but it was not followed farther afield, in North Africa or Spain, where by the fourteenth and fifteenth centuries chancery documents were often crammed onto one sheet.

Paper was already cheaper than papyrus by the mid-ninth century in Egypt, but it was still not cheap, and writing materials remained relatively costly. In the late ninth century pages from discarded books, such as the Thousand Nights fragment in Chicago, were used as scratch paper, and many of the other scraps found in the Fustat dumps had been repeatedly reinscribed. This is not surprising, given that paper at this stage was still an imported item, but even after paper began to be manufactured in Egypt, it was still saved for reuse and recycling. A Geniza fragment first inscribed on 26 April 987, for example, was reinscribed nearly two centuries later, on 21 December 1085. According to one tenth-century source, 125 sheets cost six and two-thirds dinars, a sum sufficient to support a lower-middle-class family for more than three months. As in Iran, old paper was used for stuffing and stiffening caps and other garments, and sheets of old paper were pasted together to make cardboard for bookbindings.
The Spread of Papermaking

Such practices continued well into modern times, according to a long but extremely revealing description by Ameen Rihani of how daily affairs were transacted in early twentieth-century Yemen. It is quoted by Nabia Abbott, in her book on the rise of the Arabic script, to make the point that Arabs were not "naturally fond" of recordkeeping. Although this idea now seems remarkably out-of-date, the anecdote serves to remind us how precious paper remained for centuries.

The economy of paper in the Imamdom reaches the sublime. Seldom one sees an envelope, seldom a full sheet of stationery—the scrap is the rule, and very rare is the exception. . . . Evidently the Imam Yahya, who won "a wealth" of guns and cannons from the Turks, turned their archives also into service. Books, coupons, petitions, documents of every sort, they have all been cut into scraps to be used in every department of the Government.

Only in foreign correspondence are envelopes and regular stationery used. But in the country, the Government itself has set the example—a Government without red tape, without pomp, without official affectation, without luxuries. A messenger brings you "a cigarette" [a document rolled up tight], which you find is from the Imam, and in his own hand. After reading it, you tear off the blank portion and write your reply upon it. Should you ever receive a communication in an envelope, you cut it up and use the inside part for correspondence, and should your correspondent be an intimate friend, and his message written on a slip as big as a visiting card, you write your answer in the blank space, though it be as small as a thumb-nail, and send it back to him. Waste is reprehensible; extravagance is condemned. This economy in paper teaches also an economy in words. Some of the petitions which the Imam receives from his subjects are not more than three or four lines. . . .

The Chamberlain Saiyed Ali Zabarrah, who was visiting us one day, lingered a while to overhaul his papers. He took out of his bosom pocket about twenty little "cigarettes" and as many out of the folds of his turban, where he also sticks his fountain pen and his tooth brush. He then began to separate the white portion from the written, and tear up the latter. . . . One of the papers which Saiyed Ali showed me was a line from the Imam ordering him to pay 200 reals to a certain Government official. "Are you not going to destroy this too?" I asked. "If I pay two thousand reals," he said, as he tore it up, "no one will question." "But the Imam is likely to forget, and he will ask you to
produce the order." "He forgets not," the Chamberlain replied, "and he questions not." "And does not the Government keep any records at all?" Saiyed Ali looked at me, while still destroying his own private and public documents, and said: "There is very little worth keeping." A soldier then came in with a message from the Imam, written on a scrap 3 inches square, and Saiyed Ali replied to it on a scrap not as big. His Eminence is laconic, and his officials, if they want to rise in his favour, try to emulate him. The standard model is the thumbnail note, with just enough blank space on the sides—the Imam is very fond of writing in circles—for the reply.

In fourteenth-century Egypt the use of paper still seems to have been associated with people of quality. According to Ibn Battuta, the Moroccan globe-trotter who visited Egypt in 1327, none might enter the city of Damietta without the governor’s seal. Persons of repute had the seal stamped on a piece of paper, which they showed to the gatekeepers; all others had the seal stamped on their forearms.

In spite of the increasing availability of paper in medieval Egypt, other writing materials were still in demand. The Jews continued to use parchment for Torah scrolls, as did the Coptic Christians for their Gospel manuscripts. Book lists found among the Geniza documents and other surviving manuscripts show that Jews also used parchment for transcribing many other religious, scientific, and literary works. Certain types of documents, such as marriage contracts and bills of divorce and manumission, were normally written on parchment, as were the circular letters of religious authorities, which were meant to be handed around among a wide audience and needed to be especially durable. Among Muslims, documents such as marriage contracts were written not only on parchment but also on leather and silk. A particularly magnificent example on white silk survives from the reign of the Fatimid caliph al-Mustansir, in the eleventh century.

As in Ilkhanid Iran, the arts of the book flourished in Egypt during the fourteenth century, although most of the effort seems to have gone into making fine, large manuscripts of the Koran for the Mamluk rulers’ pious and charitable foundations rather than illustrated books of epics and poetry. The Ilkhanid taste for large Koran manuscripts had been brought to Egypt, whose Mamluk rulers, despite waging nearly continuous war against the Mongol rulers of Iraq and Iran, emulated the latest styles of Iranian art. In 1304, the Mamluk sultan Baybars al-Jashangir commissioned a seven-volume manuscript of the Koran for the Sufi convent he was building in Cairo. Each volume has 155 folios and measures 12½ by 19 inches (32 by 48 centimeters),
approximately the same size as the untrimmed half-Baghdadi pages used for the Compendium of Chronicles. According to a later source, the manuscript was actually written on Baghdadi paper; the calligrapher was Ibn al-Wahid, who had trained in Baghdad under Yaqt al-Mustasimi, and it was illuminated by three assistants. The unusually large size and multivolume format of the manuscript, as well as its splendid calligraphy and illumination, brought it to contemporary attention. As far as we know, the size and scale of the Baybars Koran were not immediately reproduced in Cairo, although in 1326 a Mamluk amir bequeathed the enormous thirty-part manuscript made for the Mongol sultan Uljaytu in 1313 to the amir’s mausoleum in Cairo.

The production of large-format manuscripts reached its apogee in the Mamluk domains toward the middle of the fourteenth century under Sultan Hasan, his wife Khwand Baraka, and their son, al-Ashraf Shaban II. The manuscripts made under their patronage are all large, and some are huge, measuring approximately 20 by 27–30 inches (50 by 70–75 centimeters), the sheets being full-Baghdadi size and folded in half. The ability to order manuscripts of such dimensions was a prerogative of great wealth. For the incompetent Hasan the Black Death helped in realizing his dreams of glory, for the estates of those who died intestate passed to the government.

In Cairo the book crafts were localized near the Azhar mosque, the center of Cairene intellectual life. In the fifteenth century, according to the historians al-Maqrizi and al-Sakhawi, the stationers’ market, suq al-warraqin, was near the madrasa, or theological college, founded by al-Malik al-Ashraf Barsbay. Al-Maqrizi also mentions a khan al-wiraqa (papermakers’ warehouse) near the Bab al-Futuh, one of the gates of Cairo, but paper was probably not made on this spot, so far from the Nile. By the sixteenth century, according to the historian Ibn Iyas, the paper market was being used by textile merchants, a trenchant comment on the decline of the industry in Egypt.

Paper had always been relatively expensive in Egypt, but at the beginning of the fifteenth century, living costs rose considerably in the Mamluk realm, and customers found it difficult to afford good Syrian or Egyptian paper. They turned instead to Italian paper, made from linen rags, which had become increasingly available in the late Middle Ages. Egyptians had continued to produce great quantities of linen, but at the beginning of the fifteenth century, Egyptian habits of dress changed. The Egyptian textile industry was in the midst of a serious decline, largely as a result of depopulation following the Black Death, technological stagnation, and the Mamluks’ mismanagement of the economy. Native Egyptian linen became increasingly expensive, and for the first time upper-class Muslims wore garments made from European woolen broadcloth, known as jukh, rather than from domestic linen. Euro-
peans were able to produce cheap woolen broadcloth not only because they had access to English wool but also because they had adopted several technical innovations, including the spinning wheel, the treadle loom, and the water-powered fulling mill, which lowered the cost of production. The increased availability of European woolens, combined with declining Egyptian demand for linen, meant that fewer linen rags were available for Egyptian papermakers to turn into paper. Thus Italian papermakers could flood the market, and their paper was cheaper than the local product.

The Italian merchants who brought paper to Mamluk Egypt returned from commercial ventures there with paper playing cards, which had been introduced to Egypt and Syria from Asia in the medieval period. Playing cards had been used in China before the ninth century and had been disseminated over much of Asia before the time of the Crusades. After merchants brought them to Italy, they spread quickly throughout Europe. The oldest playing card known from west of China is a fragment, decorated in black ink with blue, red, and gold, said to have been found in the Fustat dumps. It is dated to the thirteenth century. Although only the right half of the card remains, it clearly represents the four of the suit of cups, or goblets (fig. 35). Although the paper is fragile, it is probably an actual card, not just a design for one; before the mechanical reproduction of designs, it would have made little sense to draw and color a design from which to copy other hand-drawn designs. Because the

![Image: Fragment of a playing card (the four of cups). Egypt, mid-13th century. Courtesy of the Keir Collection, England (I.27)]
fragment has nothing on its back, the sheet was probably intended to be (or once was) pasted to a stiffer backing of paperboard.

An almost-complete pack of hand-painted cards dating to the fifteenth century survives among the extraordinary collections of the Topkapi Palace Museum in Istanbul. As reconstructed, the pack consists of fifty-two cards in four suits: swords, polo sticks, cups, and coins. Each suit consists of numerals from one to ten, and court cards labeled *malik* (king), *naib malik* (deputy king), and *thani naib* (second deputy). This arrangement is virtually identical to the Italian variety of Latin-suited pack, and the early date of the Fustat fragment clinches the argument that cards arrived in Europe through Egypt. Furthermore, the Arabic word *naib*, or deputy, is the source of both the Italian word *naibbe* and the Spanish *naipes* for the "Game of Deputies."

Paper made in such Italian towns as Treviso and Fabriano was another of the European manufactured goods that Italian merchants traded for the Oriental spices and silk they bought in Cairo’s bazaars. One Johann Lio claimed in a lawsuit against the widow of Lorenzo Bembo, his agent in Alexandria in 1412, that he had sent the deceased *corta da scriver* (writing paper); in 1417–19 the same man entrusted one Giacomo di Zorzo with the sale of a quantity of paper he had shipped to Alexandria. In 1441, according to another lawsuit, a certain Michiel Michiel claimed that he had sent the Venetian merchant Nicolo de Nani six bales containing sixty-eight reams of paper (a total of thirty-four thousand sheets) to be exchanged in Egypt for spices. European paper was also sent to Tripoli and other Syrian cities, where it was exchanged for native cotton. Good-quality European paper was initially more expensive than that produced locally in Syria or Egypt, but Italian merchants mostly exported cheap paper into those Muslim countries where paper was still produced; elsewhere, they also exported the better kinds. Given a choice, Muslim writers may have used these cheaper papers not for books and manuscripts, many of which have been preserved, but for notes, letters, and bills, which have largely disappeared. A contemporary Egyptian writer, al-Qalqashandi, claimed that the European paper imported into Egypt was "of the worst kind."

Some paper continued to be made in Egypt until the seventeenth century, but from the sixteenth century French and Italian papers were dominant there. The few dated documents in the Geniza collection from the second quarter of the sixteenth century, for example, are on European, rather than locally made, paper. By the eighteenth century the role of Cairo in the paper industry had declined considerably; now it was merely a redistribution point for the export of European paper to Arabia. In the seventeenth and eighteenth centuries, the stationers’ market in the Ashrafiyya quarter sold almost exclusively European products. Nearby were the inkmakers (habbirun) and those in
the book trades (kutubiyya), including binders, bookcover makers, pasteboard makers, and booksellers. The seventeenth-century Ottoman traveler Evliya Chelebi mentions only thirty booksellers working in twenty bookshops, a sad testament to the mediocre level of intellectual life in Ottoman Cairo, as well as the decline of papermaking in Egypt.

THE MAGHRIB (NORTH AFRICA AND SPAIN)
Unlike all the other Islamic lands, writers in the Maghrib used parchment when elsewhere it had been abandoned in favor of paper. The major reason was that the provinces of Ifriqiya (corresponding to modern Tunisia) and Sicily were centers of sheep raising, and the manufacture of leather and parchment, as well as the export of hides, remained an important industry. The oldest surviving Maghrabi Koran manuscript on paper is dated 1139–40, but scribes used parchment well into the fourteenth and even fifteenth centuries. Scribes also continued to use parchment for other types of manuscripts long after paper had become common elsewhere. For example, one Muhammad ibn Hakam ibn Said transcribed a copy of Abu Hatim al-Sijistani’s Kitab al-nakhl (Book of the Palm) in a distinctive North African (Maghrabi) script on twenty-seven small parchment folios; he completed his work on 26 March 1004, a date by which such a book produced elsewhere would have been copied on paper. Private letters and accounts sent from Tunisia found among the Geniza documents were written on parchment well into the middle of the eleventh century; Egyptian writers had made the transition to paper about a century earlier. Geniza documents also indicate that Tunisians got whatever paper they used from Egypt. Nevertheless, paper was known in North Africa perhaps as early as the ninth century, and papermaking was practiced there from the eleventh century, if not earlier.

Paradoxically, the only medieval account of Arab papermaking to survive anywhere is the eleventh-century treatise on bookmaking by the Zirid prince Tamim ibn al-Muizz ibn Badis, who ruled a small principality in northeast Algeria. He makes no mention of the preparation of parchment, although he does give recipes for making special colored inks to use on it. According to Ibn Badis, to make paper

you soak the best white flax repeatedly in water and quicklime, rub it with your hands, and then dry it in the sun until the plant stalks release the fibers. Next you soak the fibers in fresh water to rinse away the lime and then pound them in a mortar until they are very fine. You then dissolve the pulp in water and make it into sheets on molds. These are made from straw used for baskets, and nails, and the walls are col-
ZIGZAGS

Zigzags were made on the sheet when it was still damp, as with the Chinese watermark technique, which left wavelike patterns in the paper. Zigzags may take the form of a zigzag line, whence its name, or they may resemble the teeth of a comb, a series of X’s, or even random lines sometimes reduced to large points. This most distinctive feature of Maghribi and Spanish papers is found on most Spanish papers made before 1360. The earliest dated example occurs on an Andalusian manuscript of 1166; the latest appears on a document of 1360, which also bears a watermark. Their purpose is unclear: they may have been a precursor of watermarks, an indication of the grain of the paper, or an aid to folding the paper. Perhaps the most likely explanation is that they imitated the marks left by tanners that are sometimes seen on parchment.

The rest of his description refers to the sizing of the paper with equal quantities of chalk and starch, or with rice starch, and to dyeing paper different colors.

Taken as a whole, Ibn Badis’s text is remarkably out-of-date, for he neglects to mention the use of rags, which we know were added to the vat, and he describes the floating screen, which most papermakers had long abandoned except for special jobs. Because his text is the only one to survive on the subject, it has been treated with reverence, but the author’s ignorance of basic facts raises questions about the reliability of his information. In sum, Ibn Badis’s book is comparable to many medieval Islamic how-to manuals: long on theory but short on practical advice.

The fourteenth-century writer Ibn Abi Zar reports that by the end of the twelfth century, that is, during Ibn Badis’s lifetime, the city of Fez, in Morocco, had 472 papermills. Whatever the accuracy of the numbers, the presence of papermills in Fez was encouraged by the swift stream that still flows through the industrial center of the city, even now supplying dyers and tanners with running water. Documents show that as late as the fourteenth century, Fez shipped fine paper to Majorca and Aragon.

Nevertheless, as in Egypt, by the middle of the fourteenth century Maghribi chancelleries began to use European papers. A letter dated 8 December 1350 from the sultan of Tunis to Peter IV of Aragon—Catalonia was written on paper bearing a griffin watermark, a sign of European manufacture. Because watermarks had been invented in Italy in the late thirteenth century, the paper is probably of Italian manufacture and would have been exported to Tunis in trade. Genoese merchants, among others, had been resident in Tunis throughout the thirteenth century, and the Pisan merchant Leonardo Fibonacci had lived there before writing his treatise on Arabic numerals in 1202. Another paper document, dated 23 February 1360, is written on a sheet bearing both a watermark and a zigzag, the distinctive mark of Spanish papers. It was probably made in Italy especially for the North African or Catalan market.

Muslims were troubled about using these European products, some of which bore images that conservatives found objectionable. In Tlemcen, a city now in western Algeria, the noted jurisconsult Abu Abdallah ibn Marzuq
delivered a long fatwa, or legal decision, on 21 August 1409. Entitled *Taqrir al-
dalil al-wadih al-malum ala jawaz al-nashk fi kaghid al-rum* (Decision . . . Concerning
the Permissibility of Writing on Paper Made by Christians), it indicates that
Italian paper had entirely supplanted local production by the beginning of the
fifteenth century. According to the document, paper had once been made in
Tlemcen, as well as in Fez and the Muslim regions of Spain, but no longer was.
Pious Muslims were therefore forced to write on European paper bearing
watermarks that they found offensive because the designs often contained a
cross or an image of some living being. According to Ibn Marzuq’s decision,
which saw the problem in terms of ritual purity, writing in Arabic over the idolatrous
designs rendered them invisible. Writing God’s name (and message) on
such papers, Ibn Marzuq argued, replaced falsehood with truth. The situation,
he said, was comparable to transforming a Christian church into a mosque.

Paper had been introduced to the Iberian Peninsula in the tenth century,
probably as a result of the trade described so vividly in the Cairo Geniza doc-
ments. The first Spaniard to mention paper was the Spanish Muslim poet
and encyclopedist Ibn Abd Rabbih. In his encyclopedia *al-Iqâ al-Farîd* (The
Unique Pearl), he discusses the different kinds of reed pens most suitable for
writing on parchment, papyrus, and paper. Considering the time when he
wrote—in the late ninth and early tenth century—he probably encountered
paper on his pilgrimage to Mecca rather than in Spain itself. By the middle of
the tenth century, however, substantial quantities of paper must have been
available for the lexicographer Ibn Hani al-Andalusi to give his students paper
on which to copy books from his private library. The library of the Umayyad
caliph and bibliophile al-Hakam II was said, perhaps incredibly, to contain
400,000 volumes. Only one manuscript from al-Hakam’s library is known to
survive, a copy of the *Mukhtasar* (Summary) of Abu Musab Ahmad ibn Abi Bakr
al-Zuhri, now in the library of the Qarawiyîn Mosque in Fez. It bears a note
saying that it was copied by Husain ibn Yusuf in Shaban 359 (June–July 970).

As elsewhere in the Muslim world, religious affiliation was no impediment
to using paper. The earliest Spanish Christian manuscript on paper is believed
to be the Mozarabic Breviary and Missal in Silos, which has been dated on
paleographic grounds to the second half of the tenth century. Of the 150
leaves, the last 38 are of strong and thick paper made from linen rags well sized
with rice starch; the rest are of parchment. It seems that the scribe ran out of
parchment and had to substitute what he considered an inferior material. The
early thirteenth-century catalogue of the monastery’s manuscripts refers to it
as a Toledan missal on "rag parchment [pergamino de trapos]."

Papermills were established throughout the Iberian Peninsula in the
eleventh century. The first specific mention of a papermill dates from 1056,
when a certain Abu Masafya (or Mescufá) is reported as owning one "next to the old irrigation-channel" near the city of Shatiba (now Játiva or Xàtiva), located southwest of Valencia. Already in Roman times, the city of Sàebtis had been famous for its fine linen cloth, which was woven from flax grown in fields irrigated by the many rivers flowing through the region. The same rivers provided abundant water for the preparation of flax fibers and, eventually, for powering papermills. Around 1150 the geographer al-Idrisi praised Shatiba for its magnificent paper, which was of a quality found nowhere else and which, he said, was exported to the East and the West. The paper, known by the generic term shabi, from the Arabic name of the town, was famed throughout the Mediterranean for its weight as well as its smooth and glazed finish.

In 1094, nearly forty years after Abu Masafya's mill at Shatiba is mentioned, his son Matamín fled Valencia to establish another papermill in Ruzafa. In 1085, the year in which Christian forces retook the city of Toledo, a "rag-paper mill" is mentioned there. Ibn Abdun, supervisor of markets for the Almoravids in Seville around 1100, noted in his manual of market regulations that "papermakers must make their paper somewhat larger and glaze it a bit more," which tells us not only that paper was made there at that time but also that papermakers, like many other artisans, tried to cut costs.

Spanish paper was well regarded, especially for copying books, and was exported throughout the Mediterranean. According to the Geniza correspondence of the twelfth-century Spanish Jewish poet Judah ha-Levy, he sent five hundred sheets of Toledan paper to his friend Halfon ben Nethanel in Egypt around 1125. Another letter in the Cairo Geniza collection, written from Granada in 1130, is on unusually white, strong, and "pleasantly smooth" paper—we can see why this Andalusian export was in wide demand.

As in Iran, colored papers were popular in the Maghrib. Ibn Badis gives recipes for dyeing paper in the eleventh century, and the Nasrid sultans of Granada used colored papers varying from red or vermillion to purple or pale pink for their correspondence. Known by the generic term of nasrī after the dynasty, which presided over its export from the late thirteenth century, nasrī sheets are smaller than Játiva paper, measuring approximately 11 by 14 inches (27 by 36 centimeters). Perhaps the most striking example of nasrī paper in the Aragon archives is a blood-red paper made equally of linen and hemp, which bears a letter written in 1418 by Muhammad VIII of Granada to Alfonso V. It has been suggested that the vivid color was intended to symbolize the wrath of the writer, although the Nasrids and the kings of Aragon did not necessarily share a common language of color symbolism.

Considering the importance of paper in Islamic Spain, it is surprising that its history there, as in Egypt, must be reconstructed largely from official doc-
ments rather than books. Whereas the lack of Egyptian books from the Fatimid period remains something of a mystery, the absence of Spanish Arabic manuscripts is a direct consequence of the *reconquista*. To eliminate all copies of the Koran from the formerly Muslim areas of the peninsula once the Moors were driven out, the Catholic church and state ordered the wholesale destruction of all Arabic manuscripts. The book burners’ success was virtually complete, and the only manuscripts that survive are those carried to safer havens. Among the few literary works to have survived the flames is the illustrated manuscript of the romance *Bayad and Riyad*, probably produced in early thirteenth-century Seville. The manuscript, copied on paper, measures 11 by 8 inches (28.2 by 20 centimeters). The first and last pages of the text are missing, but fourteen graceful illustrations in a unique style are preserved, and testify to the extraordinary richness of the vanished culture of the book in Islamic Spain (fig. 36).

In sum, although paper had been used in Central Asia and Iran before it was used in Iraq, the heartland of the empire, the decision by the Abbasid bureaucracy in Iraq to use paper was instrumental in its acceptance everywhere else. Iran, which at times encompassed parts of both Iraq and Central Asia, remained at the forefront of paper technology, particularly as a result of repeated contact with China in the later Middle Ages. On the other hand, the Maghrib was initially slow to accept paper. Once it did, however, this was the region that was ultimately responsible for the transfer of the technology to Europe. But it transferred paper, not printing. It was bookmaking by hand that reached a high art in the Islamic lands.